Practical Computing

50p

An ECC Publication. Volume 2 Issue 1

January 1979

Playing with the Pet in the Panther

We test Nascom-1, the £200 computer

Turning IBM typewriters into terminals

Is Pascal better than Basic?

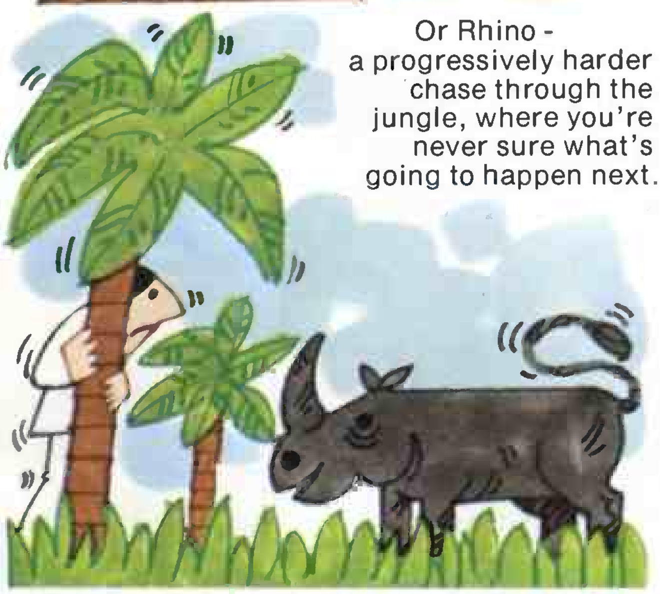
Learn typing by computer

After you've been chased by rhinos and have met the hangman, it's time to learn a thing or two...

One lesson you'll have to learn on your own - how to tear yourself away from your computer in the early hours. Infoguide provides you with a new concept in recreational, educational and business software.

You'll probably start in the Playgroup.

Insert your Compusette, and there's the Hangman to challenge.



Or Rhino - a progressively harder chase through the jungle, where you're never sure what's going to happen next.

Insert other Compusettes, and ...

Middle School

could see you taking your computer on at Mastermind. Or Go!

High School

sees you and your computer working on statistical programmes. Conversion. Financial management. Forecasting. These - and many other functional programs - are on Compusette.

At Degree Level,

why not simulate an enzyme reaction? Change any one (or more) of six parameters and see what happens? Maybe discover, when playing chess, that your computer is a Grand Master? A Compusette will supply each of the necessary programs.

An interesting variety of Compusettes are being made available for PET, Apple II and TRS 80. Each is accompanied by a fully detailed booklet with listings of the programs - there are up to three on each tape.

You will find that most dealers handling personal computers will be stocking the Compusette range. Ask you dealer now.

For as little as £2.70 per program* - that's value!

COMPUSETTES

Compusettes are produced by Infoguide Ltd,
142 Wardour Street, London W1.
120 El Camino Drive, Suite 108, Beverley Hills, Cal 90212 USA

* Based on three programs on an £8.00 Compusette.

Practical Computing

Managing Editor
Dennis Jarrett

Computabits Editor
Nick Hampshire

Production Editor
Harold Mayes

Advertisement Manager
Erica Gibson

Advertisement Representative
Tom Moloney

Subscription Manager
Annabel Hunt

Publisher
Wim Hoeksma

Company Secretary
Carole Fancourt

Managing Director
Richard Hease

Editorial, Advertising and subscriptions: 01-278 9517.

Practical Computing is published by ECC as a subsidiary of WHICH COMPUTER? Ltd at its registered office, 2 Duncan Terrace, London, N1, and printed by Bournehall Press Ltd, Welwyn Garden City. Distributed by Moore Harness Ltd, 31 Corsica Street, London, N5.

ISSN 0141-5433.

Subscription rates: Single copy: 50p. Subscriptions: U.K., £6 per annum (including postage); overseas, £12 (including airmail postage).

Contents

February issue on sale January 17, 1979

MINE OF INFORMATION LTD

1 FRANCIS AVENUE, ST. ALBANS AL3 6BL TELEPHONE 0727 52801

BOOKS * PROGRAMS

LOW PRICES! FAST SERVICE!

Introduction to Microcomputers by Adam Osborne
- Vol 0 The Beginner's Book .... £ 5.40
- Vol 1 Basic Concepts + free MoI corrections list. .... £ 5.90
- Vol 2 Some Real Products (June 1977) .... £ 9.90

Microprocessor series, by Rodney Zaks
- C201 From Chips to Systems. .... £ 7.50
- C207 Interfacing Techniques .... £ 7.50

Microprocessor Systems Design, by Edwin Klingman
- ISBN 0-135-81413-8 (1977) 480 pages hard cover £16.40

CMOS Cookbook by Don Lancaster .... £ 6.90
6800 Assembly Language Programming by Leventhal .... £ 6.50
6800 Software Guide & Cookbook from Scelbi. .... £ 7.90
8080 Software Guide & Cookbook from Scelbi. .... £ 7.90
8080A/8085 Assembly Language Programming by Leventhal. .... £ 6.50
8080A Bugbook Interfacing & Programming
- by Rony, Larsen & Titus (1977) 416 pages .... £ 6.90

Z80 Programming for Logic Design by Adam Osborne .... £ 5.90
Z80 Microcomputer Handbook by William Barden .... £ 7.20

Structured Programming & Problem Solving with Pascal
- ISBN 0-138-54869-2 (1978) 365 pages by Kieburtz .... £ 9.50
- "When will your microcomputer speak Pascal?"

BASIC Computer Games - Microcomputer edition .... £ 5.40
Best of BYTE Vol 1 (1977) 376 pages .... £ 8.90
Best of CREATIVE COMPUTING
- Vol 1 (1977) 326 pages .... £ 6.90
- Vol 2 (1977) 323 pages .... £ 6.90

Send s.a.e. for latest complete booklist
All prices include postage. Pay by ACCESS, cheque or PO
For delivery outside UK add £1 per order (any quantity)

MoI OTHELLO Game for 2 players on NASCOM 1 cassette .... £ 2.00
MoI MINI PILOT powerful text editor and interpreter in ½KB!
- NASCOM 1 cassette or RML 380Z cassette .... £ 5.00

MINE OF INFORMATION LTD

1 FRANCIS AVENUE, ST. ALBANS AL3 6BL TELEPHONE 0727 52801

● Circle No. 109

AIRAMCO LTD — MICROCOMPUTER PRODUCTS

Distributors for JADE, S. D. SALES, MATROX
All products brand new with full industrial specification

S100 COMPUTER CARDS KIT		ASSEMBLED	BARE BOARD
S100 Mother Board Kit 13 slots	£71	£82.50	£26.25
Jade 8080A CPU BOARD	£75.00	£122.50	£22.50
Jade Z80 CPU BOARD 2MHz	£95.00	£135.00	£26.25
Jade Z80 CPU BOARD 4MHz	£99.95	£145.00	£26.25
Jade Serial/Parallel I/O BOARD	£89.95	£129.95	£22.50
Jade 2708/2716 EPROM BOARD	£44.95	£82.46	£22.50
(16×2708 or 2716) WITH 8 2708s	£97.46	£134.96	£22.50
Problem Solvers 16K STATIC RAM 450nS		£240.00	—
16K STATIC RAM 250nS		£296.00	—
S. D. SALES STARTER SYSTEM Single-card computer system based on Z80. Similar in appearance to KIM or D2 kit. 1K RAM PROM programmers, 4-channel counter-timer, cassette interface, provision for S100	£159.95	£249.95	—
VERSAFLOPPY DISK CONTROLLER (up to 4 drives 5¼ or 8"	£111.75	£165.00	—
SHUGART 8" Drive 801R	—	£355.00	—
S100 Desk Top Rack	£225.00	£249.00	£125.00

Components

2708 1024×8 EPROM	£6.99
2716 2048×8 EPROM (intel)	£29.90
TEXTOOL 24 pin	
ZERO FORCE SKIS (equivalent of above) T.I.	£5.60
1702 256×8 EPROM	£4.85
2104 4906×1 DRAM	£3.50
8 for	£26.00
21078-4 4096×1 DRAM	£3.50
8 for	£26.00
MK 4118 STATIC RAM 1K×8 PIN OUT same as 2708 EPROM	£16.50
4116 16K×1 DRAM	£10.50
8 for	£75.00
6821P PIA	£5.90
AY51013 UART	£4.50
AY51014 UART (5V)	£6.50
AY53600 ENCODER	£9.99
8080A CPU	£8.99
21L02-1 450nS	£1.20
8 for	£7.92
21L02 250nS	£1.40
8 for	£9.60
2112-1 256×4 (450)	£2.25
4044 4K×1 (450)	£7.45
4045 1K×4 (450)	£8.25

Note New Low Prices 16K Memory
All Prices EXCLUDE VAT @ 8%.
Trade discounts on Quantity
Please add £1.00 P&P for S100 items then add VAT @ 8%.

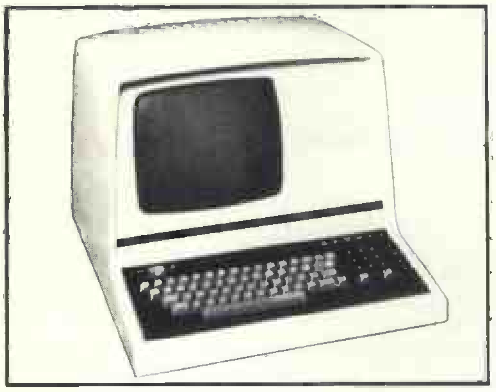
24-hr Ansaphone order service with ACCESS or BARCLAYCARD.
MAIL ORDER ONLY

For components please add 40 P&P, then add VAT @ 8%.

AIRAMCO LTD
30 WITCHES LINN
ARDROSSAN
AYRSHIRE
KA22 88R
TEL. 0294 65530
TELEX 779808

Semiconductor prices are always changing and the trend is generally downwards. So ring for latest up-to-date details.

● Circle No. 110



Introducing the Lyme 4000 family of visual display computer terminals, the British-designed and built Terminal exploiting all the very latest Microprocessor and N-MOS circuits. Only 32 Chips provide a VDU giving the highest performance and flexibility at low cost.

- * 4,000 character page with 1,920 characters viewable at any one time
- * 64/96 character set
- * Switchable transmission speeds 75–9,600 bps (split speeds optional)
- * HDX FDX (Model 4002) Block Mode (Model 4004)
- * Dual interface—RS232C and 20 ma current loop
- * Protected areas (defined by reduced intensity)
- * XY Cursor addressing, 12" diagonal screen
- * 12 × 7 dot matrix upper and lower case
- * Character delete and insert
- * Up to 16 dedicated function keys. Printer Port RS232 optional
- * One off end user price £645

Lyme Peripherals Limited, 2 Avenue Court, Farm Avenue, London NW2 2PT.
Tel: 01-4520490.

● Circle No. 111

PETALECT
ELECTRONIC SERVICING LTD.

WANTED

Good Homes for Intelligent Pets

THE

PET 2001 Computer

£643·52 plus VAT

This unbelievably versatile, compact, portable and self-contained unit has many varied applications and offers tremendous benefits in the worlds of

- **BUSINESS and COMMERCE:** Can be used efficiently for Trend Analysis · Stock Control · Payroll · Invoicing · Inventory Control, etc.
- **SCIENCE and INDUSTRY:** The 'PET' has a comprehensive set of scientific functions useful to scientists, engineers and industry.
- **EDUCATION:** An ideal tool for teaching and it can be used to keep records, exam results, attendance figures, etc.
- **ENTERTAINMENT:** Games including Backgammon, Noughts and Crosses, Pontoon, Black Jack and Moon Landing

Possesses all usual alphanumerics PLUS 64 graphic characters for plots, artwork, etc., a printer, 2nd cassette deck and software available AND IN THE NEAR FUTURE 'Floppy Disc' data and programme storage system.

We have six years' experience in servicing electronic calculators, mini-computers in S.E. England. 24-hour service contract available at £69·50 per annum. Credit and leasing terms available.

For full details and demonstration contact Peter Watts . . . Now!

PETALECT
ELECTRONIC SERVICING LTD

(Authorised Commodore Pet Dealer) Specialists in Electronic Servicing, Programming, Electronic Design and Prototype Manufacture

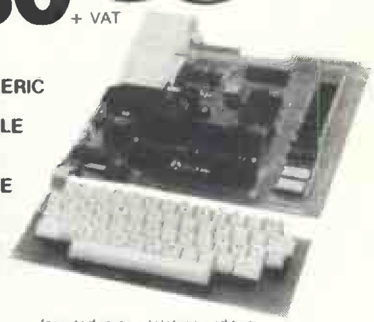
33 PORTUGAL ROAD, WOKING, SURREY GU21 5JE.

Tel: Woking (04862) 69032/68497

● Circle No. 113

AIM 65

£249·50 + VAT



FEATURES INCLUDE:
- 20 COLUMN PRINTOUT
- 20 CHARACTER ALPHANUMERIC DISPLAY
- FULL 54 KEY TERMINAL-STYLE KEYBOARD
- TTY INTERFACE
- TWIN CASSETTE INTERFACE
- RAM — 1K TO 4K OPTIONS

OPTIONS INCLUDE:
8K BASIC INTERPRETER ROM
4K ASSEMBLER/EDITOR ROM

AIM 65 comes to you fully built and tested with a full alphanumeric keyboard, 20 character display and a 20 column printer — for keeping a permanent record of all your work.
Available in 1K- and 4K-byte RAM versions, AIM 65 is designed around the 6502 CPU, which has 64K address capability with 13 addressing modes. This is the microprocessor at the heart of many other, more costly, systems such as PET and APPLE.
AIM 65 has a 4K ROM-resident monitor program for all peripheral control and user programming functions.
Spare sockets are included for expanding on-board program memory via user PROM-based programs and/or Rockwell assembler, text editor and BASIC interpreter plug-in options.
AIM 65 has a connector for external access to system bus for memory and I/O expansion, a separate connector for interfacing a teletype and two cassette recorders. There is a user-dedicated Versatile Interface Adaptor, featuring three 8-bit, bidirectional ports (two parallel, one serial) and two 16-bit interval timer/event counters — thus allowing the user to interface his own system, without extra interface devices in many cases
AIM 65 is probably the most effective, low-cost microcomputer development system available — an invaluable educational aid to first time users and and ideal general purpose microcomputer for the engineer
AIM 65 is available in the UK only from PELCO ELECTRONICS LTD at £249 50 + VAT, complete with User's Manual and Schematic, R6500 Programming and Hardware Manuals and a handy pocket reference card.

Pelco (Electronics) Ltd
Enterprise House,
83-85 Western Road, Hove, Sussex BN3 1JB
Telephone: Brighton (0273) 722155

Buy it with your Access or Barclaycard.

● Circle No. 114

EQUINOX 300

A powerful multi-user
multi-tasking
multi-language

16-bit microcomputer time-sharing system

supporting
- BASIC
- LISP
- PASCAL
- Floppy discs
- Hard discs

including a powerful Text Formatter, Assembly Language Development System and disc-based Sort utilities.

Priced from **under £5,000**

Write or phone for further information.

EQUINOX COMPUTER SYSTEMS LTD
32-35 Featherstone Street,
London EC1Y 8QX.
(Tel: 01-253 3781/9837)

● Circle No. 115

I BYTE

BUT COMPUTERS DON'T

Come and see for yourself at

the BYTE SHOP Ltd

Stockists of the largest range of micro computers in the U.K.

Take the opportunity to experiment with and get to know any of the vast range of micro computers always in stock at The Byte Shop.

Whether you want a micro computer for your home, your business, for industry, for education - or if you'd just like to find out which model you get on with best - you'll find a visit to The Byte Shop a new and invaluable experience.

Call in at The Byte Shop any time from Monday to Saturday. It's right by Gants Hill tube station.

The Byte Shop 426/428 Cranbrook Rd., Gants Hill, Ilford, Essex. Telex 897311
Telephone 01-554 2177

NOW OPEN in NOTTINGHAM
(92 Upper Parliament Street)

OPENING SOON in
Tottenham Court Road, London; Birmingham; Glasgow; Leeds; Southampton.

● Circle No. 116

INTRODUCING

THE GREAT BRITISH KEYBOARD BY alphameric

NO SWITCHES TO FAIL	ALPHAMERIC'S very own A/D LSI/MOS encoder plus ALPHAMERIC's patented proximity detection minimises soldered and mechanical connections, minimises component counts, and eliminates expensive PTH boards. The result is outstanding reliability at modest costs.
ALL 128 ASCII CODES	54 trimode coded keys (including Escape, Delete, Back-slash) plus Control, Caps Lock (for TTY compatability) Shifts, on-board Repeat, plus a DC level key for firing Reset, Interrupt etc. 60 keys in all.
TRUE N KEY ROLLOVER	Unbeatable by the fastest operator.
TACTILE FEEDBACK	Like some high quality typewriters, it tells your fingers what they're doing. Has Industry Standard full-travel keys.
RUGGED CONSTRUCTION	A steel chassis takes the knocks and protects the PCB. The key mechanics cannot transmit excessive stress to the PCB.
LOW POWER CONSUMPTION	Only 25 ma at +5V and −12V.
TWO SHOT MOULDED BUTTONS	For key inscriptions that never fade.
POSITIVE OR NEGATIVE LOGIC	Logic for data bits (one TTL load) and for strobe/DC outputs (5 TTL loads) are separately user-selectable for easy interfacing to Micros, UARTs, etc.
PROFESSIONALLY PROVEN DESIGN	ALPHAMERIC's keyboards are in thousands of Great British Terminals (and overseas terminals too!) ALPHAMERIC's MOS encoder (world's first for capacitive keyboards) was first available five years ago.
AVAILABLE NOW	Brand new, ex-stock, with data sheet and 12 month warranty. Cash and Carry or clip the coupon. £75 each plus £6 VAT plus £2 P & P if applicable. Mating 20 way Berg connector plus 2 metres 20 way ribbon cable available at £3 plus £0.24 VAT.

DON'T TAKE A RISK WITH A HEAP OF MECHANICAL SWITCHES! INVEST A LITTLE EXTRA IN STATE-OF-THE-ART SOLID-STATE RELIABILITY! CLIP THE COUPON NOW!

ALPHAMERIC Keyboards Ltd.
Reg. in England No. 1044892

Manor Way, Old Woking,
Surrey. GU22 9JX

NAME . . . .
ADDRESS . . . .
. . . .
. . . .
. . . .

Send me . . . Great British Keyboards at £83 each inc VAT and PP
Send me . . . . mating connectors each with 2 metres cable @ £3.24

I enclose my cheque (allow 7 days for clearance)
Charge to my VISA/ACCESS/DINERS card
Expiry date:

Card No: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_| ← Not VISA
Signature:

● Circle No. 125

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback – it is your chance to keep in touch.

Pet group

A GROUP of Pet owners has decided to form an organisation for sharing ideas and information about the Pet. The group has taken a formal existence and already has more than 50 members.

I have taken the job of secretary from Norman Fox, who did a splendid job of getting the group set up.

We are hoping that as many Pet owners and users as possible will join and come to our meetings to share their knowledge and to learn from the experiences of others. So far we have held two meetings and I, for one, have learned a great deal.

We have seen the Pet being used to control a variety of equipment through its user port; we have heard it playing music and we have swapped ideas and programs.

The group is deliberately independent of Commodore and we are not in competition with its Users' Club. We feel that there will be times when we wish to be critical of Commodore; the delay in producing the long-awaited printer and the problems of head alignment on the cassette decks are two issues where external pressure may speed up things.

We will be circulating all dealers with information concerning the group, in the hope that they may be willing to supply details of our group to all new buyers. If any dealer wants further information, please get in touch with me.

We will be holding regular meetings throughout the country and we will be producing a regular newsletter with ideas from our own members and with information gleaned from elsewhere, including some of the information produced by Pet groups in the U.S.

If anyone wishes to join, please send SAE to me and I will send details.

Mike Lake
Independent Pet Users' Group
9 Littleover Lane
Derby

Auto-code

AFTER your monthly issue of *Practical Computing* which contained the programming language Basic, I wonder whether you can send me a booklet on AUTO-CODE.

I am a student and am working on a program to work out problems involving trigonometry but have a problem on the use of tables given by AUTO-CODE—how to look up the tables backwards. For example:

When the computer works out an answer e.g., 1·19, the program requires it to print this as an angle (TAN), which in this case it is 50 degrees (No backwards).

I wonder whether you can help me on this problem?

N. Chan
Banbury

● **Can any readers recommend a suitable book?**

Manual problems

I WOULD like to comment on my experiences with the Kim so far:

The three Kim 1 manuals assume that the reader has some knowledge of machine code programming. Without advice on some of these points from other sources the gaps are not easily filled.

In contrast, the Vim 1 (Sym 1) has only two manuals—one of which is identical to the Kim programming manual—but the instructions are much easier to understand.

The extra facilities built into the Sym 1 suggest to me it is a much better buy than the Kim 1 than the price difference would indicate. In nearly every respect, I think, it is worth twice the value of the Kim 1.

A tip for Sym 1 users. Use a reed (3–4 volt) relay between the built-in cassette switching and your cassette recorder remote control connector. The polarity of the cassette can then be disregarded. This is particularly useful when trying several recorders to see which one the Sym 1 likes best.

Another tip is to avoid using page 1 except for very simple programs. The Sym 1 control program makes continual use of page 1 for the stack and will overwrite anything you put on (in) page 1.

For raw beginners, remember that 0 (ø) is a number, particularly in hexadecimal. It is obvious when you know but mind-boggling if you don't.

I would have made very little progress with either Kim 1 or Vim 1 (Sym 1) without the considerable help given to me by the Bears at Newbear Computer Store. I would like through your columns to express my sincere thanks to them in general and to Tim Bear in particular.

Jesse James
Letchworth,
Herts.

Alternative

AS AN engineer who makes considerable use of calculators and was considering the purchase of one of the more sophisticated models, it came as a surprise when someone suggested that the personal computer had now reached the stage of development where it could provide an economic alternative to a good calculator, while providing a fascinating hobby at the same time.

A newspaper advertisement led me to the November issue of your magazine but I must confess that extensive use of trade jargon limited my understanding of the subject matter.

I am writing, therefore, to enquire whether you can recommend a suitable introductory text to the subject, so that I may better understand the specialist terms used and also learn how to join together the many items of equipment to build a system to meet my requirements.

Andrew J. Middup
Coventry

● **Our favourite is** *An Introduction to Personal Computing*, **by Rodney Zaks.**

Kit site

WITH regard to Mr Richards letter in the November issue of *Practical Computing*, a Sharp Associates kit for conversion of a Selectric may be purchased from J & A Computers of 15 Fleetwood Gardens, Market Harborough, Leics. This kit includes a read/punch port and RS232 serial interface, and it costs £540.

Q. J. North
Brighton

System advice

CAN YOU please advise on possible systems meeting the following criteria:

8K Basic on ROM (or tape + 8K RAM); 8K RAM (expandable to 32K); compatible with domestic TV; compatible with cassette recorder; including ASCII (integrated or separate) keyboard, preferably upper- and lower-case characters; additional graphics desirable but not essential; adequate maintenance organisation; price less than £500.

I feel sure such a system would be of general interest since, as you have pointed out, most households have a TV and cassette recorder.

J. S. Palmer
Altrincham, Cheshire

● **We suggest you look at the systems described in the Buyer's Guide in this issue, particularly the Nascom and Micros.**

Who is second?

I ENJOYED the article How to Play Mastermind (November issue), but wish to take issue with the author over his claim that "a good human player has the edge over even the most sophisticated computer strategies."

I have carried-out recently a computer

(continued on page 19)

Put more than enthusiasm into your hobby ..

The Shugart minifloppy

When you buy the Shugart minifloppy you are buying
the leading miniature floppy in the business at no extra cost.

You gain performance and reliability at a price competitive with cassettes.

And you have the backing of the number one in low cost disc storage technology.

CPU

Shugart Distributors

Total support-technical service,
training and maintenance

for the quality professionals expect

order from your local computer store

CPU Computers Limited, Copse Road, St. Johns, Woking, Surrey GU21 1SX Telephone: 04862 73883. Telex: 859592

● Circle No. 126

(*continued from page 17*)
analysis of the so-called original Mastermind (4 pegs, 6 colours), the results of which will appear shortly in the *Journal of Recreational Mathematics vol. II.*

The essence of this analysis is that there is a strategy requiring a maximum of five guesses and an average of 4·37 guesses. Further, this strategy, in the form of a standard Fortran program, has been implemented on the PDP-11 computer in this department, and I would back it confidently to triumph over any human opponent in the long run.

Dr. R. W. Irving
University of Salford.

For starters

I AM interested in putting together a computer system, starting from a basic kit and expanding at a later date to a floppy disc system with video monitor and hard printing terminal.

I would be grateful if you could advise me of the right kit with which to start. Would Nascom 1 kit be suitable?

As cost is a limiting factor, I would prefer to spend no more than £250 at present.

M. Regan
Southport

● **Yes, Nascom is a good starting-point Again, take a look at our Buyer's Guide.**

Keep it simple

HAVING just read Programming the structured way, I would like to prove my skill at reading tea-leaves. Having swilled the dregs at the bottom of my cup, I would say that the author works in education—probably in higher education, possibly a polytechnic.

To be truthful, I cheated. The article appeared to be a collection of bits from lectures I attended at a polytechnic earlier this year. Everything is there, structures, modules, abhorrance of GO TO, waste of time drawing flowcharts, Basic is nasty and Pascal will be our saviour. Module dependency charts appear to have been forgotten.

Most of the programs I write are Basic Plus and sometimes Cobol for a mini-computer. I like Basic and the industry appears to have a growing need for Basic programmers. My three main comments are:

GO TO can be used provided it is used wisely; there are times when the use of unconditional GO TO cannot be avoided.

I write Basic programs as a group of modules and connect them with GOSUB. It works, and provided a REMARK line is put at the start of each module to identify it, there is little difficulty in reading a listing.

What method a person uses to record the logic before writing a program does not matter, be it a flow chart, the shorthand method as in the article, or just scribbling on the back of an old envelope.

If a person has completed a program he intends to keep and use I would advise that person to draw a flowchart of the logic in the completed program. If the program is to be passed to other people, or there is a possibility that it might be altered in the future, a flowchart can often show more easily how a program works than a well-laid-out program listing.

Two pieces of advice which are perhaps even more important to people programming for the first time—Keep it simple; and enjoy what you are doing.

Paul Woolley
Enfield, Middx.

Payroll task

AS a complete novice in the world of computers I am (was?) interested in the purchase of a small system purely to operate monthly payrolls for several small companies, a total of approximately 300 staff. I have been told that the equipment, including a suitable printer, would cost some £2,000 but for the one task this is not economic.

Would you agree with the rough estimate I was given and can you give me advice on what equipment would be required?

J. Humphrey
Great Harwood
Blackburn

● **That is about the right price. Your first point of call could be the Commodore Pet. That costs £695 plus about £500 for a printer and £25 for a payroll package. You could then, of course, use the computer for other tasks apart from payroll. Or you could try a computer bureau like Centrefile.**

Advice to teachers

MAY I congratulate you on the successful launch of *Practical Computing* but express some reservations about your general approach to programming and the educational market?

The best article in your November edition was, in my view, Nick Hampshire's Programming the Structured Way. Unfortunately, its general tone and the fact that it was at the end of the edition gave the impression that simple programming is one thing and structured programming is something to be considered at some later stage.

Not so. Good programming implies readability by people as well as machines and there is no point in learning bad habits in the early stages if they can be avoided. Even in Basic one can and should follow this principle, which implies the avoidance of GOTO statements.

In your review of the Tandy you "definitely recommend that the novice starts with Level 1". But on page 32 of the Level 1 manual appears the suggestion: "The IF-THEN statement is what is known as a CONDITIONAL branching statement". Thus beginners are given a definition which is both incorrect and the strongest possible incentive to develop bad programming style.

Your article, Pet goes to School, could easily be misinterpreted by British teachers. It is clearly based on U.S. conditions and experience and a British school should think very carefully before it spends about £700 on a machine which does not match requirements of English computer studies syllabuses and teaching practices and has a graphics system without a proper SET or PLOT facility.

The trouble is that in most British schools the purchase of one machine will preclude the purchase of any other for several years. Unfortunately, the limitations of the Pet are such that teachers and pupils are likely to feel the restrictive effects within a very short time after purchase. I would very strongly recommend teachers to talk to a number of educational users before making any important decisions.

Roy Atherton
Head of Computer Education
Resources Centre,
Reading.

Group request

I HAVE had a Tandy TRS-80 machine for some time and feel it is about time that a users' group was formed. I wrote to Tandy suggesting that it took the initiative in this matter but there was no reply. I wonder if you could indicate in your pages that I would be prepared to organise such a group?

I have been using machine language with my system for some time—via T-BUG—and have succeeded in using it for hardware control with an output port connected to the system bus.

I have just upgraded to 16K of RAM by installing 4116 RAMs myself—far cheaper than having it done by Tandy—and soon will be obtaining the Editor/Assembler which will enable me to write some rather interesting system software. A macro processor is likely to be one of my first efforts.

Congratulations on your magazine. I hope you will include plenty of articles with a software orientation in future issues and keep articles on Basic to a minimum.

L. F. Heller
Newport Pagnell, Bucks.

Logic aid

THERE is an article, Peripheral Equipment for a Small Digital Computer, by A. D. Booth and J, M. S. DeVries, on page 155 of the March, 1966, *Electronic Engineering*.

It discusses, among other things, the use of an old-style IBM typewriter; logic diagrams are given but no mechanical details.

If Mr. Richards would care to contact me I will let him have photocopies at cost.

J. B. Jehu
15 Hangcliff Lane
Lerwick,
Shetland

THE PET AND THE PA

IT HAD to happen. What must be the ultimate in luxury car accessories—not a television to watch, a stereo player to listen to, but a computer to play with.

It is either very heartening or extremely depressing, depending from which end of the socio-political spectrum you look, to find that there is a substantial number of people in the world queueing to pay a minimum of £45,000 for a British Leyland-engined car which is designed intentionally to look a good 20 years older than even the dear old Morris Minor.

Motor magazines have dubbed it "the world's silliest piece of motoring extravaganza" or "an automotive exhibitionist's dream come true". It is both, but it is also a tremendous example of British craftsmanship at its best—a safe, luxurious car which is totally modern in all but appearance and ambience.

Practical Computing exclusive
by CAROL GOURLAY

It is to motoring what the Atlas was to computing, a wondrous example of outdated style and opulence which cannot fail to arouse nostalgia in those who behold them.

Panther cars are among the most prestigious, most sought-after cars in the world. The De Ville saloon is one of the latest in a line of fantasy creations which Panther managing director Bob Jankel has been offering to an appreciative world since 1970.

The bulk of them have been a distillation of the best of 1930s design, based loosely on Jaguar or Frazer-Nash. The De Ville was obviously inspired by the magnificent Bugatti Royale created in France for the exclusive elite of Europe's pre-war establishment.

Powered by a V12 Jaguar engine, the Panther is a classic with its elegant styling. It is the ultimate luxury car. Only three per month are built, and only four a year are allocated to the U.K. market.

It is not as strange as it may seem that this magnificent anachronism should be the first car in the world to offer that amazing product of the technical revolution of the 1970s, the microcomputer, as a factory-fitted option.

Air conditioning, stereo radio with four loudspeakers, and electric windows are standard fittings. In addition, Panther is often requested to install all kinds of equipment in the De Ville—quadrophonic sound and television for example—and is only too happy to comply.

Naturally, the customer list contains

(continued on next page)

The Pet console in the rear of the Panther (above); the Pet is dwarfed by the magnificent 1979 De Ville saloon (lower picture).

NTHER

(continued from previous page)
many illustrious names from the show business fraternity—Elton John, Liz Taylor and Sammy Davis junior, not to mention Oliver Reed and James Caan. A Nigerian tribal chief has one, as do several Arab sheiks.

Yet sales director Rechard Govett emphasises that Panther doesn't live from that kind of glamorous market. In general, the average customer is a successful business person.

It was one of those who suggested that Panther install a computer in the De Ville. He wanted it not to play Lunar landings, to pass the time in rush-hour traffic jams, but to be able to run programs from his business computer away from the office.

Standard console

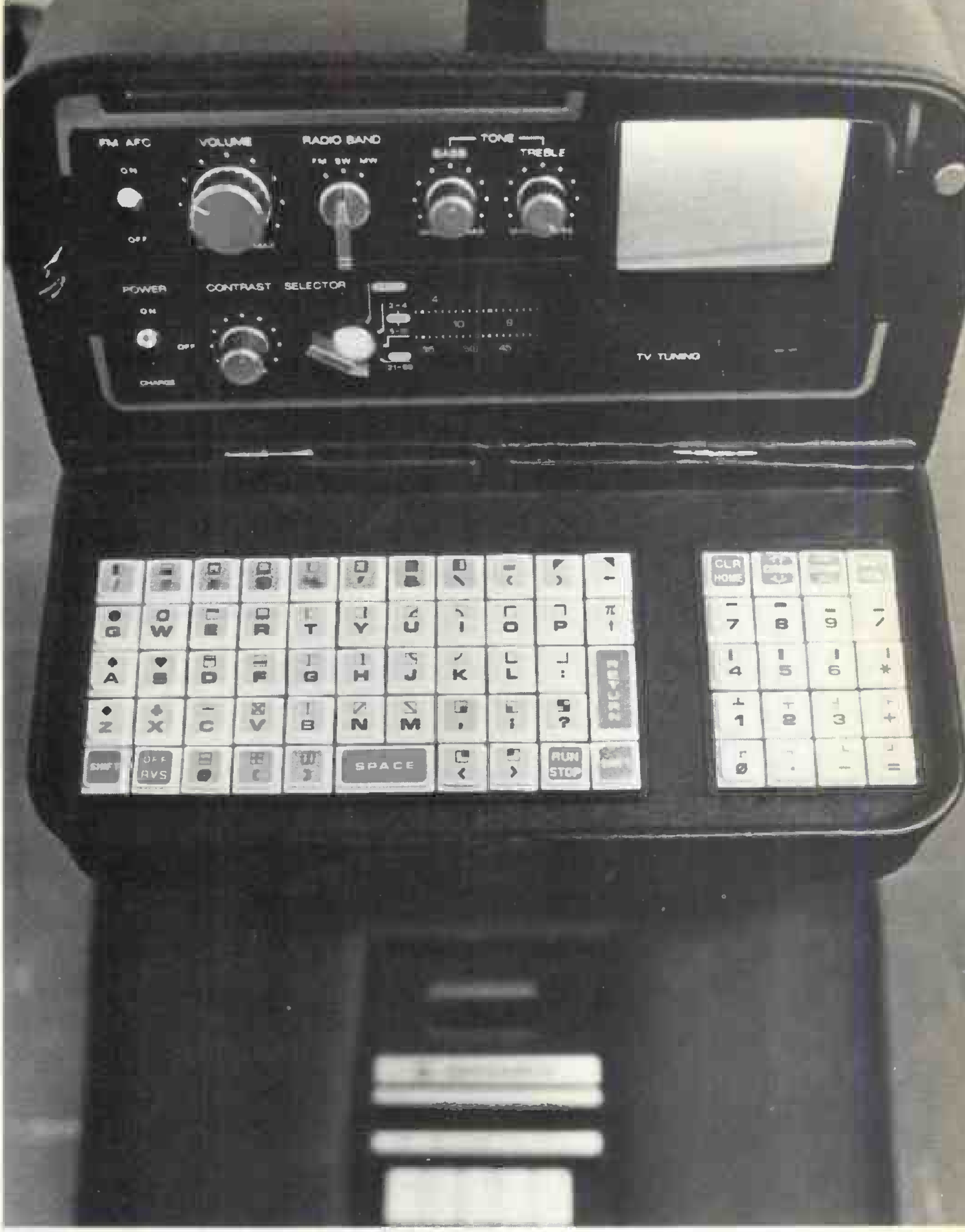
Such a computer had to fulfil two essential requirements—it had to be compact, and it had to be compatible with his business machine.

Panther would also have liked the computer to be totally British-made and designed. Wherever possible it likes to live up to the Union Jack displayed proudly on the front of each model. Despite these patriotic preferences, it was decided that the requirements were met best by the American-built and designed Commodore Pet. The configuration and installation was carried out by David Hughes, of the recently-formed Thames Personal Computers Ltd. Thames made a particularly neat job of building the keyboard into the hinged lid of the radio/television/VDU console. The *Practical Computing* review of the Pet (October, 1978) was not alone in calling the keyboard 'disappointing' because of its smallness, describing it as a 'calculator rather than typewriter keyboard'. In the De Ville the diminutive nature of the keyboard becomes a real asset rather than a disadvantage.

Clear display

Panther produces a standard console to carry a TV set and cocktail cabinet, or whatever its wealthy customers desire, and the Pet fits neatly inside it with plenty of room left for bottles. The console fits in the car behind the front seat—presumably most De Villes are chauffeur driven.

To accommodate the Pet, Panther added a large base to the console. It contains the CPU and the cassette tape unit. Even with three-inch Sony TV fitted to the model we saw, the display is remarkably clear and surprisingly readable. Future models will have a 4½in. screen, and this can, of course, be used as a normal television set when the computer is not in use.



Thames Personal Computers has built the standard Pet keyboard into the hinged lid of the radio/TV console.

The keyboard is in a flap in front of the screen, which can be closed. This must be the first time the Pet keyboard has not seemed too small.

Certain modifications were necessary. The system had to be adapted to run from the car battery, so that the owner does not have to search for a co-operative transport cafe before updating the sales ledger.

The most ingenious innovation is the inclusion of a small transmitter in the base, which transmits the video display to the TV screen. The lack of wires and connections is designed to improve the reliability of a system which must be subject to the potholes of our pock-marked highways.

The Pet has yet to undergo the 7–800 miles of gruelling road tests every Panther car receives before being released to the customer. Panther is optimistic that a computer will prove as reliable as a TV or any other sensitive piece of equipment.

The whole console containing the Pet can be removed from the car so that one can also use the computer in the privacy of one's own mansion or penthouse.

Panther had the Pet available for demonstration to potential customers at the Motor Show in Birmingham, but has waited for this edition of *Practical Computing* to announce it to the world.

Waiting list

The price? Well, it is really cheap compared to the £3,000 some customers pay for a complete Music Centre in a De Ville. If any *Practical Computing* reader is looking for the perfect gift for the wealthy executive who already has a limousine with TV and stereo, the Panther De Ville costs slightly less than £45,000. The console and computer increase that only by £2,000. There is still a long waiting list and even after paying £47,000 you will have to supply your own gin and tonic.

Paper tape reader

ONCE the staple input device for all computer systems, the paper tape has declined in use, with punched cards, key-to-disc systems, key-to-tape, and all kinds of terminals gaining ground through the years.

The paper tape, however, can still be a cheap and fast input device and ideal for the micro user. So it is interesting to see that Microsystem Services is offering what it describes as a low-cost (£680) paper tape reader for use with its Models 7, 9 and 16 PROM programmers, or any application requiring a serial or parallel interface.

It is called the MSS96R and can run at several speeds up to 9,600 baud. It can handle both the 8-level codes used in data processing, and the 5-level (Baudot) codes used commonly in data communications.

For information: Microsystem Services, Duke Street, High Wycombe, Bucks. Tel: 0494-41661.

Managing with micros

THERE are a few tickets remaining for the one-day conference to explore the potential impact of microprocessors on the process of management, sponsored jointly by *Practical Computing* and Eastern Counties Operational Research Society. It is on January 10 at St Albans, Herts, and applications for tickets (£5 each including buffet lunch) should be made to:

Ian Roderick, 237 Lonsdale Road, Stevenage, Herts., enclosing payment. Cheques should be made payable to Eastern Counties Operational Research Society.

Plessey add-on memory for Pet

PLESSEY MICROSYSTEMS has developed an add-on memory for the Commodore Pet. Called Petite, the self-contained module expands the Pet to its full capability and allows more complex programs to be run, as well as providing an extension to the graphics facility.

The RAM incorporated in the Petite is organised as 24K bytes in its standard form. Alternative configurations are available from 8K bytes, which is the minimum useful configuration, through to 32K bytes, which provides additional storage for long machine-language programs and display storage.

Each system is complete in a compact portable case and has been designed to interface directly to the Pet memory port. It is supplied with mating connectors to expand the Pet without any modification.

Unlike add-on units, there is no need to open the Pet cabinet and consequently it does not affect the power drain or heat dissipation adversely.

Plessey Microsystems will handle orders from Pet users directly on a cash-with-order basis initially, but expects to operate through authorised distributors in 1979.

The end-user price is set at £449 for a 24K-byte unit complete with leads, connectors, detailed technical handbook and six months' warranty.

One of the first distributors is Torbus, Chesham House, 150 Regent Street, London W.1.

Systems for Intel range

THREE NEW development systems for the Intel range of microcomputers have been announced by GEC Semiconductors. Model 210, the smallest of the three, is for small development projects using the MCS 48, 80 or 85 micro systems.

It has 32K bytes of RAM, interfaces for teletypewriter, display screen, paper tape punch/reader, universal PROM programmer, and an eight-level priority interrupt system.

The middle model, the 221, has a floppy disc and upper- and lower-case keyboard as well as the features of the 210. Top of the range is the 231, which is designed for the user who wants to use high-level languages such as Fortran, Coral 66 and PL/M. It has 64K bytes of RAM and a megabyte of disc back-up storage.

Further information: GEC Semiconductors Ltd, East Lane, Wembley, Middx HA9 7PP.

New version of CIS Cobol

THE software house, Micro Focus, has a new version of its CIS Cobol to run on micros under the widely-recognised CP/M operating system.

Marketing efforts have been aimed previously at manufacturers of minicomputers but the micro version is now being sold to end-users of microcomputers which support the CP/M operating system. They include the Altair, Imsai, Cromemco and Casu Super C.

The basic requirement for running CIS Cobol is an Intel 8080 or Zilog Z80-based system with at least 32K bytes of read-write memory and a CRT terminal.

The only difficulty is that the package is not cheap—in hobby computing terms, at least. It costs £400, probably 10 or 20 times more than many micro users have ever paid for a piece of software.

As Micro Focus points out, using a high-level programming language not only makes programming so much easier, but it also whisks away the user from the realms of back-room electronics into the shining world of data processing. Make sure you're not dazzled by the glare.

For information: Micro Focus, 18 Vernon Yard, Portobello Road, London W11. Tel: 727-5814.

Cheaper memory

FOR THOSE who've passed the beginner's stage and are starting to play around with the more basic components of microcomputers, there's good news from Intel. This company—which, by the way, produced the world's first commercial microprocessor—has developed a device to allow you to use cheaper memory chips without any loss of performance.

The device—a chip called the 8202—is a dynamic RAM controller. Dynamic, as opposed to 'static' RAM normally has to be refreshed all the time, otherwise it loses its contents.

The 8202 automatically refreshes up to 64K bytes of dynamic RAM, allowing the system designer to treat the read-write memory as if it were of the static (and more expensive) variety.

Tutorial program

ARE you about to buy a micro, but do not know Basic? If, like many others, you decide to buy one of Commodore Systems' Pet machines, you will be pleased to know that a tutorial program is being supplied to take the user through the nuances and complexities of Basic.

It is in cassette form and costs £9 from Commodore. It has been produced, we are told, because of the Pet success in the educational world—21 percent of its sales, to be precise.

The cassette is loaded into the Pet system and the program gives the lesson to the user on the VDU, asking him questions and checking his progress.

It comprises 15 chapters, six sample programs and even gives the student homework assignments.

More details from Commodore Systems Division, 360 Euston Road, London NW1.

Low-cost golf-ball printer available for Pet

A LOW-COST, business-quality printer which interfaces directly to the Commodore Pet is available from GR Electronics Ltd, of Newport, Gwent. Based on the highly-reliable IBM 3982 golf-ball unit, it gives full ASCII printer facilities with the ability to change typefaces and fonts to suit specific applications.

The Petprint 3982 will copy letters, invoices and program listings in upper- and lower-case, either as set on the computer VDU screen or input through the cassette unit. Printing speed is 15cps and line length 130 characters, with 10-pitch which may be modified to 12-pitch if required.

The printer is driven from the Pet user port, not the IEEE interface, and its operation is controlled by a machine code program supplied on cassette. It gives the user complete flexibility in code conversion and timing, as well as carriage return, line feed, tab and backspace functions.

When loaded into the Pet, the printer program occupies less than ¼K of store normally and will not be affected by loading of further information through the cassette unit. Routines included in Basic are for listing of Peek/Poke characters, solenoid codes and characters printed. A further facility is a step/print function which allows 'mapping' of other printing elements.

The printers are second-user, heavy-duty units, maintained regularly during their initial service life as satellite printers in a large distributed system. They have been reconditioned by an IBM specialist, from whom service and repair facilities will also be available. Price with fitted interface and software cassette is £475.

Limrose system based on 6800

LIMROSE ELECTRONICS, of Northwich, Cheshire, has introduced a new microcomputer system, the LMC 6800-2 based on the Motorola 6800 microprocessor.

Priced at £290 in kit form, the minimum system has 4K of read–write memory, motherboard, power supplies and interface for VDU or teleprinter.

It also features what Limrose calls a 'crash-proof' Basic interpreter, pre-programmed in read-only memory. Software debugging is done by a device called the 'trap', a built-in logic analyser which allows the user to examine the cycle-by-cycle operation of the microcomputer. By trapping up to 250 machine cycles, the user can then single-step backwards in a program in search for any incorrect program commands.

The system comprises three boards. The central processor board holds the 8K Basic interpreter; 4K RAM is on the second board; and the third contains the trap facility and I/O interfaces. To this system can be added a tape cassette interface; floppy disc controller and interface are planned in the near future.

For information: Limrose Electronics, Microprocessor Division, 241–3 Manchester Road, Northwich, Cheshire. Tel: 0606 41696/7.

For estate agents

MICRO-SOFTWARE SYSTEMS, the software house from Essex which appears to be making something of a reputation in the world of micros, has produced a new package for estate agents.

It is designed to run on an Equinox system with 24K dual mini-floppy system. VDU and DECwriter. A complete system would cost slightly less than £4,000, excluding VAT.

The package allows the estate agent to search his records, matching the requirements of prospective buyers to what he has to sell. As a by-product, the system generates letters to both parties to confirm offers, and covers the monetary aspects of the deal from deposit and commission to the final statements.

For information: Equinox Computer Systems, 32–5 Featherstone Street, London EC1Y 8QX. Tel: 01-253 3781/9837.

microForth licence

GOLDEN RIVER of Bicester, Oxfordshire, has bought a licence for microForth, a high-level computer language for use in conjunction with the RCA 1802 microprocessor.

A user-defined interactive programming language, microForth has the facility of allowing the user to design his software from the top down, and makes structured programming follow automatically. Algorithms and routines are tested on-line with the development system, minimising the inevitable problems when transporting the finished program to the target system.

An advantage is the minimum system overhead of 512 bytes Nucleus, compared to from 2K to 10K overheads with compilers such as Fortran and Basic.

Golden River will be using microForth alongside its 1802 Assembler for its own and consulting projects in progress. Later it intends to introduce another high-level language for the 1802, this time a compiler for the proposed universal micro language Pascal.

Mike Dalgleish, managing director of Golden River, says the Pascal compiler will run on RCA 1802 development hardware with an additional 20K of RAM inserted into the pre-wired 18S005 sockets. A kit for the RAMs will be offered and the total software and hardware upgrade will be less than £1,000.

An absorbing crime tale

THE AUTHOR of *The Consultant —A Novel of Computer Crime* (Weidenfeld and Nicholson, £4·95) is John McNeil, whom I remember in his pre-Data Logic days as the snappily-dressed, high-living, Porsche-driving, co-founder of a computer consultancy off London's Goodge Street.

The hero of his novel, Christopher Webb, is a snappily-dressed, high-living, Porsche-driving, co-founder of a computer consultancy just off Goodge Street whose success depends materially on his non-standard attitude to the normal codes of professional behaviour and honesty.

While the book is obviously in no way biographical, it would appear as if McNeil may have drawn heavily on his experience with the Scicons and Logicas of the Computer Belt (sic) to provide an extremely inventive and spell-binding who-patched-it?

In the book, Webb's imaginary co-founder of "Systems Technology Ltd" is Andrew Shulton, with whom Webb had worked at IBM. Life at "SysTech" is exhilarating and the only fly in Webb's ointment is that his contentment is flawed fatally by jealousy rooted in the fact that Shulton owns the majority stake in the company, having advanced the initial funding.

This, and a penchant for gambling and the good life, causes Webb to take an unusual approach to the art of consultancy and, in particular, to computer crime detection.

The path into which this leads Webb makes an absorbing, fast-moving tale. While anyone who appreciates a really first-rate thriller will thoroughly enjoy McNeil's first novel, computer freaks will get a special kick from the awesome possibilities for major crime offered by the total dependence of the major banks on their huge computer installations.

The flow of the narrative is slightly checked by the descriptive passages being written in a rather pretentious style which does not match the slick patter of the book's lightly-drawn main characters.

There is also a rather tiresome insistence on listing the street names in the West End, which becomes even more irritating when it leads inevitably to inaccuracies—such as transplanting Rotten Row from the south to the north side of the Serpentine.

These are but minor jolts, however, in a fast and enjoyable journey through an ingenious web of crime and intrigue. Strongly recommended. W.H.

Super-board from Ohio

OHIO SCIENTIFIC has introduced what it calls the Superboard II. It is a very attractive deal for the hobbyist or system builder, because it sells for less than £300 with 8K Basic in ROM, 4KB RAM, and a built-in QWERTY keyboard.

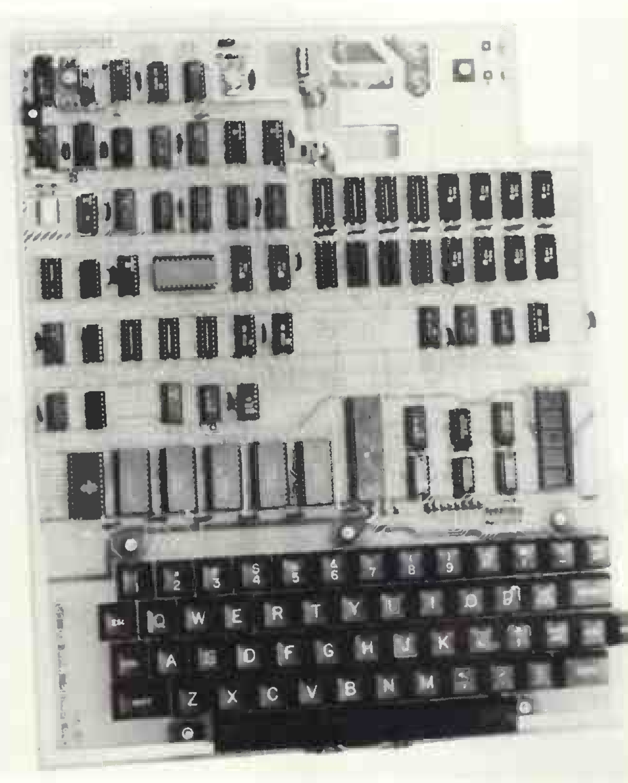
It runs from a very simple power supply, which you will need to provide, and has on-board interfaces for video and cassette (Kansas City CUTS standard).

An optional expander board adds 24KB and interfaces for printer and mini-floppies.

Dealers are just being appointed in the U.K. and they should have stocks now. The cheapest we have seen is from CTS in Littleborough, which has Superboard and 4KB at £275; other outlets have it at around £296.

Other items to watch for from Ohio are the Challenger 3, a diskette-only version (32KB and dual floppies plus the three micros at $3,600 in the States), and the very interesting Challenger 2—"we designed a direct competitor for Pet but with better video and faster Basic"—American price from less than $600.

OHIO Superboard II.



Instant take-off

MAINS-BORNE interference, a threat to data in small business or hobby systems caused by such things as drills, heaters, central heating and other equipment, can be overcome using the Beyts Logic plug-in suppressor.

The unit needs no wiring and can handle 1,500 watts at 6 amps and reduces interference between 150 kHz and 100 MHz. The device does not suppress radiated interference, for example from passing motor vehicles.

The unit has been used on micro-based business systems —including a computer, printer, disc drive and VDU. It is complete with 65cm long lead and standard 13 amp mains plug (fused for 7 amp) for £17·90, including VAT and postage, from Beyts Logic Ltd, Windmill Road, Sunbury, Middx.

Keen Computers, go SoFT!

A full range of Apple II software is now being developed:

Software available at present:

Incomplete record accounting	£250	Co-Resident Assembler	£ 25
Addressing & Mailing program	£ 50	Matrix Inversion	£ 25
Word-processor	£ 50	Analysis of Regression	£ 35
Chequebook	£ 10	Analysis of Variance	£ 35
Shape-Create	£ 25	Correlation Analysis	£ 35

In addition to these packages, we also offer a consultancy service.

Hardware

Keen Computers are the only **Apple II** dealer in the Midlands area.
The APPLE II has to be the most advanced Micro on the U.K. market.
— It uses a 6502 microprocessor—a very updated version of the Motorola 6800.
— It has excellent colour graphics and a very comprehensive basic.

Apple II computer (16k)	£985	Data 100 fast matrix printer	£1,750
Additional memory	£200	D.D.T. Decwriter II	£1,050
Disk unit with controller	£425	Centronics 779 printer	£ 850
Disk unit without controller	£375	Axiom Microprinter	£ 349
Applesoft ROM card	£115	Printer card	£ 110

For further information please contact:

Keen Computers Ltd,
58 Castle Blvd.,
Nottingham
Tele: Nottm
45865

● Circle No. 129

Nascom-1 is real value for money

This month we review a £200 computer kit. Building your own computer is becoming an increasingly popular way of starting in computing, as our reviewer discovered.

by Vincent Tseng

OUR Nascom-1 was a week late being delivered. Not a criticism, but more a worry as our deadlines seem earlier each month. It is not surprising, though, that the machine was late, as it reflects the phenomenal success story of the Nascom-1.

A little more than a year ago when the Nascom-1 computer kit was a mere twinkle in the designer's eyes, a figure of 300–500 orders was thought to be over-optimistic by Nasco and Lynx Electronics.

To date, they have received more than 12,000 orders and have delivered more than 4,000 kits, overwhelming in anyone's terms. So a delay in delivery, I suppose, is inevitable.

Construction

Very fortunately for us the review kit delivered was not a kit, but a ready-built and working machine, because the Nascom-1 is not a trivial kit to assemble.

That is its major disadvantage, as it arrives as a box of parts, some 203 components for the CPU board, which amounts to approximately 1,310 solder points in construction. On a board roughly the size of this page with that number of components—55 are integrated circuits—the layout packing is very tight and the printed circuit tracks very thin. The construction notes supplied suggest a total of 20 hours required for construction; I think they are optimistic.

Another criticism is the board layout; component numbering is not in sequence, making finding the place on the board for the correct component difficult.

Remember, part of the price the purchaser pays is the tedious work of putting together the kit. Obviously, the kit is not insuperably difficult as there are many satisfied customers but it needs very careful and patient construction.

Design

The strongest point of the Nascom-1 is the user's interface. It was designed with how the user communicates with the computer in mind. For the user to talk to the computer, one of the most acceptable ways is provided by a full alphanumeric keyboard in a conventional typewriter QWERTY layout. This gives the potential for using sensible English words.

The computer should be able to display more than one line of information at a time and not be limited to the permutations of a 7-segment display. The method used in most computer installations is by the cathode ray tube VDU, as it has low running costs. The Nascom-1 uses cleverly what is in the majority of homes —a domestic UHF TV set.

The possibility of providing graphics display at a later date is now open. Also, to allow the user to retain the work done on the computer on a more permanent mass-storage medium, an interface to an ordinary audio cassette recorder is provided.

The hardware design is well thought out. It was designed from the outside (user's interface) inwards (the CPU) instead of the usual "Here is a microprocessor, what can we put round it?". Considering the user's interface foremost has given the kit the capability of being easy to use and increased its potential for a much wider range of uses even in its basic form.

Technical specification

SUMMARY

CPU:	Z-80
Clock rate:	1, 2 or 4 MHz link-selectable (the majority of components suitable only for up to 2MHz operation).
Keyboard:	Alphanumeric on conventional QWERTY layout (ready-built).
Display:	Interface to domestic UHF TV set, displaying 48 char × 16 lines.
Memory:	1K 2708 EPROM monitor NASBUG; 2K RAM of which 1K is dedicated (memory mapped) for TV interface.
I/O:	Serial interface, link-selectable to audio cassette, Teletype (20mA current loop) or RS232C. 16 lines of programmable I/O on PIO IC.

SOFTWARE

Monitor: NASBUG Commands

B	Set breakpoint
C	Copy an area of memory to another
D	Dump to serial interface
E	Execute from specified address
L	Load from serial interface
M	Display and modify memory
S	Single-step program
T	Tabulate memory
. (full stop)	Terminate command

Prices

NASCOM-1 kit	£197·50
Power supply 3A	£24·50

Adequate

The TV interface on the basic kit is only just adequate, i.e., the display on the TV screen is legible but not of particularly good quality, and is very susceptible to interference; also, the RF cable provided is rather stiff, along with the fixing method —soldered on to pins on the board— which makes it annoyingly easy to break off if any amount of plugging and unplugging from the TV set is done.

For very little extra cost, Nasco offers a read-built UHF modulator (from a TV game) and details of the necessary modifications which solve both the above problems—the quality of the TV display is likely to be improved by 200 percent.

The cassette interface is not Kansas City standard, but Nascom's own; it is slow, about 10 cps, but reliable if NASBUG-1 "T2" is supplied. If you have problems with the cassette interface, you can check very simply if "T2" or NASBUG was supplied, by tabulating memory from 0045H to 49H:

```
> T45 49 NL
```

and the display should be:

```
0045 30 F7 DB 01 C9 .....
```

Monitor

The hardware design gives the kit its potential but the manner in which the computer performs depends on the software implemented—in this case it is the monitor, the NASBUG. NASBUG is

(continued on page 29)

IF YOU CAN'T BEAT THEM :-

VECTOR GRAPHIC INC

VECTOR V18A slot Motherchassis accepts the wide range of Vector S100 cards and makes an ideal base to build a microcomputer system. Computing power is available to perform a wide range of tasks from industrial control to small business.
£350

PR2 12K PROM/RAM card holds a comprehensive monitor program for system testing and configuration. Normal operation is in conjunction with a serial terminal via I/O card.
£160

FLASHWRITER, memory mapped VDU with graphics, allows a system to be built without a terminal or I/O card. Specify version EV of monitor program.
£150

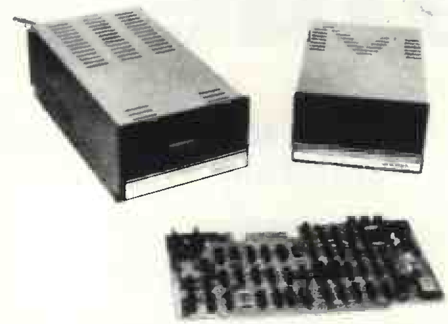
I/O, Switchable 110 to 9600 baud serial interface plus two 8-bit parallel I/O ports.
£125

High resolution graphics interface bit-maps 8K of RAM to 256 x 256 points, or 128 x 128 with 16 level grey-scale.
£150

Z80 Processor card	£140	8080 Processor card	£120
8K Static RAM 4MHZ	£140	16K Static RAM 4MHZ	£300
Analogue Interface	£70	Precision analogue interface	£250
Rackmount 18 slot motherboard	£150	Rackmount power supply	£90

8K Computer System £895

MICROPOLIS



Micropolis disk drives employ higher standards of engineering to pack either 143K or 315K bytes per diskette, formatted, Supplied complete with controller card, cables, manual and software they plug directly into the S100 bus; 8080 or Z80.

Extended disc BASIC, mnemonic editor and assembler are provided, to run under the powerful MDOS operating system.

Add-on units are supplied to extend the system to four drives and one drive per system may be powered from the S100 bus.

143K System S100 powered	£439	143K Add-on S100 powered	£279
143K System Mains powered	£499	143K Add-on Mains powered	£339
315K System S100 powered	£649	315K Add-on S100 powered	£349
315K System Mains powered	£699	315K Add-on S100 powered	£399
Twin drive System 630K	£1159	Twin drive Add-on 630K	£859
S100 bus regulator	£14	Diskettes per five	£24

Unmounted drives available from £225

JOIN THEM !

VECTOR MZ

£2300

Combining the best features of the VECTOR GRAPHIC computer and twin MICROPOLIS 315K byte drives. The Vector MZ produces, in one package a powerhouse of Microcomputer ability.

The VECTOR PROM monitor bootstraps directly to either MDOS, for housekeeping and Assembly language operation, or to BASIC to run high-level user programs. Provision is made to immediately attach a printer, for example one of the extensive range from Centronics sold by Sintrom, enabling use of the powerful printer-related features in the MICROPOLIS Software.

Applications Software for the VECTOR MZ now in preperation will perform a wide variety of business functions; stock control, invoicing, ledger and mailing lists. Further applications exist as a microcomputer development system, and low cost replacement for minicomputer control and instrumentation.

VECTOR MZ configuration includes:

Twin disk 630K minifloppy.
Full Micropolis disk software.
Z80 4MHZ 32K processor.
1 Serial port, 2 Parallel ports.
12K PROM RAM card with extended monitor.

And will support:

Flashwriter, Graphics interface, Analogue interface
Additional RAM, additional minifloppy drives.

Centronics Microprinter	£398
Centronics 779	£780
ADM3A VDU	£620

SINTROM GROUP

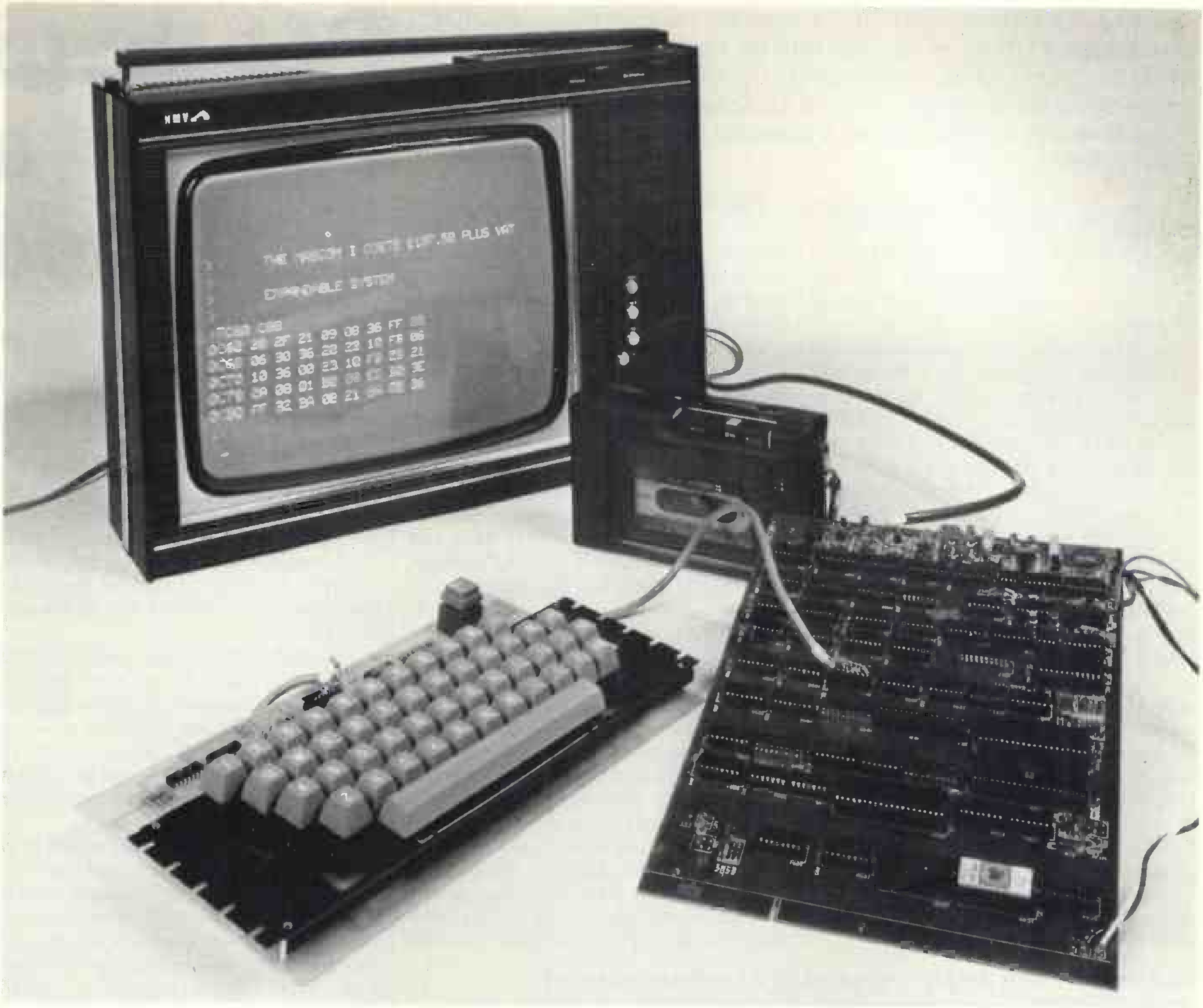
PRICES EXCLUDE VAT
ALL EQUIPMENT FULLY ASSEMBLED AND TESTED
OEM AND DEALER ENQUIRIES WELCOME

DEMONSTRATIONS IN OUR SHOWROOM

Sintrom Microshop

14, Arkwright Road,
Reading, Berks. RG2 0LS.
Tel: Reading (0734) 84322
TELEX: 847395
CABLES: SINTROM READING

● Circle No. 130



(*continued from page 27*)

a 1K 2708 EPROM and it offers the basic facilities for the user to make use of the computer's potential.

Although the facilities offered by the monitor could be classed as minimal, all the essentials are there. The monitor commands enable the user to examine and change memory ("M"); start execution of the entered program ("E"); to test and examine the program by single stepping ("S"); and run to breakpoints ("B").

Large blocks of memory may be displayed or tabulated on to the screen ("T") or copied to another area of memory ("C"). Lastly, commands are available to load ("L") from and dump ("D") to the serial interface (cassette and the like).

Missing Command

The command missing is one to access and modify the registers easily for presetting certain conditions prior to an execution. Also note the command characters "B", "C", "D" and "E" are also valid hexidecimal characters—it can be infuriating to think you are addressing memory to find that you have called-up accidentally one of those commands, and it sometimes can have disastrous effects.

With a little more thought the use of those letters could have been avoided so simply and at no extra cost but these are minor points which do not detract from the good design and potential of the system.

Uses

It may seem that I have been over-critical of the Nascom-1. Far from it; I stress again I like the good conceptual hardware design and the potential of even the basic system.

I have seen a few good games programs on the basic non-expanded Nascom-1. More seriously, there has been a demonstration of a fairly comprehensive Letter Editor where letters can be created, edited, stored on cassette, read back, modified and outputted to a printer, all on a basic, non-expanded Nascom-1.

Power supplies are awkward because the kit required four power rails of ±5V and ±12V. The power supply offered by Nasco is convenient and good value for the basic kit—well worth having. It is adequate with a little in reserve for the basic kit; if expansion is considered, then the 8-amp power supply planned might be a better bet. When Nasco can deliver however, is not known.

The main instruction manuals supplied are *Construction Notes* and *Software Notes*. The construction notes are good.

The software notes are adequate, but programming examples using some of the routines in the monitor would have been useful. I understand the software notes are being re-written at present.

CONCLUSIONS

- **The Nascom-1 is tedious to build but that may be what you enjoy.**
- **Delivery may be slow.**
- **It is, without doubt, a good basic kit offering good potential and facilities. Although it is short of a few finishing touches, at £200 it represents one of the best value-for-money kits available.**
- **It is produced by an enthusiastic company which has given some careful thought to the hardware design and which is already planning improvements and expansions to the basic kit, so that the potential will be further extended and exploited.**

Pet begin era in an and mode school co

"I FEEL sometimes more like a museum curator than a teacher", says Stephen Green as he steps into his classroom, and you can see what he means. His "collection" of computing hardware must represent some kind of a record in school computing terms—no fewer than five computers and a terminal link to a local college for good measure.

Along the back wall, occupying the width of the classroom, stands what Green describes as his "white elephant", an Elliott 4100, equipped with 24K of 24-bit memory, three tape drives and a card reader.

Arrayed beneath the windows are the curios of the collection, three Monrobot XIs. The name is unlikely to bring a sparkle of recognition. Imported by Adler in the early '60s, they were among the first office computers, taking cards or paper tape as input and producing hard copy on a primitive-looking electric typewriter.

The oddest thing about these odd-looking machines is the memory. The only form of storage is a high-speed drum, offering 2K of 32-bit words, and an access time between 0 and 15 milliseconds.

In a corner and looking inconspicuous by comparison is the school's latest acquisition, a CBM Pet.

Green has been in charge of computing at Bishop Stopford School, Kettering, Northamptonshire for nearly four years. Like many teachers in a similar position, he was given the task of establishing a subject which requires considerable capital equipment—and no money to buy it. Apart from the Pet, the school has paid nothing for its room full of hardware, other than transport costs.

The first arrivals, the Monrobots, were acquired from British Airways and from Kettering and Wellingborough councils. At one time there were six of them, which, since there are only 15 in the country, gave Green a near-monopoly.

Despite their primitive facilities and slow speed, the Monrobots have proved to be remarkably useful for teaching, especially since Green and a sixth-former wrote a CESIL interpreter for them. Certainly they provide more and better hands-on experience than the terminal link, which until recently was rationed to four hours' use a week. They have also proved to be extremely durable, with not one CPU breakdown in four years.

Too much power

The Elliott 4100 is another matter. Acquired in a fit of enthusiasm from SATRA, the Shoe and Allied Trades Research Association, it has proved to have more power than Green or his pupils can deal with comfortably.

Transport and installation cost £200, by far the biggest cost incurred to that point, which had to be raised by the parents' association in the form of trading stamps.

While Green can handle the maintenance needed on the Monrobots, the 4100 needs specialist maintenance by Systems Reliability Ltd. That has cost £175 already, despite the limited use of the machine.

The real problem, though, is the software. The operating system is too complex for classroom use and the only high-level language available is Algol. Basic, which is available in theory, cannot be run because of a missing link in the systems software.

The 4100 might still be a useful machine if the school had a strong sixth form to make use of its capacity and also perhaps to produce software to make it more suitable for younger pupils. As it is, Bishop Stopford is still in the process of going comprehensive, and the new intake has reached only the third year.

Most computing is at CSE and O level standard and it is unlikely that the 4100 will still be around when the sixth form is fully established. Still, Green manages to get some use from it, mainly for demonstrating what "real" computing is like and it certainly makes an impressive piece of furniture.

Whatever their faults, these computers, together with the terminal link, have made it possible to get computing established at the school. All pupils take an introductory course in the third year, and CSE and O level classes are growing in strength from year to year.

Two junior pupils deeply engrossed in a lunch-time project.

Endorsement

Enthusiasts are encouraged to work on their own projects in free time and, more recently, have been made welcome on Monday evenings at a club run by the Kettering computer shop, HB Computers Ltd.

The arrival of the Pet could well be the start of a new era in computing at the school and is certainly an indication that Green's efforts have come to fruition. The money to buy it was again provided by the parents' association, and the computer had to compete with numerous other projects for the available funds. The decision to buy it was effectively an endorsement by the parents of the importance of the role of computing in the curriculum.

Although delivered only in September,

(continued on next page)

s new
cient
rn
mputing

(*continued from previous page*)

the advantages of the Pet are already becoming apparent. In the first place, it allows Basic to be taught without recourse to the terminal; and by connecting it to a television set, it can be used for demonstrations to a full-sized class.

Green also appreciates the mobility provided by having the whole package in a single unit. He is keen to spread the gospel of computing to other departments in the school, but so far has met with little success. One reason, admittedly, was the difficulty of finding programs which could be run on the older machines but the main ones were the problems of educating the staff and of getting the class to the computer.

Creating enthusiasm

The Pet clearly has created much more enthusiasm. Already, staff can be found in the computer room at lunch-time, taking lessons in computing from the pupils. Green is still short of software—at present he is adapting some of the programs from the *Computers in the Curriculum* course to run on the Pet, but what little is available is finding a ready market.

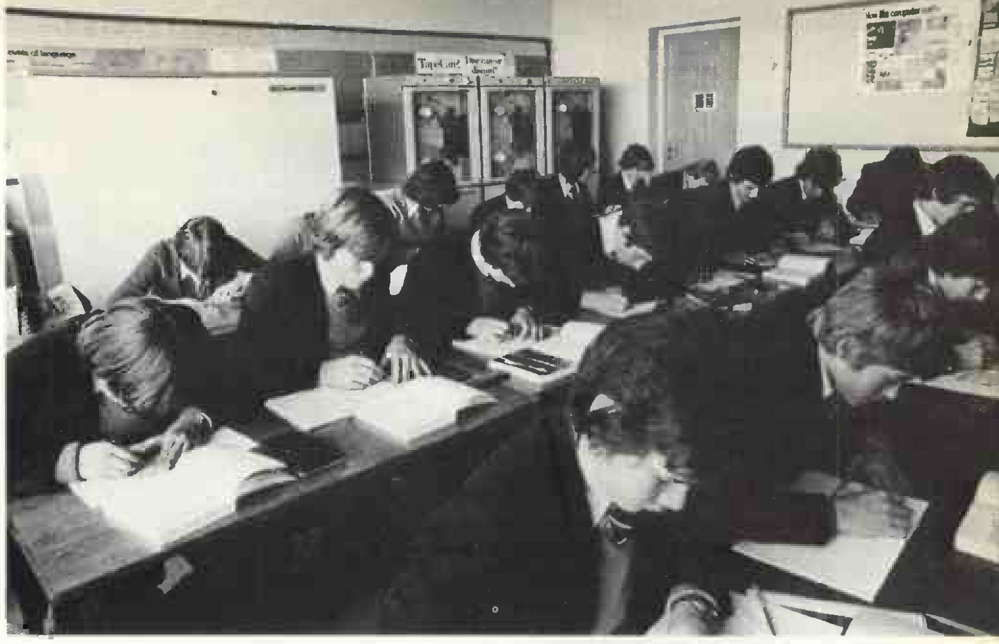
From the start, Green received enthusiastic support from the headmaster, Dr Hopkins, and as a result, school plans for the future of computing are decidedly ambitious. As part of the re-organisation involved in going comprehensive, a computing laboratory is planned. If the funds can be raised, it should be equipped with six Pets by 1980, one of them reserved hopefully for use by other departments.

The connection with the computer at Nene College will probably be retained. If it were relinquished, the money now spent on telephone charges would not be made available for other purposes, because of the usual local authority budget restrictions.

Apart from that, programs written as part of CSE and O level projects have to be proved to be working and this is done by sending them for batch processing at the college, after being debugged and tested on the Pet.

The older machines, however, will disappear gradually. The 4100 will probably go first, since it will be impossible to move it upstairs to the new laboratory. The Monrobots will probably be retained until they grind to a halt. Even then, they will still be in good working order, if anyone can be found to repair them from Green's stock of spares.

Is anyone in the market for some vintage hardware?



Occasional over-heating problems arise from the Elliott 4100, which occupies the whole of the back wall of the computing classroom.

The teacher taught. Marion Brace, of the mathematics department, is instructed by some of her pupils in the use of the Pet.

Cheap to I/O

This month we show how you can turn an IBM typewriter into an output terminal for your micro and save hundreds of pounds by doing so.

by ROLAND JERRY

COMPUTING POWER has fallen in price at a dramatic rate recently but the cost of input/output terminals, which provide essential communication with the computer, is relatively unmoved. A terminal capable of high-quality printing, if purchased new, is at least as expensive as the whole of the rest of the system.

To our aid, however, there is the IBM Selectric Input/Output writer (type 735), available at present on the surplus market. The 735 is a heavy-duty IBM Selectric typewriter to which a number of contacts and magnets have been added, to enable it to communicate electrically with a computer. Although, from above, the terminal resembles an office typewriter, the base has been extended by a few inches to accommodate the extra mechanics.

The terminal is fundamentally half-duplex—every input from the keyboard is printed directly on the paper—so it can be used off-line as a normal typewriter.

As a printer is a complex mechanical construction, a number of timing contacts are made available to the computer to indicate the position in a printing cycle of the machine when it is free to print the next character or to transmit the next character from the keyboard. It is important to follow those signals exactly to maintain the full printing speed of 15·5 characters per second and to avoid unnecessary wear on the mechanism.

When considering the design of an interface between the terminal and a computer, there are trade-offs concerning the use of hardware and software, in a suitable combination, to handle the various timing codes. Certain operations, such as "carriage return", take a considerable time compared to a print operation and it is not, therefore, possible to operate the terminal successfully as an asynchronous serial terminal, such as an ASR33 Teletype, but only as a synchronous parallel terminal in the manner of most matrix line printers.

The protocol existing over such an interface relies on a handshake between the computer and the terminal. Firstly, the computer signals that valid data is present on the interface and the terminal accepts and prints accordingly. When the terminal is ready for the next operation it signals back to the computer that new data should be presented.

It is the function of the interface to be described to collect together the various timing signals from the IBM terminal and combine them into a single signal for the computer, and to cause printing upon the terminal on receipt of data and strobe signals from the computer.

Within the terminal, printing is divided into two separate parts. Firstly, all characters which appear on the golf-ball are identified by a seven-bit code which is generated by the keyboard on input and used to energise the seven-character selection magnets on output.

Secondly, the seven non-golf-ball characters—carriage return, line feed, tab, space, backspace, shift to upper, shift to lower—are brought out as a one-from-seven code from the operational contacts and printed from a one-from-seven code applied to the operational magnets. The nature of those codes depends on the exact model of terminal being used, and whether input or output is being considered.

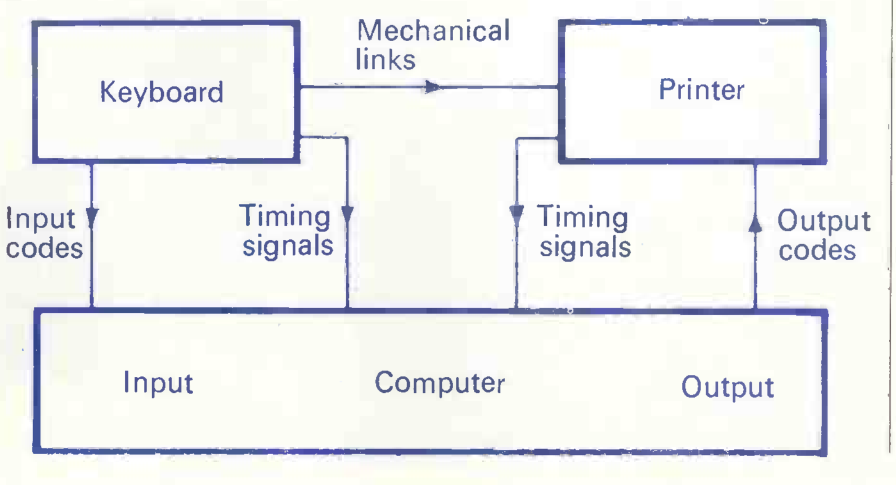
Two families

The character selection magnets have an inherent connection with the golf-ball, controlling its tilt and rotation. The code used, therefore, defines the position of the desired character on the golf-ball. There are, however, two families of golf-ball which can be used, the BCD family and the familiar office, or correspondence, family.

The mechanical configuration of the keyboard reflects the nature of the golf-ball for which it was designed so that, when operated off-line, the correct characters appear on the paper.

There are in existence three types of

Figure 1



er route capability

terminal, the BCD terminal, the correspondence terminal and the BCD-converted-to-correspondence terminal. There are considerable differences in the internal wiring and code patterns for the different versions, but suffice it to say at present that the interface will handle all types. To remain as simple to implement as possible, it is necessary to re-wire the various contacts within the terminal. The code table given will operate with office golf-balls and must be re-arranged to accommodate BCD golf-balls.

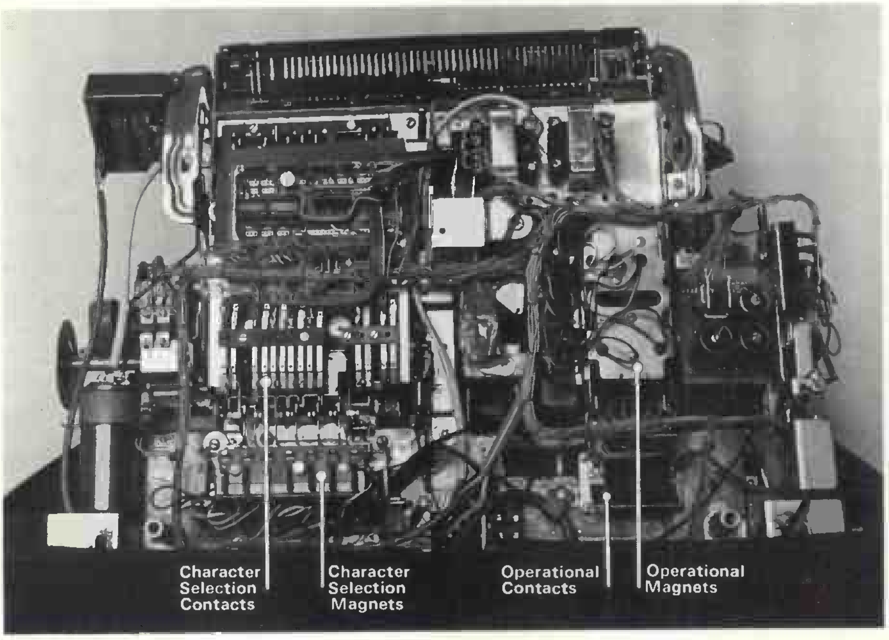


Figure 2.

Positive-earth magnets

All terminals so far examined have positive-earth magnets which are wired to a common line. A power supply is required to hold this line at +50 volts. As viewed from left to right in fig. 3 and in fig. 4, the magnets activate the mechanism to produce tilt and rotation of the golf-ball. Wires are brought out to the connection socket as indicated, and the use of internal suppression diodes allows a very simple open-collector driving transistor (fig. 5).

Timing is generated from the contact C2 (see fig. 3 for location) and there is a very simple relation between the timing contact and the application of power to the magnets. The magnets may be energised when C2 N/C is closed, and must be de-energised when C2 N/O closes. The next magnet cycle may begin when C2 N/C recloses.

To ensure continuous synchronous printing, the new magnet driving code must be available when C2 N/C closes again—timing diagram (fig. 6).

Again wired with a common positive earth, each operation selection magnet also has its own suppression diode and connection to the rear socket (see figs. 7, 8 and 9). The operational magnets are timed by a collection of feedback contacts spread around the machine. The signals have the same meaning, with N/O closure signifying that the magnet must be de-energised and N/C re-closure signifying that the next cycle may begin.

C3 times shift operations, C5 times backspace, space and tab, while C6 times carriage return and line-feed. Two final contacts are included to ensure that the long operations tab and carriage return have been completed.

Normally they take much longer than any other cycles and the machine must be halted until their interlock contacts have re-made.

Single signal

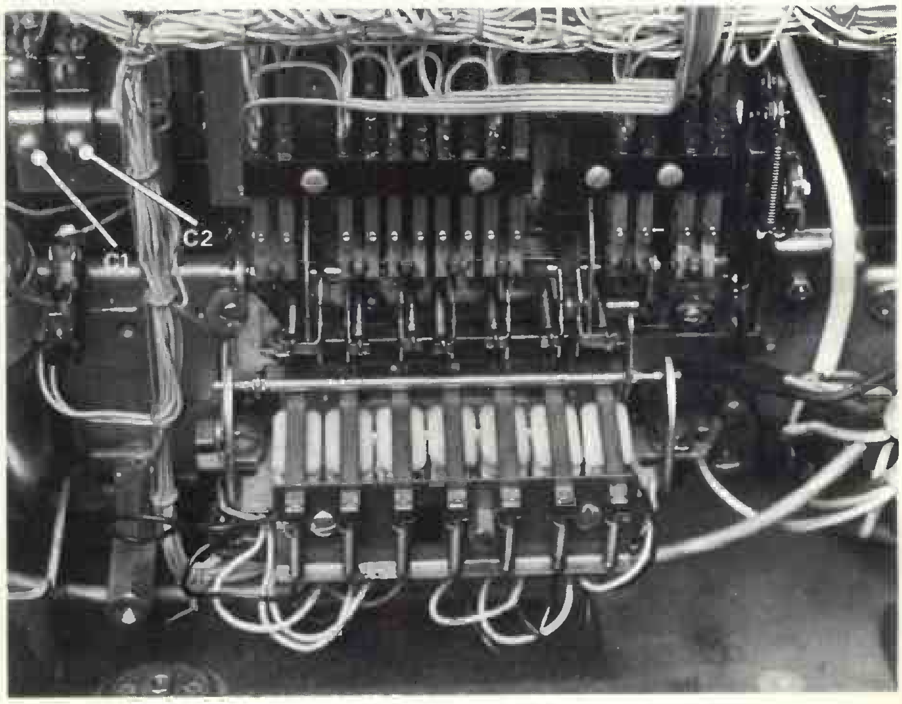
All the timing and interlock contacts can be combined to produce a single signal for the interface logic. The bistable (fig. 10) is set by the first "N/O make" and is re-set only after the last "N/C re-make". Although the internal wiring of the terminals as supplied is substantially as illustrated in fig. 10, it has been found that minor differences from machine to machine make it easier in the long run to re-wire the contacts rather than trace the existing wiring.

Primarily an input operation, shift, however, must be examined on output so that the terminal may be placed in the correct case before a character is printed. It is simplest to feed the shift transmit contacts to a bistable and examine the output before each print cycle, performing the relevant shift if required.

The shift is a complete operation,

(*continued on page* 35)

Figure 3



The Age of Affordable Personal Computing Has Finally Arrived

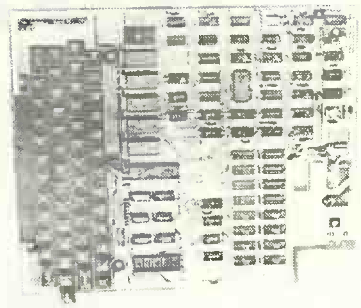
Ohio Scientifics

Superboard II

Full 8K basic and 4K user RAM
Built and tested

£284.95

inc. VAT & P&P



Superboard II was designed specifically with low price and the first-time user in mind. It promises to be the most dramatic price and performance breakthrough to date, in the microcomputer industry. Ohio Scientific, with headquarters in Aurora, Ohio, are one of the leading manufacturers of complete computer systems — from hobbyist right up to business and OEM applications.

The single board construction and custom LSI chips used in the Superboard II result in large cost savings, and ease of use. In fact it has more features and better performance than some other systems that are selling at up to £1,000. In the early 70's computers with inferior performance cost over £10,000.

The broad range of features include 8K BASIC in ROM, up to 8K of RAM on board (4K supplied), full 53 key computer keyboard, Kansas City cassette interface, video display interface (with graphics). Available options include an expander board for additional 24K RAM, dual mini-floppy interface port adaptor (for printer and modem).

The Superboard II comes preassembled, and only needs a power supply and case. Any 5V supply at 3A will power it.

Standard Features

- Uses the ultra powerful 6502 microprocessor
- 8K Microsoft BASIC-in-ROM
- Full feature BASIC runs faster than currently available personal computers and all 8080-based business computesr
- 4K static RAM on board expandable to 8K
- Full 53-key keyboard with upper-lower case and user programmability
- Kansas City standard audio cassette interface for high reliability
- Full machine code monitor and I/O utilities in ROM
- Direct access video display has 1K of dedicated memory (besides 4K user memory), features upper case, lower case, graphics and gaming characters for an effective screen resolution of up to 256 by 256 points. Normal TV's with overscan display about 24 rows of 24 characters, without overscan up to 30 x 30 characters.

Extras

- Available expander board features 24K static RAM (additional mini-floppy interface, port adapter for printer and modem and OSI 48 line expansion interface.
- Assembler/editor and extended machine code monitor available.

Commands

CONT	LIST	NEW	NULL	RUN	

Statements

CLEAR	DATA	DEF	DIM	END	FOR
GOTO	GOSUB	IF...GOTO	IF...THEN	INPUT	LET
NEXT	ON...GOTO	ON...GOSUB	POKE	PRINT	READ
REM	RESTORE	RETURN	STOP		

Expressions
Operators
—, +, *, /, ↑, NOT, AND, OR, >, <, < >, > =, < =, =
RANGE 10^{-32} to 10^{+32}

Functions

ABS(X)	ATN(X)	COS(X)	EXP(X)	FRE(X)	INT(X)
LOG(X)	PEEK(I)	POS(I)	RND(X)	SGN(X)	SIN(X)
SPC(I)	SQR(X)	TAB(I)	TAN(X)	USR(I)	

String Functions

ASC(X$)	CHR$(I)	FRE(X$)	LEFT$(X$,I)	LEN(X$)	MID$(X$,I,J)
RIGHT$(X$,I)			STR$(X)		VAL(X$)

Plus variables, arrays and good editing facilities.

Fully built and tested. Requires only +5V at 3 amps and a videomonitor or TV and RF converter to be up and running.

At this price there is going to be an enormous demand for Superboard II and supplies are going to be extremely limited. Lotus Sound is expecting first deliveries from the States in mid-December and orders will be treated strictly in the order they arrive, so post off today if you want to avoid long delays.

LOTUS SOUND

4 MORGAN ST., LONDON E3 5AB

Mail order only
Callers by arrangement
01 - 981 3993 (24 hr answer)
Telex 261426 Attn: Lotus Sound

To: LOTUS SOUND
4 MORGAN ST., LONDON E3 5AB

Please send me ...... Ohio Scientific Superboard Computer(s)
I enclose cheque/PO for £ ....

Name ....

Address ....

● Circle No. 131

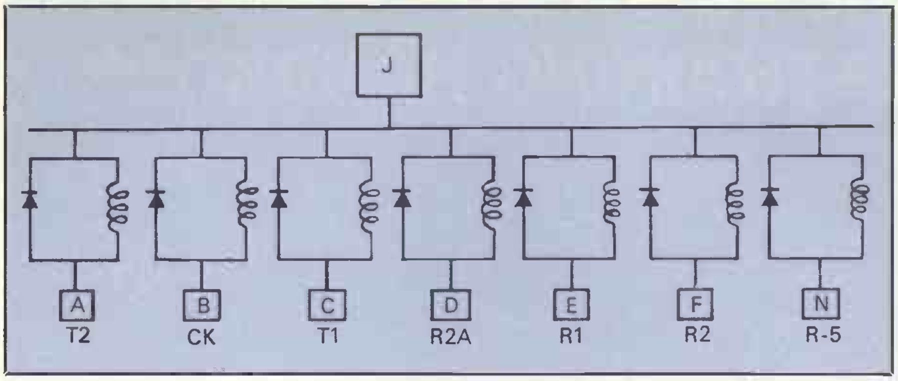


Figure 4

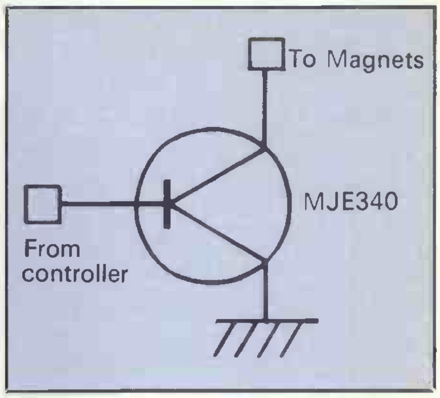


Figure 5

(*continued from page* 33)

taking one cycle-time of the machine, and cannot be combined with a print from the golf-ball. If the keyboard lock solenoid is wired in parallel with the shift-to-lower-case magnet, the terminal will operate correctly if it is left in manual upper-case lock from the keyboard. The keyboard lock solenoid also removes any shift-lock. The wiring for fig. 10 must be extended to include the keyboard lock contact.

The timing controller has eight input lines and two output lines. The output lines transmit the case and a BUSY status to the computer, while the input lines carry the data and a combined strobe-mode signal. All input lines are active low. On the transition of B7 the monostable is triggered, setting bistable B, energising the magnets. The input code B0-B6 is gated with B7 to select either a character or operational cycle. The BUSY line is lowered as soon as the strobe is received, and stays low until the end of the cycle.

A signal from the timing bistable A de-energises the magnets by re-setting bistable B at the correct point in the cycle as signalled by the feedback contacts. The cycle is completed when bistable A is re-set. A circuit diagram and timing diagram are supplied.

Within an operating system such as Southwest Technical Basic or Micropolis MDOS/Basic it is possible to re-write the printer driver routine in assembler code. This allows the use of non-standard hardware, such as the IBM terminal.

In general, this new routine should transform the ASCII values sent by the calling program into IBM codes and handle the timing. The program listing to be published next month is in Basic and although it will work at less than full synchronous speed, the ideas contained within it should be translated into assembler code and patched into the target operating system.

The interface may be contained, with its power supplies of +5 and +50 volts, within the terminal, as illustrated; within the computer; or in a separate enclosure. Components required are:

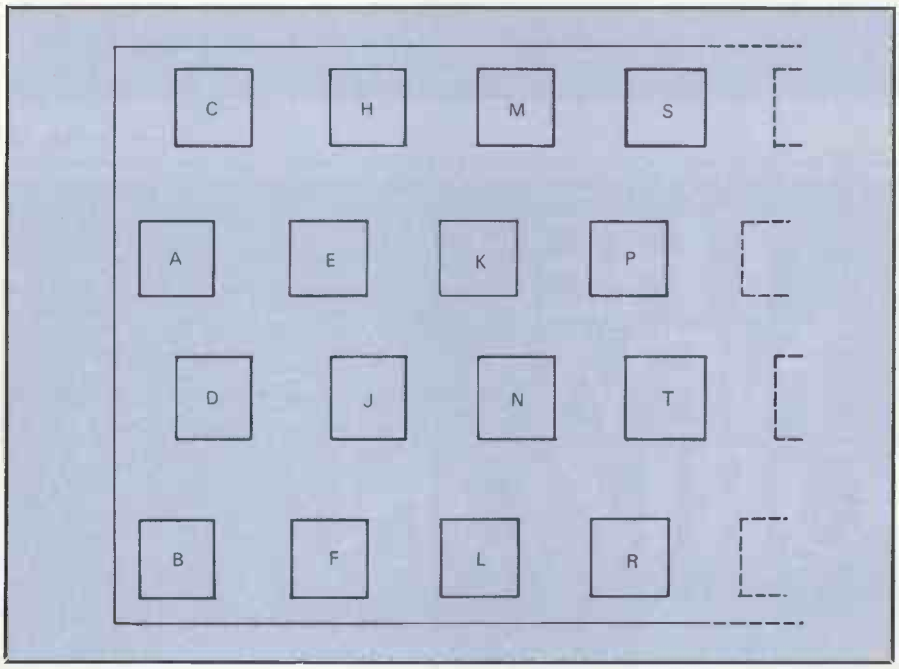


Figure 4a

Interface

SN7400 × 2
SN7402 × 2
SN7404 × 3
SN74121 × 1
MJE340 × 14
1K0 × 14
4K7 × 4
10nF × 10 (Decoupling capacitors)
Veroboard

PSU

RS 207-166 0-20, 0-20 20VA
RS 196-303 0-12, 0-12 3VA
1,000uF 100V
1,000uF 25V
1N4001 × 8
7805

(*continued on page* 37)

Next month: The driving software.

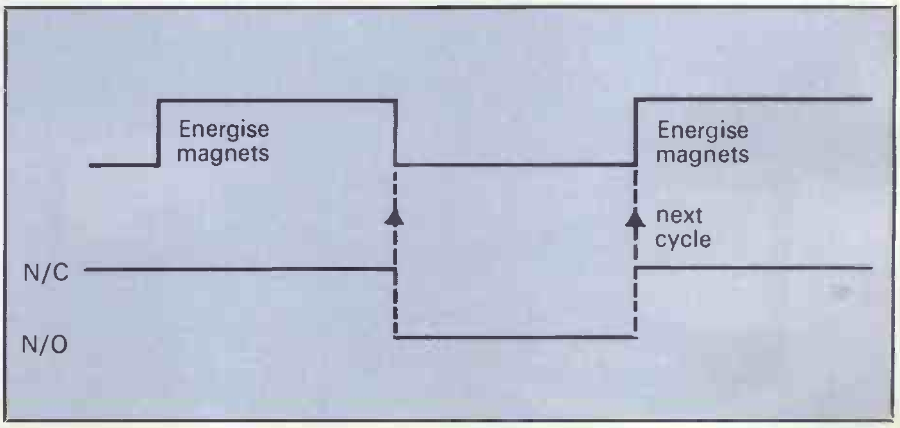


Figure 6

(continued from page 35)

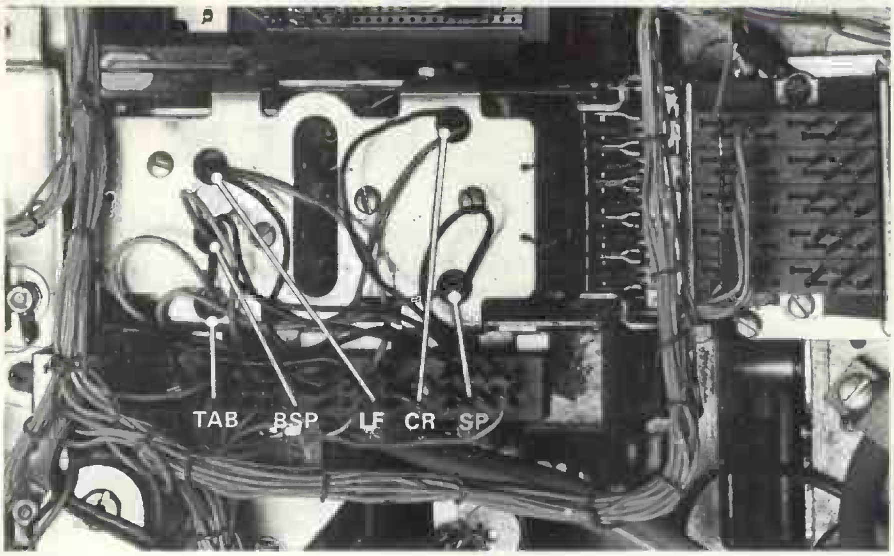


Figure 7

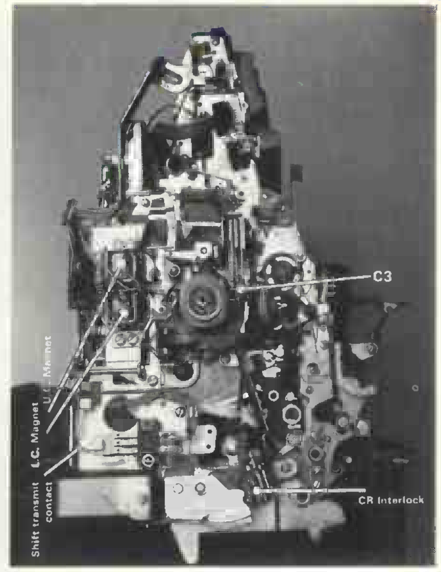


Figure 9a

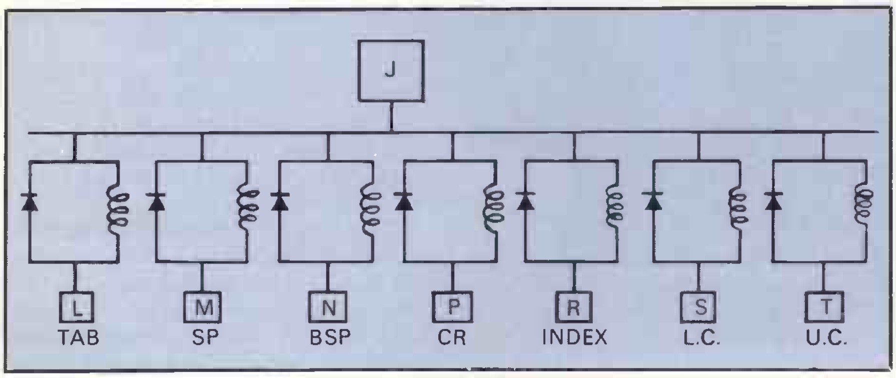


Figure 8

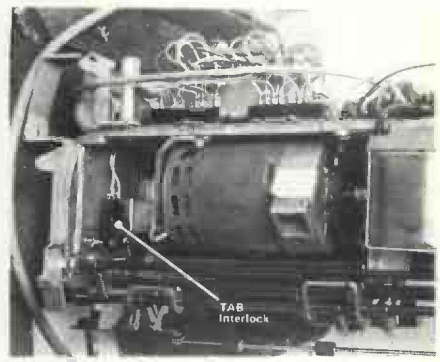


Figure 9b

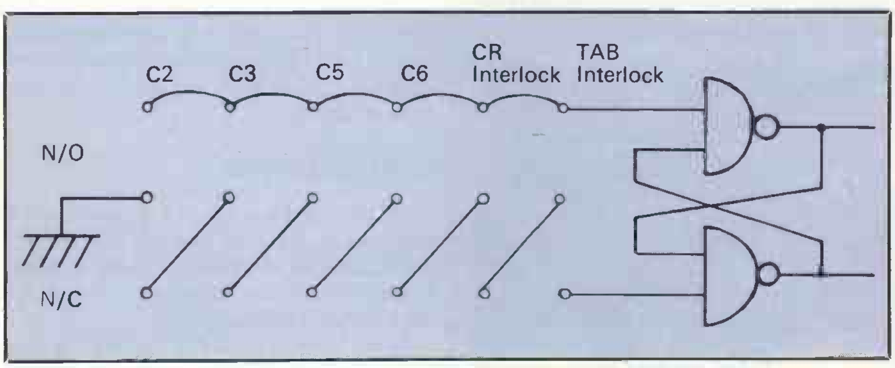


Figure 10

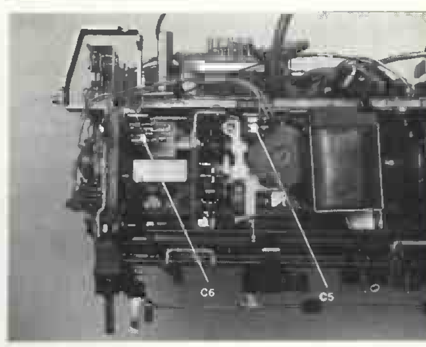


Figure 9c

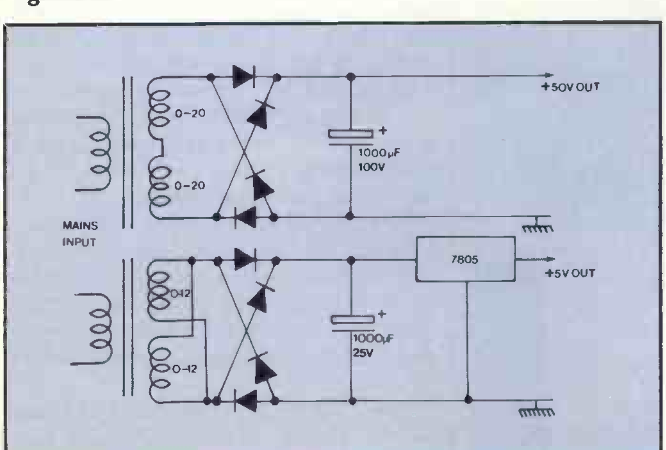


Figure 11

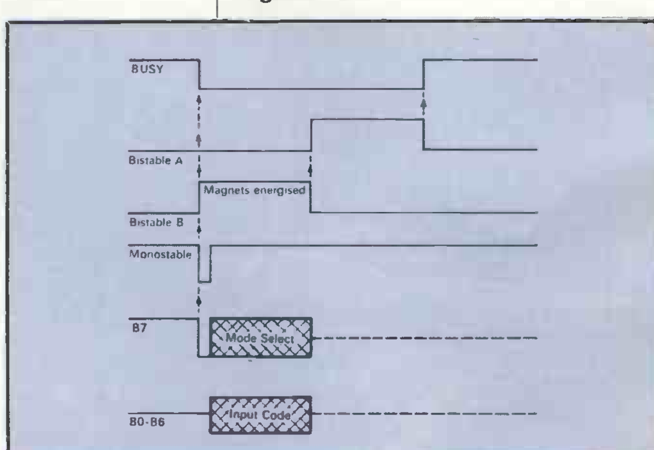


Figure 12

To Los with a crystal

Visiting an American computer exhibition is like taking a glimpse into the future. You can be almost certain that the new products and ideas on display there will reach the U.K. market after about six months.

by
RICHARD HEASE

The Los Angeles West Coast Computer Faire was no exception. With November temperatures still in the high 80s, the air-conditioned Convention Centre comfortably accommodated the 150-odd companies selling myriad computers, software, peripherals and ideas to the 12,000 visitors.

Personal computing is still going strong in the U.S. You can be certain to find a show taking place each month. Missing from this show—because they cannot keep up with the pace of orders, it is said—were Commodore and Apple, two of the largest-selling computer firms in the U.S. Their computers were there, however, being sold through distributors and shops in abundance.

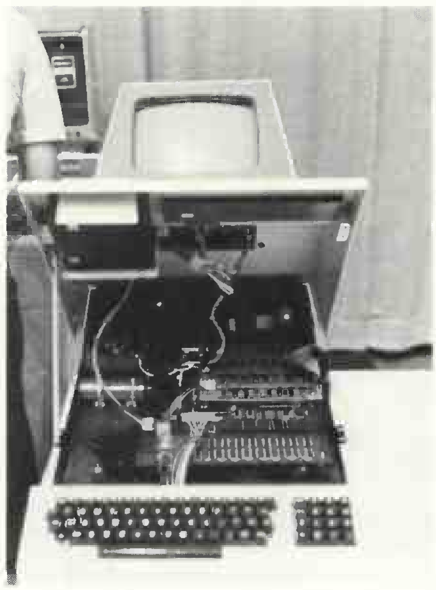
The Tandy Corporation, known as Radio Shack in the U.S., was there. No wonder. The company is the largest seller of computers for hobby use in the world. It is now estimated to have sold a staggering 200,000 systems.

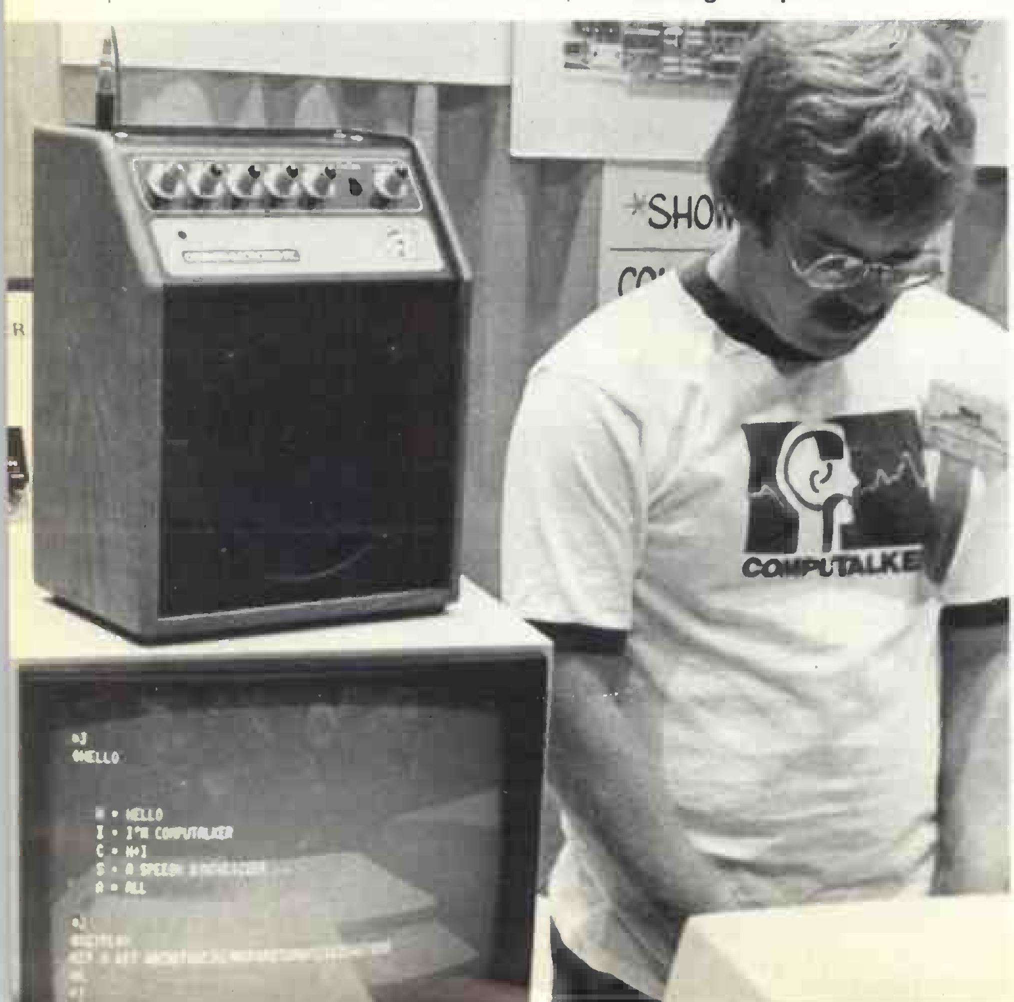
It is not surprising, therefore, that most of the new developments at the show centred on the Tandy computer.

First, though, a word about prices. I know it is a popular topic but the first thing to strike home in the States is the price of computers.

Tandy, for example, sells its TRS-80 range at almost half the U.K. price. It is difficult for a multi-national company truly to justify this, I feel.

Tandy, is, of course, not the only company doing so. Just about every piece of computer equipment, software and peripheral is almost half price compared to the U.K. The reason is simple. U.K. companies have to pay shipment and set-up costs for a lower volume market. Because it is a lower-volume market, U.K. companies cannot buy in the quantities which provide the best discounts.





A new keyboard for the Pet (above), and (below) Computalker, the talking computer.

This is unlikely to change in the foreseeable future, unless the U.K. market grows its own competitive system to force the larger companies to offer bigger discounts to remain competitive.

As the market is still very buoyant, however, computers can hold a higher price. So do not expect any significant reductions here for a long time. If it is any consolation, prices in Europe and Japan are higher than our own.

Still, it is rather disconcerting when you can buy a Pet for £400, a Kim for £90 and a Compucolor with graphics and disc for £750—not to mention the fact that Tandy in the States is offering a complete disc-based business system with printer to rent for £75 a week.

The most outstanding point of the show was the amount of software available or under production. Because it is the largest selling system, the Tandy attracts most attention.

Coming soon

As the system with the greatest sales potential in the U.K., merely because of the number of shops offering the system, it is satisfied that we can expect some software to reach here soon.

At the moment, it is still typically games software. Biorhythms, mastermind, star treks, backgammon, chess, bridge; you name it, it is available, not just for the Tandy but for the Pet and Apple as well.

There is a big increase in the number of business applications packages coming to the market. Word processing appears to be the most popular application, covering automatic letter-writing and text editing. For example, there is a piece of software for the Tandy known as the Electric Pencil which allows you to produce mailing lists, business forms, camera-ready copy for printing, and large numbers of personalised business letters for £50.

For £25 there is a version of Pilot to run on the TRS-80. It is being hailed con-

(continued on next page)

Angeles ball

(*continued from previous page*)

tinually as the language for educational applications in the U.S.

Payroll, sales ledger and other types of accounting systems for the Pet, Apple and TRS-80 are also becoming available. I brought back software which I plan to test and preview before it arrives here.

On the hardware front there are interesting developments. The most enjoyable was to hear a computer talk. There were three synthesised speech units available as optional extras. The one I enjoyed most was the Computalker. It is S-100 bus-compatible and works in one of two ways—you can produce speech from a predetermined speech file or type-in phonetically what you want to hear (e.g., HHEHLOW).

Can be improved

The Computalker, with everything you need for synthesised speech, costs about £250 in the U.S. The quality of the speech, I feel, still needs a great deal of improvement to be perfectly understandable. I am still waiting to hear a human and a computer carrying-on a conversation and I believe that is no more than a few months away.

A system I am sure we will see soon is the Pascal Microengine from Western Digital. It features the Pascal operating system with a 64K-byte (32K-word) CPU, floppy disc controller, floating point hardware and self-test microdiagnostics. The operating system includes Pascal and Basic compilers, files manager, screen-orientated editor, debugger and a graphics package. The price in the U.S. is £1,500.

IBM, the world's largest computer manufacturer, was also at the show, displaying its 5110 computer system. It operates either with Basic or APL and was programmed to demonstrate payroll, accounts and management reports. It operates with a screen and printer and floppy discs. The price is £9,000 and upwards.

At the other end of the scale was the Superkim from Microproducts. It is a single-board control computer for applications where intelligent control is desirable, such as manufacturing or production line processes. It is totally compatible with Kim-1 and Apple II hardware interfaces and has TTY, audio cassette interfaces and eight latched priority interrupts which are re-settable individually under software control. It costs £200.

The Exidy Sorceror, examined in last month's *Practical Computing*, was attracting its fair share of attention.

The Compucolor II is a machine which I hope we shall be able to review soon. It features a beautiful eight-colour, high-resolution graphics and is complete with display and keyboard. The system is based on the 8080 micro, uses discs, and is expandable to 32K. The expected U.K. price is about £1,200.

I am sure it will not be long before the Interact home computer is available here. To be priced at around £300, it connects to your own TV and includes an 8080 micro, 8K RAM, 2K ROM, hand controls, built-in cassette unit 53-key keyboard and a music synthesiser.

For the future, the most interesting gossip around the show was that Schugart has a low-cost floppy disc unit and printer ready to be unveiled early in 1979. The £100 mini-floppy and the £100 printer may be just around the corner.

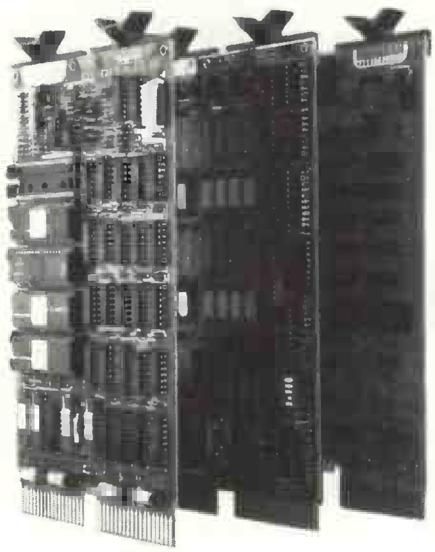
Apparently, Schugart and Matsushita have a 5in. floppy disc with 70K bytes capacity under development which will retail for £65. The impact printer, also said to be from Schugart, may be priced at £125. If the price of input and output can be reduced to prices of this kind, 1979 will be a very interesting year.

IBM sells to the "hobby" market.

DEC Microcomputer System from DICOLL

Meet the LSI-11/2 Microcomputer Family from DICOLL; offering the power of the LSI-11 and the PDP-11 family of mini-computers. The same versatile instruction set. The same powerful software. The same 16-bit performance. The same interrupt and floating point arithmetic powers. Indeed, only its form factor has been changed.

The Family is comprised of a four-line serial interface (DLV11-J), which features four independent asynchronous channels and the facility to be independently programmed. A 16-bit microcomputer module, KD11-HA, with a raw compute speed of 380ns microcycle time. A dynamic MOS RAM, MSV11-D, with a 32K word capacity. Then there is the range of backplane assemblies H9281 with a self-contained LSI-11 bus — the key to the Family.



Our complete systems capability can make all the difference to your process. Call us for the full facts. We'll introduce you to our family.

DICOLL
BASINGSTOKE

Dicoll Electronics Limited
Bond Close, Kingsland Estate,
Basingstoke, Hampshire.
Telephone: Basingstoke 61551
Telex: 858769

● **Circle No. 134**

---

computer centre

	Kit	Ass.
8K bytes ECONORAM II (450 n.s.)	£79	£89
8K bytes SSM 250 (250 n.s.)	£95	—
16K bytes ECONORAM IV	—	£199
8080A CPU with vector interrupt	£69	—
SBC 100 Z80A, serial + parallel, ROM/RAM	£199	—
104 2 Serial/Parallel	£89	—
VBI-B VIDEO	£79	—
MOTHERBOARD MT3 11-Slot Board		£19
PIS 100 Edge Connectors	—	£3·50
S100 Prototype Board	—	£19
TARBELL Disc Controller	£125	—
VERSAFLOPPY Disc Controller	£95	—
SA400 MINIFLOPPY Disc Drive	—	£195
DRI 7100 8in. Disc Drive	—	£290
Z80 Starter kit	£145	—

Ring 02514 29607 for full catalogue.
Mail Order Address: 20 Durnsford Avenue, Fleet, Hants, GU13 9TB.

THE DISCOUNT MICRO STORE

S100 Hardware
CP/M Software

Computer Centre Mini Disc Kit £786

S100, Z80 micro, 16K bytes memory, MINIFLOPPY drive, programmable baud rate serial I/O, parallel, PROM monitor and boot, CP/M operating system, cables, connectors, 10 manuals.
Add your power supply and terminal.

CP/M Disc Operating System +BASIC-E	£52
CP/M Manuals (6)	£22
CP/M U.S. User Group library (8in. floppy disc, 25 volumes)	FREE with media £4.50 ea.

Also available for CP/M: Microsoft BASIC FORTRAN and COBOL
All items currently in stock.
Add 2% postage (min. 25p), Add 8% VAT.

● **Circle No. 135**

COMPANY	SYSTEM	APPLICATION	PRICE RANGE
COMART PO Box 2, St Neots, Cambridgeshire 0480 215005	**Microbox,** Min. size: Chassis with three sockets. Max. size: Chassis with six sockets.	Aimed mainly at OEM industrial users and perhaps the serious hobbyist. Manufactured in Britain by Comart, it will take Cromemco, North Star and other processors and software.	£70–£195
	Cromemco System Two, Min size: Processor alone with six sockets in kit form. Max size: 21 sockets; 512K of memory; up to three mini-diskettes of 90K bytes each.	Software: Extended Basic; Fortran IV; Cobol; Macro-assembler; Word-processing, DBMS. American system suggested for systems development.	£395 to around £5,000
	Dynabyte, Memory board for any S100 bus system. Available in 16-32K units.		£275–695
	Cromemco System Three, Min size: 32K memory; terminal and printer interface; dual 250K-byte IBM compatible floppy discs. Max size: 128K memory; two–three terminals.	Software: Same as System Two. Suitable for a wide range of commercial and scientific applications. Theoretical maximum of 512K of memory.	£4,174–£10,000-plus
	Horizon, Min size: 16K memory; serial interface; one mini-diskette drive with 90K bytes; power supply. Max size: 48K memory; three diskettes; hardware floating point board.	Software: Extended Basic; disc operating system; monitor; access to CP/M range. Manufactured by North Star Computers of the U.S. Aimed at educational and small business users.	£995–£3,500
	SOL 20/16, Min size: 16K memory; integral keyboard and monitor; serial and parallel interface; cassette unit. Max size: 64K memory; up to 1MB disc capacity.	Software: Extended Basic; Fortran; Focal; Assembler; Editor; Games. Another American system from Processor Technology Corp aimed at the small business and education markets.	£1,785–£5,000-plus
COMMODORE SYSTEMS DIVISION London NW1 01-388 5702	**PET,** Single unit containing screen, tape cassette and keyboard. Memory is expandable from 8–32K.	Software: Basic; Games; Business packages. The British subsidiary of Commodore Systems of the U.S. sells Pet for home, educational and small business applications. Reviewed in the October issue of *Practical Computing*; there are more than 50 dealers throughout the U.K.	From £695
	Kim 1, Min size: Processor (6502 chip); small calculator-type keyboard; LED six-digit display; built-in interfaces for audio-cassette and Teletype; 1K RAM; 2K ROM. Max size: Can add: Kim 4 motherboard; Kim 3B 8K RAM (up to 64K); Kim 5 resident assembler.	Software: None available yet, but it has three good manuals. An American import which gives Pet-type capabilities with a maximum configuration. For the hobbyist but used mainly as an evaluation board for the 6502 chip. There are two dealers, GR Electronics and J Marshall, which offer further facilities.	£129–£600 (+VAT)
COMPELEC 107 Kilburn Square, Kilburn High Road, London NW6 01-624 7744	**Altair System 1300,** Min size: 32K memory; dual minifloppy discs, 71K bytes each formatted; serial interface. Max size: 64K memory; 4 serial ports.	Software: Basic (single and multi-user); Fortran; Cobol. The hardware for the Altair systems is from Pertec in the States, but the software is Anglo-Dutch. For educational and small business systems.	£3,000–£5,500
	Altair System 70, Min size: 33K memory; dual floppy discs, 300K bytes each. Max size: 64K memory; provision for up to 8 VDUs.	Software: Single and multi-user Basic; Fortran; Cobol; APL. Aimed exclusively at business applications; packages are available for general and sales and purchase ledger, payroll, word processing, stock control, estate agency, hotel or small airline reservations, transport management and freight costing. A point-of-sale package will soon be ready.	£4,500 to £10,000-plus
	Altair System 300, Typical size: 64K memory; 10MB disc drive; turnkey processor; VDU; Qume daisywheel printer and disc unit.	Software: Single-user Basic; Fortran; Cobol. The same packages as for the System 70 are available for this top-end-of-the-market-business, orientated system. Compelec has its own office in Birmingham, but a full distributor network is being set up.	£10,000-plus
COMPUTERBITS LTD 40 Vincent Street, Yeovil, Somerset 0935 26522	**System 8,** Typical size: 64K memory; 1MB disc storage; serial I/O port for VDU; parallel port to printer; CP/M operating system.	Software: Basic; Pascal; Fortran. This British-manufactured microcomputer system is almost exclusively for business applications.	£3,000–£5,000

(continued on next page)

(continued from previous page)

COMPANY	SYSTEM	APPLICATIONS	PRICE RANGE
COMPUTER MART LTD 38 St Faiths Lane, Norwich. 0603 615089	**VDP-80,** Typical size: Single desk-top unit housing a 12 in. display, dual standard floppy disc drive, processor, power units, cooling system and fully-programmable keyboard containing 62 alphanumeric, 12 numeric and 12 cursor controls in separate keypads. Normally sold with 32K memory and 1.2M bytes of disc storage but may be expanded.	Software: Included in the price is a sophisticated operating system with Commercial Basic. A range of commercial application packages is available, including word processing if required.	£9,500
COMPUTER WORKSHOP 38 Dover Street, LondonW1 01-491 7507	**System 1,** Typical size: 40K memory; dual 8 in. floppy discs, total storage capacity 1·2MB; Ricoh daisywheel printer. **System 2,** Typical size: 24K memory; dual minifloppy discs of 80K bytes each; Centronics 779 dot matrix printer; VDU. **System 3,** 12K memory; cassette interface; 40-column dot matrix printer.	Software: Range of Editors, Assemblers, Basics and Games; Information retrieval package. These systems were designed and built in Peterborough and are suitable for educational, small business users and perhaps the more serious hobbyist. There is a large number of dealers around the country.	System 1—£5,000-plus; System 2—around £3,000; System 3—from £1,350
EQUINOX COMPUTER SYSTEMS LTD 32–35 Featherstone Street, London EC1Y 8QX 01-253 3781/9837	**Horizon,** Min size: 16K memory; Z80A processor; single minifloppy disc drive. Max size: 64K memory, three minifloppy disc drives, any acceptable S100 peripheral boards.	Software: Standard—Basic Interpreter (includes random and sequential access), disc operating system and monitor; Options—Basic Compiler, Fortran, Cobol, and Pilot. The system is suitable for commercial, educational and scientific applications. Application software for general commercial users.	£1,000–around £2,500
	Equinox 300, Min size: 48K memory; dual floppy discs giving 600K bytes of storage; 16-bit Western Digital m.p.u. Max size: Up to 256K memory; up to four 10MB hard discs.	Software: Basic, Lisp, Pascal, Macro Assembler, Text Editor and Processor. All software is bundled. The system is a multi-user, multi-tasking, time-sharing system for 2–12 users. Application software is available for general commercial users.	£5,000–£40,000-plus
MICRONICS 1 Station Road, Twickenham, Middlesex 01-892 7044	**Micros,** Typical size: 1K monitor; 47-key solid state keyboard; interfaces for video, cassette, printer and UHF TV; serial I/Os; dual parallel I/O ports; 2K RAM; power supply.	Software: Extended Basic; Pascal. A British-designed and manufactured system which is being enhanced rapidly. Already available are a 40-column impact printer using plain paper at £360; what is claimed to be the cheapest data terminal around—a system with an acoustic coupler and VDU for £1,020. Prospective applications: small businesses, process controllers and hobbyists.	

(continued on next page)

(continued from previous page)

COMPANY	SYSTEM	APPLICATIONS	PRICE RANGE
NASCOM MICROCOMPUTERS 92 Broad Street, Chesham, Buckinghamshire 02405 75151	**Nascom 1,** Min size: CPU; 2K memory parallel I/O; serial data interface; 1K monitor in EPROM. Max size: CPU; 64K memory; up to 16 parallel I/O ports.	Software: Mostly games, but a maths package is on its way. The British-manufactured system started as a hobbyists' package but has found an increasing number of industrial users. Printer and minifloppy interfaces are in preparation. There are about two dozen dealers around the country.	From £197·50
NEWBEAR COMPUTING STORE 7 Bone Lane, Newbury, Berkshire and 2 Gatley Road, Cheadle, Cheshire 0635 49223	**Sym 1,** Size: 6502 chip and keypad, with memory available in 4K blocks to 64K.	Software: Any Kim software. An American system meant to be the foundation for very small business and hobbyist users.	From £200
	7768, Size: CPU board; 4K memory; cassette and VDU interfaces.	Software: Range of Basics and Games. A British manufactured system for the hobbyists. Expandable to 64K memory, it is available only in kit form.	
	Cromemco Z2, Min size: Z2 chassis: power supply; motherboard; CPU; fan; sockets; Byte saver board; 16K memory. Max size: 48–64K memory; dual 8 in. floppy discs.	Software: Basic, Fortran; Assembler; macro assembler. For small business and educational applications. These systems are also supplied to more than a dozen dealers. Same basic system as Comart.	£1,375 to £4,000
PERSONAL COMPUTERS LTD 18–19 Fish Street Hill, London EC3 01-623 1434	**Apple II,** Min size: 16K memory; 8K ROM; keyboard; monitors; mini-assembler: colourgraphics; Powell card; RF modulator; Games; Paddles and speaker; 4 demo cassettes. Max size: Expandable to 48K memory, and floppy discs and printers are now available.	Software: Basic; Assembler; Games; Business packages. An American system regarded as suitable for any kind of applications. There are 15 dealers throughout the country and maintenance contracts are offered.	£1,000–£2,000
RAIR 30–32 Neat Street, London WC2 01-836 4663	**RAIR Black Box,** Min size: 32K memory; dual minifloppy discs, 80K bytes each; two programmable serial I/O interfaces. Max size: 64K memory; 8 serial interfaces; 1MB disc storage (or 10MB hard disc); range of peripherals.	Software: Advanced Basic interpreter, Fortran IV compiler; Cobol compiler. Described by the makers as the only 'sensible' British-designed and manufactured microcomputer, its uses are small business and educational applications and in distributed processing networks. Hardware distributors are being signed and agreements made with software houses to add software. It is not for the hobbyists. A warranty and U.K.-wide on-site maintenance is given.	£2,300–£8,000
RESEARCH MACHINES LTD PO Box 75, 209 Cowley Road, Oxford 0865 49793	**Research Machines 380Z,** Min size: 4K memory; 380Z processor; keyboard. Max size: 48K memory. **280Z,** 4K board plus connecting cables, £398. 32K board—identical in performance to the 380Z: £722.	Software: Basic Interpreter; 12K Basic; Assemblers. A British system using CP/M software; delivery times are about 6 weeks at the moment. A minifloppy disc system is on trial. Sintel is the sole distributor.	From £830
SCIENCE OF CAMBRIDGE 6 Kings Parade, Cambridge 0223 312919	**MK 14,** Min size: 8060 SC/MP; ¼K user memory; ½K PROM with monitor program; Hex keyboard and 8-digit, seven-segment display; interface circuitry; 5v regulator on board. To this can be added: ¼K RAM (£3·60); 16 I/O chip (£7·80); cassette interface kit (£5·95); cassette interface and replacement monitor (£7·95); PROM programmer (£9·95).	Software: None provided, but a 100-page manual includes a number which will fit into 256 bytes covering monitors, maths, electronics systems, music and miscellaneous. Based on American National Semiconductor chips. Science will soon have a VDU interface and large manual on user programming. Half of sales are to hobbyists, half to engineers.	Basic price is £39·95. All prices are exclusive of VAT
STRUMECH ENGINEERING ELECTRONICS DIVISION (SEED) Portland Place, Coppice Side, Brownhills, Walsall, Staffordshire 05433 4321	**MSI 6800,** Min size: 16K memory; Act I terminal (keyboard); cassette interface. Max size: Three disc systems are offered: Minifloppy disc system with triple drives of 80 bytes each and 32K memory. Large floppy system with dual 312K-byte capacity disc and 32K of memory. Hard disc system with 10MB, five fixed, five removable, and 56K.	Software: Basic interpreter and compiler; super editor assembler; text processor on small disc system. This is an American-designed system which is being increasingly manufactured in U.K. A SEED survey of its sales showed 60% of the customers were educational establishments, a further 10% research institutes, 10% hobbyists and the rest commercial companies. A distributor network is being set up.	Basic system is £1,100 (£815 as kit); Minidisc—£2,500; large floppy disc £3,200; hard disc £8,000-plus
TANDY CORPORATION Bilston Road, Wednesbury, West Midlands 021-556 6101	**TRS-80,** Min size: Level 1 4K memory; video monitor; cassette; power supply. Max size: Level 2 16K memory; line printer, floppy disc system.	Software: Basic; some business packages. An American system from the 200-outlet Tandy chain—reviewed in this issue. The Level 1 is aimed at the hobbyist and education market and Level 2 at small business applications.	Level 1—£499; Level 2—£2,434

Solution to problem of man/machine interface

by A. G. Roberts

STAND BACK and watch almost any programmer or part-time keyboard user, such as the typical Apple II user, typing with one or two fingers. Even the really proficient by this means may be typing at 5–10 words a minute.

It is obvious that by far the slowest link in the man/Apple system is the man/Apple interface—the keyboard. The user and the Apple are both capable of working far faster than that 5–10 words a minute. This application is intended to speed this interface by perhaps a factor of 10.

The main object is to learn a form of touch-typing specially designed for Apple, or any other Teletype. And what better way to learn than on the Apple?

The overall objectives are to remove the need to look at the keyboard; to enhance the speed of typing; to be good fun; to concentrate on eliminating the user's bad points; to run on the 4K Apple II; and to be stored on a minimum number of cassettes—hopefully four blocks.

The details of this application are broken-down thus:
The System: ANALYSIS.
The System: DESIGN.
The System: USE.

The System: ANALYSIS

Modules

First, the objectives need to be divided into logical groups because I suspect that the whole course cannot be held in 4K or 8K of core.

The Apple II user is likely already to be fairly proficient at two-finger typing, so the first thing is to concentrate on bringing the other fingers into play and to "unlearn" dependence upon the two index fingers. Then an instinctive "feel" of the location of each letter can be learned, followed by real practice at "touch-programming".

So the logical divisions are: finger/key relationships; finger/key character interrelation; full typing; and speed and accuracy.

Methods

Apple II is ideal for this application—the only feature not used is the games paddle. Colour graphics, sound generation and the standard keyboard are essential, as are features such as the address stack, used for following series of lessons in response to the users' mistakes in a true "programmed learning" manner.

Detailed breakdown

Block 1. Manual skills: Finger/key relationships. This is the basic touch-typing skill—being able to use all fingers to strike the appropriate keys. To do this the system uses a screen representation of the keyboard and requests that keys are struck in turn. Note that the range of keys for each finger is indicated by its own colour.

By requesting that a specific finger be pressed down, the position of the hand is calculated and, if incorrect, correcting instructions are given. Also, response times can be noted and, based on them, games can be played requiring rapid recognition and response to the correct finger/key relationship, e.g., by quick flashes of a series of keys on the screen or by the sounding of a tone.

Games are an important part of this learning process and the system makes considerable use of them while evaluating performance and later causing corrective measures to be taken. For instance, such games can be "tuned" to the speed of response of the user or to particular faults, e.g., difficulty in striking keys controlled by the little finger automatically by totalling response times in an array of store locations.

Hence, at the end of a lesson, or game, the "programmed learning" features of the course can send back the user to study some previous lesson. The games, by insisting upon revision prior to a repeat of the game, can encourage persistence in acquiring these manual skills.

The lesson matter of each session can be varied by introducing a "random" effect into the choice by the system of sequences of keys to be flashed up to the screen.

Block 2. Basic Typing: Finger/Key/Character inter-relations. In block 1 there is deliberately no mention of using the keyboard to generate characters. The emphasis there is upon learning instinctively to use the fingers on specific keys. Now the relationship between key position and its appropriate character on the screen is to be concentrated upon and learned. The method, however, is very similar to the methods of block 1, and, as we shall see, to blocks 3 and 4.

A screen representation of the keyboard is used at first, to learn the characters produced from each key—without looking at the keyboard. Later, groups of letters are used to exercise individual fingers in a different presentation of the games of block 1, to provide motivation, light relief and speedy responses.

It may be possible to generate the sound of letters to be typed via the Apple II loudspeaker. If this can be done, then the resultant exercises would be well worth the effort. Perhaps the Tone Generator could be developed further to other uses in the course.

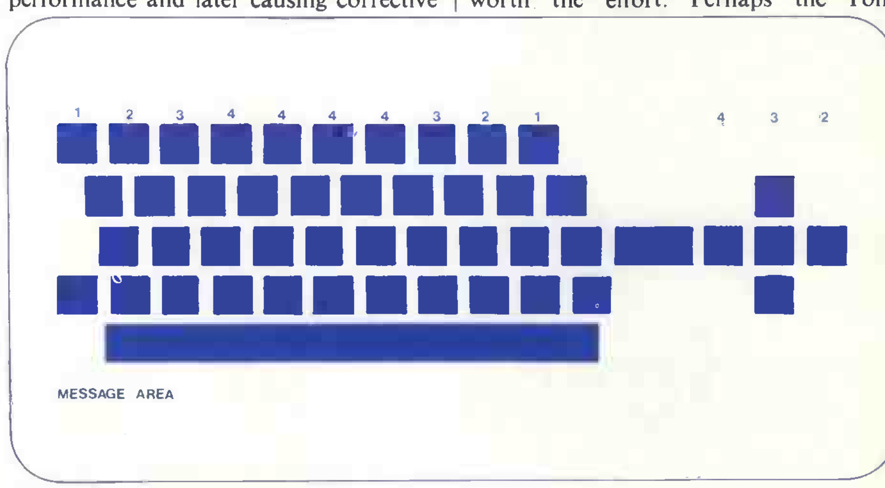
"Special" keys are included in this block, such as the return/newline key, backspace, and the like.

During this stage, some may find it useful to cover the characters printed on the keys by small self-adhesive labels so as to avoid "cheating".

Block 3. Full Typing. This block develops real typing skills, using words, phrases and number sequences, but still following the same basic lesson logic. Not only would phrases be written on the screen but written material provided to be copied and checked automatically; if faults are found, corrective lessons are called up, as before.

Particular emphasis is placed on pro-

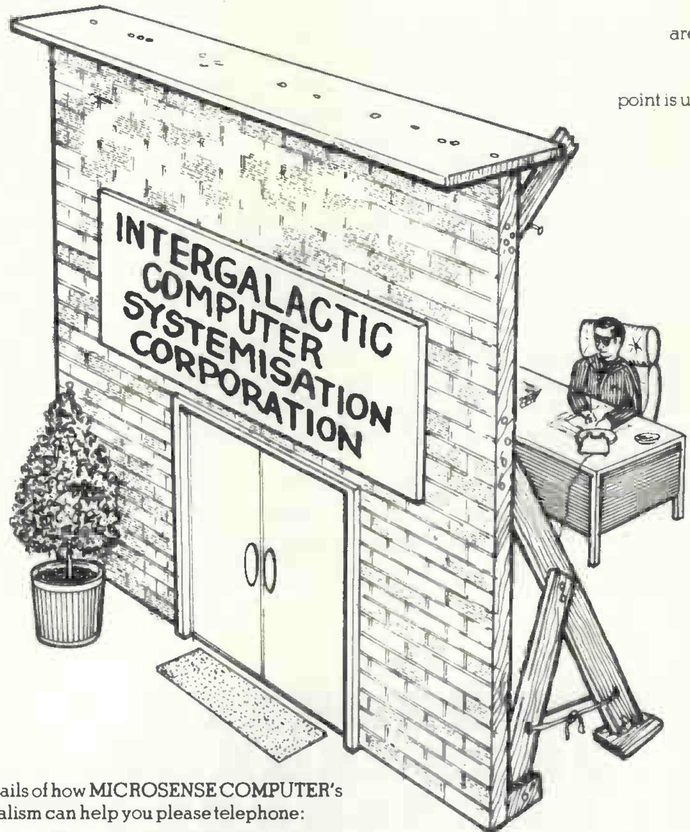
(*continued on page 47*)



Approximate screen layout

As they say in Hertfordshire –

"If I was going there, I wouldn't start from here."



Starting from the right place is vital if you are seriously considering buying a computer to help you to run your business, or even to use for pleasure, THE best starting point is undoubtedly MICROSENSE COMPUTERS at Hemel Hempstead, Hertfordshire.*

MICROSENSE COMPUTERS is a division of Data Efficiency Limited, staffed by computer professionals with more than their fair share of commonsense, and with a sound business record of constant growth since the Company's formation in 1964. The Company's established position within the UK computer scene ensures their continuance, and guarantees your investment in their products and services.

Any smooth salesman can say "Yes" to all your queries, but it takes the commonsense professionalism of a Microsense Systems Engineer to say "No!" if to do so is in your interest.

Buying a computer* for business or pleasure is a serious business and we are seriously in the microcomputer business so come and talk to the professionals, now!

For full details of how MICROSENSE COMPUTER's professionalism can help you please telephone:
David Jarman or Chris Murphy on (0442) 41191 (3 lines)
Or write to them at:

***Commodore PET and KIM (ex-stock)**
ITT 2020 (Apple II based)
MICROSTAR 45 PLUS (see below)

microsense compμters

Microsense Computers is a Division of Data Efficiency Limited

Maxted Road Maylands Avenue Hemel Hempstead Herts HP2 7LE Or telex them on: 825554 DATEFF G

Professional Dealers Required

We are pleased to announce that we have obtained an exclusive agency for **MICROSTAR** Computers manufactured by MICRO V CORPORATION of the U.S.A. The **MICROSTAR 45 PLUS** system is unique at its price, less than £5000, since it offers a MULTI-USER, MULTI-TASKING, FLOPPY DOS, 64k RAM, 1.2 Mb Disc (on 2 drives), BASIC, & UPDATE™ DBMS. The system has three time-sharing RS232 I/O interfaces and can also run a further background process simultaneously. CP/M DOS also available.

We invite enquiries from qualified Dealers who wish to sell **MICROSTAR** systems in specific territories in England, Scotland, Wales and Northern Ireland.

We also have certain area Distributorships for the **APPLE II based ITT 2020**, and are looking for Dealers within a thirty mile radius of Hemel Hempstead (excluding certain areas of London) and in the counties of Devon and Cornwall.

Applications should preferably be made in writing to Mike Brewer or Bill Mercer, including relevant supporting information, or they may telephone Hemel Hempstead (0442) 63561.

DATA EFFICIENCY will be showing at COMPEC where prospective Dealers will be welcome.

*Also at Ashburton, Devon

● **Circle No. 138**

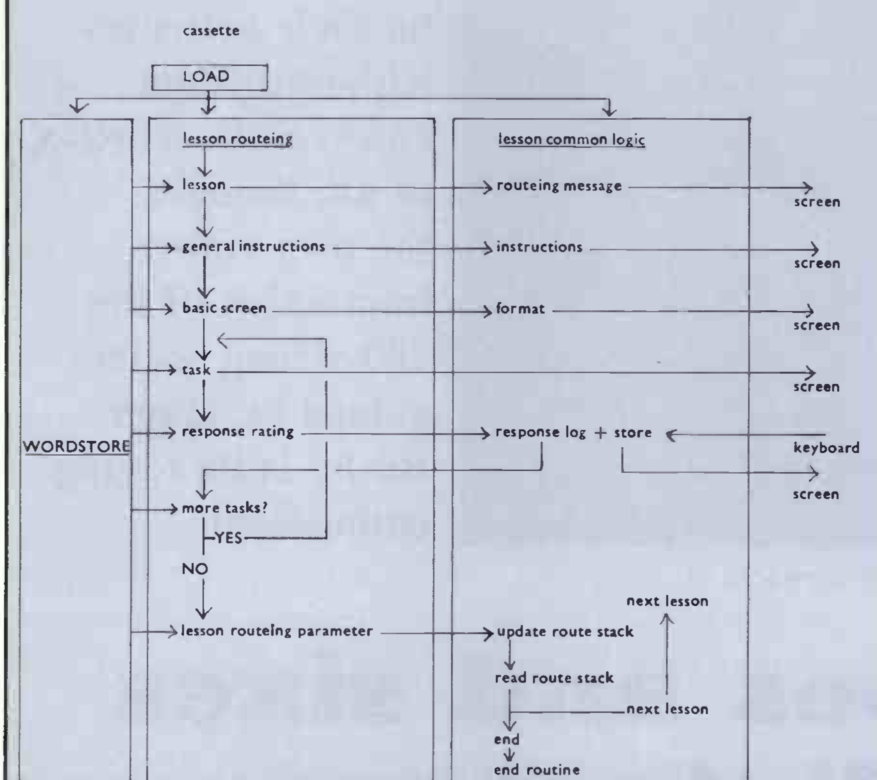
(*continued from page* 45)

gram typing, tabulating, codes, numerics and string editing. Those skills, clearly, are those which make Apple II typing distinct from those regular touch-typing.

Block 4. Speed and Accuracy. This consists purely of games designed for refresher courses and improvements of typing speed and accuracy. Simple games, such as responding as quickly as possible to a question on the screen, hitting a coloured target moving about a representation of the keyboard on the screen, striking particular keys on a signal tone—or better still on the sound of the letter—the possibilities are legion.

Only experimentation with the Apple II can really show which possibilities are practicable. The logical analysis already discussed in previous blocks will be made, however, and recommendations made on areas worth revising.

The relation between these functions is:



This general relationship is true of all lessons. Note that the lesson logic determines which lesson is to follow the current lesson by an address stack, the contents of which are up-dated by each lesson in turn.

The System: DESIGN

The size of the system presents the first problem in design. Part of this has been overcome by breaking-up the system into study blocks, each with similar design. The logic within those blocks is very modular in concept, placing great reliance on careful use of address-stacking techniques to minimise duplicated code.

Each block is read into RAM as a separate entity and the following notes indicate the working structure of each block. RAM is divided into three areas—wordstore, lessons and routeing, and lesson logic.

Wordstore is an area containing data for use in the lessons. This may be words, characters, codes representing character, colour or tone sequences, screen representation of the keyboard, and special displays or messages.

Lessons and routeing. This data dictates the content and sequence of lessons as a set of parameters to the lesson logic routines and a number of simple routines specific to each particular lesson. Insofar as is possible, the routines will be common to several lessons and differ only in the data presented and the sequence of presentation.

Lesson logic. This is a standardised set of routines performed in sequence, depending on the parameters provided at each lesson inter-reacting with the user's response at the keyboard. Much of this logic is common to all lessons at all stages of the course.

The System: USE

The user will start by following standard procedures to load the desired block from cassette. From then his path through the lessons of the block will be determined by the routeing logic in combination with his performance in each lesson. An illustration from block 2 may show this more clearly.

Each module may have an escape sequence which will store current position for later re-starts and which will enable the whole route to be started, for example at step 19).

Block 2

Main content of wordstore:
Diagram of keyboard with characters.
Array of characters and "special characters" (N/L) indexed by finger and position.
Count fields and indicators.
Messages and instructions.

Lesson/routeing module procedures.

Lesson	Action
1) Position hands:	Display route message. Display Task. Task-check hand positions, Response—set message, if not OK go to 1) if OK go to 2)
2) Home key and space:	Display route message. Display task task-type letters mix from ASDFJKL Space Response—Repeat lesson 20 times, then go to next lesson.
3) 2)+EGH	As above
4) 3)+RT	"
5) 4)+UI	"
6) 5)+CY	"
7) 6)+VB	"
8) 7)+NM	"
9) 8)+WX	"
10) 9)+OP	"
11) All characters, stops:	"
12) Numerals	"
13) "Specials"—Return, Backspace, etc. +, —, etc.-	As above. Move 19) to push down stack.
14) Little finger left/right:	Display route message and task. Task-type letters of both little fingers. Response—if poor, write 14) to stack and go to 15).
15) Ring finger emphasis	As above.
16) Middle finger emphasis	As above.
17) Index finger emphasis	As above.
18) Revision	Display route message. Response—go to last in stack.
19) Game 1:	Display route message. Display task. Task—game. Response, as per game, store response analysis. Response at end of game—write required revisions to stack, 20) to bottom of stack.
20) Game 2:	As above, but route to 21) at completion of revision required.

And so on, as space permits.

Conclusions

- **This system is not only useful for Apple II, but for any Teletype. So, although I think it would have an immediate appeal, and therefore market, to Apple II owners and users, it could well be of interest to a wider market.**
- **For instance, an employer of a number of "Teletype" programmers could well find that an Apple II dedicated to this system would be well worth its cost.**
- **The system as described would be simple to "tune" to slight variations on other manufacturers' keyboards. Spending one day with the Apple II would probably be all that most programmers would need to show a dramatic increase in Teletype performance.**
- **The system need not stop there. Once written and successful, it could be extended to teach normal touch-typing, letter layout and other clerical skills.**
- **Provided the subject matter can be formulated within the logical format of this application, then the resultant course would enjoy the benefits of "programmed learning".**

**A. G. Roberts was one of the runners-up in our Apple competition.*

EDINBURGH CASTLE, heart of SACS territory.

AMONG the delights for computer professionals who are members of the Scottish Amateur Computer Society is being able to carry on their activities without budget constraints. Most of all, though, the over-riding impression of the 100-strong society gained by Hugh Busby is its raging enthusiasm.

All shapes and sizes in Aladdin's Cave

A MODERN version of Aladdin's Cave, dreamed up by a computer enthusiast, would probably look very much like Norman Rouxel's garage in Edinburgh, a brightly-lit, white-painted interior which seems almost crammed with hardware. Two SWTPC 6800s—though, admittedly, only the one with discs belongs to Rouxel—provide a starting point.

There are terminals in abundance; two Teletypes, a Creed, a converted IBM Selectric and three or four assorted visual displays; two oscilloscopes; drawers full of components and half-finished assemblies and software to match.

Norman Rouxel is not, perhaps, a typical member of the Scottish Amateur Computer Society but then its members, and their equipment, are in all shapes and sizes. Many are computer professionals but just as many are not, and their machines range from 64K twin-disc systems to single-board kits, from LSI-11s to home-brew. Rouxel's evident dedication to computing is, however, an indication of the raging enthusiasm which seems to be a condition of membership of the SACS.

Founded a little more than a year ago, the SACS is clear proof that computing is alive and well north of the border. The society now has around 100 members, branches in Edinburgh and Glasgow, and is looking for somewhere to site a third branch to cater for enthusiasts in the less populous area further north.

Surprised at growth

The chairman, Stewart Stevenson, claims to be surprised at the rapid growth, yet his own flair for publicity clearly has contributed a great deal to the society's success. Even the official aims, as declared in the constitution, reflect a desire for recognition. They include:

- To encourage and inform all charities operating within Scotland as to the uses they may make of computers;
- To inform the general public in Scotland as to the actual and potential benefits and costs or hazards deriving from the use of computers;
- To enter into such agreements with other organisations as may further the preceding aims.

All of which might sound a trifle ambitious for an organisation which at the time numbered little more than 12 members; but in its short existence the SACS has already managed to give substance to its aims.

One recent coup was an appearance on Scottish television by Stevenson and the former chairman, Ken Talbott, explaining society aims to the viewing public on the Scotland Today program. Even more recently Stevenson was in London, where he held forth at an Institute of Data Processing Management seminar on micros.

As a result, he claims unabashedly that

"London now knows more about SACS and the developments in personal computing which are being spearheaded by the amateurs in Scotland than it does about activity, if any, on its own doorstep". Any challengers?

As well as talking about computing, the SACS is taking steps to make itself known by making itself useful. In February, it is booked to handle the scoring for the Scottish Universities rifle shooting competition.

Outward looking

The program will be run on an SWTPC 6800 and, it is hoped, will produce the results almost as soon as the competition finishes, in contrast to the normal long and tedious wait. If the operation is a success, other practical applications are likely to follow; a computerised light show for discos is one idea being discussed.

Apart from this outward-looking activity, what does the SACS do for its members? There are, of course, monthly meetings in Edinburgh and Glasgow, which normally are well attended—much better, as Stevenson is fond of pointing out, than the local British Computer Society branch meetings.

A software co-ordinator and a hardware co-ordinator have been appointed, one to develop a software library for the free use of members, the other to act mainly as a go-between for pieces of equipment looking for new homes. The society has also been able to save members money on new equipment by, for example, buying memory in bulk at improved discount rates.

There is also the monthly newsletter which, incidentally, carries enough advertising to pay for its own production costs. Normally it includes a number of how-to-do-it articles and shows a healthy balance between hardware and software interests.

The emphasis on software is, in fact, a distinctive feature of the SACS. It appears to emanate from a small group of the more active members, including Rouxel, Harry Sheldrake and software co-ordinator Robert Davidson, but is by no means confined to them. This group is, however, engaged on a major project which it hopes will be of general benefit to the society.

This is MDL, a language intended, according to Sheldrake, to approach the efficiency of assembly language while being considerably easier to use. Its main advantage, however, is that it will be machine-independent, and so, hopefully, provide a medium for the free interchange of software.

MDL is being developed using NORMAC, a macro processor written by Rouxel. NORMAC works in a way similar to a compiler, taking the user's source code as input and producing the output in machine code. The difference is that it allows the user to define his own commands and so, effectively, to create his own language.

NORMAC has been written for use on a 6800 system but that is no restriction, since NORMAC can be defined as a set of macros and run through itself to produce a version which will run on, say, a Cromemco Z-2. By producing a version of NORMAC for each machine requested by users, all programs written in MDL, or any other NORMAC-based language, will become fully interchangeable without further modification.

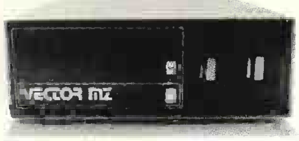
No pressures

One of the pleasures of amateur computing, particularly for computer professionals like Sheldrake and Davidson, is that it can be carried-on without pressures of budgets and deadlines.

With luck, the MDL project will do everything its designers hope. If not, they will still have enjoyed the experience and there will be something else waiting to engage their enthusiasm. For ideas, and the desire to put them into practice, are two things of which the SACS is clearly not short.

The secretary of SACS is Brian Corner, 14 Abbott Street, Dunfermline.

SACS members in Norman Rouxel's computer room, left to right, Norman Rouxel, Alastair MacPherson, Robert Davidson, Harry Sheldrake.



THE TOTAL SOLUTION FROM

ALMARC

OF COURSE!

Now Almarc & Vector Graphic offer the complete solution to your computing needs for £2300.00* . . The Vector MZ needs only the addition of a V.D.U. and it's ready to go. Completely assembled and fully tested the Vector MZ Offers the following features as standard:-

* S-100 bus
* 4 MHz Z80A processor
* 158 instructions
* two quad density Micropolis floppies—over 630k bytes on line
* serial port
* two parallel ports
* 32K static ram
* 12K prom/ram board with extended monitor
* Extended disc Basic

Simply connect your peripherals (Elbit V.D.Us & Centronics printers are available from Almarc) and your up and running and, because the MZ uses the S-100 bus, you can plug in a massive range of add on units.

Ring or Write for a demonstration to:-

Almarc Data Systems Ltd.,
29 Chesterfield Drive,
Burton Joyce,
Nottingham. Tel: 0602 248565.

* Discount terms available.

● Circle No. 139

millhouse designs limited

now DISPLAYING and DEMONSTRATING

the PET 2001-8 computer

in our new Camberley showrooms

All Commodore and Petsoft programmes available for instant running and evaluation

Engineering and Programming experts at hand to discuss your precise requirements

Centronics line-printers in stock with PET interfaces

for full details

MILLHOUSE DESIGNS Ltd.
185 LONDON ROAD, CAMBERLEY.
Telephone 042 050 374.

● Circle No. 140

THE NEWBEAR COMPUTING STORE

NASCOM I

now in stock

£197.50 (+ 8% VAT)

The Bear announces its new store at:-
2 Gatley Road,
Cheadle,
Cheshire
Tel: 061-491 2290
callers welcome, mail order to Newbury.

BOOKS

		P&P
Computer Designs 77-68 a 6800 Microcomputer	£7·50	50
WB-I a TTL Microcomputer	£6·50	50
Spare Diagram Set for WB-I	£1·00	50
Zilog Z-80 Technical Manual	£4·00	50
Z-80 PIO Manual	£2·50	50
Z-80 Programming Manual	£4·00	75
Motorola: Understanding Microprocessors	£2·75	30
M6800 Microprocessors.Programming Manual	£4·50	50
M6800 Applications Manual	£9·50	1·00
6800 Assembly Language Programming	£6·95	50
Understanding Microcomputers	£7·56	50
Z-80 Programming for Logic Design	£5·95	50
How to Buy and Use Microcomputers	£6·95	75
Microcomputer Primer	£5·55	75
Adam Osbourne Introduction to Microcomputers		
Vol. 0 Beginners Book	£5·25	50
Vol. I Basic Concepts	£5·95	50
Vol. 2 Some Real Products	£11·95	1·00
8080 Programming for Logic Design	£5·95	50
6800 Programming for Logic Design	£5·95	50
Some Common Basic Programs	£8·95	50
Payroll with Cost Accounting in Basic	£9·95	1·00
Sybex Microprocessors	£8·00	50
Microprocessor Interfacing Techniques C20	£8·00	50
Scelbi 8080 Software Gourmet Guide Cook Book	£7·95	50
6800 Software Gourmet Guide Cook Book	£7·95	50
The Scelbi Byte Primer	£9·95	1·00
What to do after you hit return	£7·00	75
PCC Reference Book on Home Computers	£4·95	50
Instant Basic	£4·95	75
My Computer Likes Me	£1·65	30
Games with a Pocket Calculator	£1·75	30
Games Tricks & Puzzles for a Hand Calculator	£2·45	30
Best of Creative Computing Vol. I	£6·95	75
Best of Creative Computing Vol. 2	£6·95	75
Hobby Computers are Here	£3·99	50
Best of Byte	£8·95	75
101 Basic Computer Games	£5·50	75
The Home Computer Revolution	£3·45	50
Computer Lib	£5·95	50
First Book of Kim	£7·00	50
Dr. Dobbs Journal (Vol. 1)	£10·00	75
Z-80 Microcomputer Handbook	£7·25	50

SEND FOR OUR NEW CATALOGUE

NEWBEAR SALE

January 6-13 inclusive

6800 and Z80 prices down

8080A Bugbook	£6·95	75
TTL Cookbook	£6·30	50
How to Program Microcomputers (Barden)	£6·30	50
Microprocessors Systems	£5·70	50
Take a Chance with your Calculator	£4·95	50
Home computers Questions and Answers		
Vol. I Hardware	£5·95	50
Vol. 2 Software	£5·95	50
Data Acquisition Handbook	£2·50	50
SC/MP Applications Manual	£4·00	50
Getting Involved with your own Computer	£4·75	50
Your Home Computer	£4·95	50
Using the 6800 Microprocessor	£6·25	50
Basic Programming in Real Time	£5·95	50
IC Timer Cookbook	£6·95	75
Active Filter Cookbook	£10·45	75
IC OP-AMP Cookbook	£9·05	75
Kim-I User Manual	£7·00	75
6500 Programming Manual	£7·00	[illegible]
6500 Hardware Manual	£7·00	75
The New Hobby Computers	£3·95	30
Accounts payable and accounts received	£9·95	75
Computer programs that work	£2·40	30

SYM-I
(formally VIM-I)

THE NEW 6502 BASED MICRO FROM SYNERTEK. FULLY ASSEMBLED AND TESTED £199·00 PLUS 8% VAT. CARRIAGE £1·00. SEND FOR DATA SHEET.

BEAR BAGS (Kits)

1 77-68 CPU P.C.B. Components and Edge Connectors	£45·00
2 77-78 LED's and Switches	£14·95
3 77-68 Power Supply *	£17·95
4 77-68 19" Bu Rack and Backplane *	£27·70
5 77-68 4K RAM P.C.B. and Components	£75·00
6 77-68 Mon I P.C.B. and Components	£50·70
7 4K Ram Exorcisor P.C.B. and Components	£71·50
8 8K Ram Exorcisor P.C.B. and Components *	£160·00
9 Petitevid V.D.U. Kit	£85·00
10 Kansas City Cassette Interface	£18·95
11 U.H.F. Modulator	£4·50
12 77-68 VDU P.C.B. and Components	£69·50
13 77-68 Mon 2 P.C.B. and Components	t.b.a.
14 Prom Programmer P.C.B. and Components	£35·00
15 Promverter	£8·50

Plus VAT 8%
50p Postage & Packing
* £1·00 Postage and Packing

PCB and COMPONENTS
77·66 PRINTED CIRCUIT BOARDS

77-68 CPU P.C.B.	£10·00
77-68 4K Ram P.C.B.	£10·00
77-68 Mon I P.C.B.	£10·00
77-68 V.D.U. P.C.B.	£10·00
Jade S100 Bus Z80 CPU board	£26·25
S100 Bus phototyping card	£12·57
Exorcisor Compatible Motherboards (8 slot)	£23·50
4K Ram P.C.B.	£10·00
Veroboard Backplane 8" × 17"	£4·30
77-68 Extender card	£4·10
ASCII Keyboard assembled and tested	£86·00
Keyboard Kit	£56·00
Keyboard Case	£20·33
U.V. Prom Eraser	£56·00
S100 bus 9 slot motherboard	£19·50

Goods are normally shipped within 24 hours, subject to availability. Barclaycard & Access. VAT at 8% for Hardware Components. 30p postage and packing unless otherwise stated. Cheques to be made out to The Newbear Computing Store. Send for an up-to-date catalogue to The Newbear Computing Store, 7 Bone Lane, Newbury 0635-49223. Callers are welcome Monday to Saturday 9.00a.m.-5.30p.m., but please ring to let us know when you are calling.

● Circle No. 141

ILLUSTRATING BASIC

(A SIMPLE PROGRAMMING LANGUAGE)

WE CONTINUE our series of articles on how to program in Basic, probably the most widely-used programming language for small computers.
For the series, we have obtained the serialisation rights for one of the best books on the subject, *Illustrating Basic* by Donald Alcock.

★

Each month, we are publishing a part of the book, so by the end of the series you will have the complete book.
It is written with a distinct informality and has a rather unusual presentation; but it is this style, we believe, which makes it one of the most easy to read tutorials.

★

Alcock *Illustrating Basic*. Chapter 2. c Cambridge University Press. Reprinted by permission.

★

Copies of *Illustrating Basic* can be obtained from *Practical Computing*.

CONTENTS

GO TO

WITH THIS INSTRUCTION YOU MAY ALTER THE SEQUENCE IN WHICH *BASIC* OBEYS THE NUMBERED STATEMENTS OF YOUR PROGRAM.

THIS PROGRAM NEVER REACHES ITS END. ON BEING GIVEN A VALUE FOR D IT COMPUTES & PRINTS V, THEN GOES BACK TO LINE 20 TO ASK FOR ANOTHER VALUE FOR D AND SO ON AND SO ON.

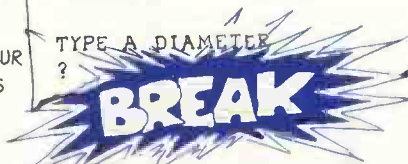
```
10 PRINT  "VOLUMES OF BALLS"
20 PRINT
30 PRINT  "TYPE A DIAMETER"
40 INPUT   D
50 LET     V = 3.141592 * D↑3 /6
60 PRINT  "VOLUME OF BALL IS"; V
70 GO TO  20
80 END

RUN

VOLUMES OF BALLS

TYPE A DIAMETER
?  6.5
VOLUME OF BALL IS  143.793

TYPE A DIAMETER
?
```



THE WAY TO STOP THIS PROGRAM IS TO PRESS THE BREAK KEY

(OR WHATEVER KEY YOUR OWN INSTALLATION USES FOR THIS).

THIS IS NOT A TRIVIAL EXAMPLE. *BASIC* IS VERY USEFUL AS A CALCULATOR FOR EVALUATING FORMULAE FOR SUCCESSIVE VALUES OF VARIABLES TYPED IN, AND THERE IS NO EASIER WAY OF STOPPING THAN PRESSING A SINGLE KEY.

SYNTAX :

```
70   GO TO   20
```

YOU MAY TYPE GOTO AS ONE WORD

ONLY LINE NUMBERS HERE: YOU CAN'T HAVE LET L= 20 AND SUBSEQUENTLY GO TO L

YOU MAY GOTO ANY LINE IN THE PROGRAM (EVEN IF IT CONTAINS A NON-EXECUTABLE STATEMENT LIKE REM) AND EXECUTION WILL CONTINUE FROM THERE. IF GO TO POINTS TO A NON-EXISTENT LINE NUMBER THEN MOST *BASICS* WILL REFUSE TO START EXECUTION WHEN YOU TYPE RUN (SIMILARLY FOR IF & ON).

IF ~ THEN

WITH THIS INSTRUCTION YOU MAY ALTER THE ORDINARY SEQUENCE OF EXECUTION ~ BUT ALTER IT *CONDITIONALLY*.

THE CONDITIONS ARE:

=	EQUALS
>	IS GREATER THAN
<	IS LESS THAN
>=	IS GREATER THAN OR EQUAL TO
<=	IS LESS THAN OR EQUAL TO
<>	DOES NOT EQUAL

```
20 IF A=B*C THEN 60
```

THE LINE HAS TO EXIST

ONE OF THE SIX POSSIBLE CONDITIONS

GO TO THIS LINE (AND CONTINUE FROM THERE) IF THE CONDITION APPLIES: OTHERWISE JUST CARRY ON

> =

DON'T TYPE A SPACE BETWEEN SYMBOLS IN A CONDITION

LINE NUMBERS ONLY: YOU CAN'T HAVE "THEN L"

THE THING ON EITHER SIDE OF THE "CONDITION" MAY BE A *NUMBER* OR *EXPRESSION*:

```
30 IF 1+SQR(A↑2+B↑2) > 0.2 THEN 10
40 IF     ABS(A-B)   <= 0.01 THEN 15
```

THE WAY TO TEST "APPROXIMATE" EQUALITY OF A&B

OR IT MAY BE A *TEXT* OR A *TEXTUAL VARIABLE* WHEN THE CONDITION IS NO MORE COMPLICATED THAN *EQUALS* OR *DOES NOT EQUAL* (BUT SEE BOTTOM OF PAGE):

```
50 IF Q$="YES" THEN 150
60 IF "FINISH" <> A$ THEN 10
70 IF R$=T$ THEN 230
```

NOTE: THE TEXTS "YES " AND " YES" ARE NOT EQUAL

IT IS NONSENSE TO COMPARE NUMERICAL VARIABLES WITH TEXTUAL VARIABLES:

```
80 IF Q$=Y THEN 99
```

MANY *BASICS* ALLOW THE WORDS "GO TO" (OR THE WORD "GOTO") IN PLACE OF "THEN" BUT FOR THE SAKE OF PORTABILITY IT IS BEST TO STICK TO "THEN".

MOST *BASICS* ALLOW MORE COMPLICATED COMPARISONS OF TEXTS. GENERALLY "Z" IS CONSIDERED "GREATER" THAN "A" AND "9" IS GREATER THAN "0". A SPACE " " IS LESS THAN ANY LETTER OR DIGIT. THUS YOU MAY SORT NAMES ALPHABETICALLY:

"A" < "ABALONE" < "ACORN" & "V2" < "V8"

CHAPTER 3

STOP

YOU MAY CAUSE *BASIC* TO STOP EXECUTION AT ANY LINE OF YOUR PROGRAM USING THIS INSTRUCTION.

THE *LAST* INSTRUCTION OF EVERY PROGRAM MUST BE "END". NO OTHER STATEMENT BUT THE LAST MAY SAY "END".

"END" SERVES IN A DUAL ROLE:

- ☆ IT MARKS THE END OF EVERY PROGRAM FOR THE CONVENIENCE OF THE *BASIC* SYSTEM WHEN TRANSLATING *BASIC* LANGUAGE INTO SOME OTHER COMPUTER CODE STRAIGHT AFTER YOU TYPE "RUN":
- ☆ WHEN "END" IS ACTUALLY *"OBEYED"* DURING SUBSEQUENT EXECUTION IT MAKES THE COMPUTER *STOP* EXECUTING THE PROGRAM.

HOWEVER THERE MIGHT BE SEVERAL PLACES IN A PROGRAM WHERE YOU WOULD LIKE TO TELL *BASIC* TO STOP EXECUTION. YOU CAN DO THIS BY A "GO TO" WHICH SENDS CONTROL TO "END" OR YOU CAN DO IT BY A "STOP" INSTRUCTION. "STOP", UNLIKE "END", MAY APPEAR MANY TIMES AND ANYWHERE INSIDE A PROGRAM.

```
10  PRINT "DO YOU LIKE PROGRAMMING ?"
20  INPUT A$
30  IF A$ = "NO"  THEN 70
40  IF A$ = "YES"  THEN 90
50  PRINT "NOT AN UNEQUIVOCAL ANSWER"
60  GO TO 100
70  PRINT "PERSEVERE!  YOU WILL LEARN TO"
80  GO TO 100
90  PRINT "FASCINATING ISN'T IT ?"
100 END
```

THESE TWO SILLY PROGRAMS DO THE SAME JOB AND ILLUSTRATE THE USE OF "END" AND "STOP".

```
10  PRINT "DO YOU LIKE PROGRAMMING ?"
20  INPUT A$
30  IF A$ = "NO"  THEN 70
40  IF A$ = "YES"  THEN 90
50  PRINT "NOT AN UNEQUIVOCAL ANSWER"
60  STOP
70  PRINT "PERSEVERE!  YOU WILL LEARN TO "
80  STOP
90  PRINT "FASCINATING ISN'T IT ?"
100 END
```

EXAMPLE *ILLUSTRATING* GO TO, IF～THEN & STOP

THIS PROGRAM SOLVES A PAIR OF SIMULTANEOUS EQUATIONS HAVING ANY NUMBER OF RIGHT-HAND SIDES. LET THE TWO EQUATIONS BE:

$$aX + bY = p$$
$$cX + dY = q$$

USING CRAMER'S RULE THE SOLUTION MAY BE WRITTEN LIKE THIS:

$$X = \frac{\begin{vmatrix} p & b \\ q & d \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}, \quad Y = \frac{\begin{vmatrix} a & p \\ c & q \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}$$

WHERE THE VERTICAL BARS INDICATE *DETERMINANTS* WHICH MAY BE EVALUATED THUS:

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = a*d - c*b$$

IF THE DETERMINANT IN THE DENOMINATOR IS ZERO (OR VERY VERY CLOSE TO ZERO) THEN NO SOLUTION IS POSSIBLE.

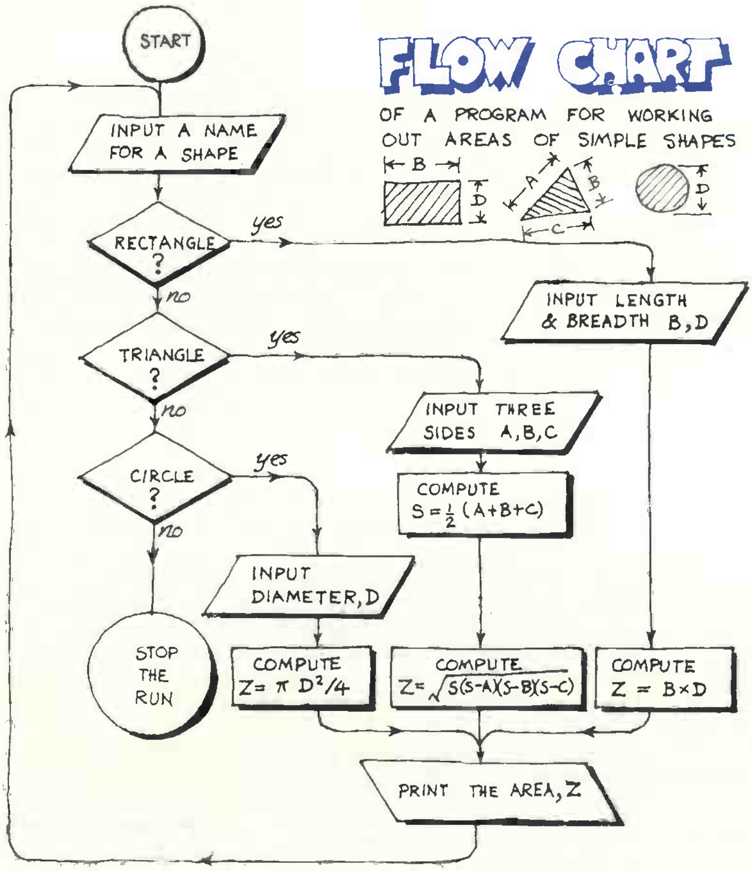
```
10  PRINT "TWO SIMULTANEOUS EQUATIONS"
20  PRINT "TYPE COEFFICIENTS OF X&Y; FIRST ROW"
30  INPUT A,B
40  PRINT "NOW SECOND ROW"
50  INPUT C,D
60  REM  EVALUATE DENOMINATOR, M
70  LET M = A*D - C*B
80  IF ABS(M) > 0.00001 THEN 110
90  PRINT "SOLUTION IMPOSSIBLE; DET="; M
100 STOP
110 PRINT "TYPE 2 VALUES FOR R.H. SIDE"
120 INPUT P,Q
130 LET X=(P*D-Q*B)/M
140 LET Y=(A*Q-C*P)/M
150 PRINT "X="; X ; "Y="; Y
160 PRINT "ANY MORE R.H.SIDES? YES?"
170 INPUT A$
180 IF A$ = "YES" THEN 110
190 REM  YOU COULD HAVE "STOP" HERE
200 END
```

CHAPTER 3

EXAMPLE ILLUSTRATING GO TO & IF THEN

HERE IS A PROGRAM DESIGNED TO CALCULATE AREAS OF RECTANGLES, TRIANGLES AND CIRCLES. IT ASKS YOU TO TYPE THE NAME OF A SHAPE; THEN IT ASKS FOR DIMENSIONS RELEVANT TO THAT SHAPE. IF YOU TYPE ANY NAME OTHER THAN "RECTANGLE", "TRIANGLE" OR "CIRCLE" THE PROGRAM STOPS RUNNING.

THE LOGIC OF THE PROGRAM IS SHOWN BY THE *FLOW CHART* BELOW. THERE ARE NICER WAYS OF ORGANIZING SUCH PROGRAMS USING INSTRUCTIONS NOT YET EXPLAINED; THIS PROGRAM WAS DESIGNED TO ILLUSTRATE "GO TO" AND "IF THEN".



```
10  PRINT "***AREA CALCULATOR***"
20  PRINT
30  PRINT "TYPE: RECTANGLE, TRIANGLE OR CIRCLE"
40  INPUT S$
50  REM
60  IF S$ = "RECTANGLE" THEN 130
70  IF S$ = "TRIANGLE" THEN 180
80  IF S$ = "CIRCLE" THEN 240
90  PRINT S$,"MEANS STOP"
100 GO TO 320
110 REM
120 REM
130 PRINT "TYPE BREADTH & DEPTH"
140 INPUT B,D
150 LET Z=B*D
160 GO TO 280
170 REM
180 PRINT "TYPE LENGTHS OF 3 SIDES"
190 INPUT A,B,C
200 LET S=0.5*(A+B+C)
210 LET Z=SQR(S*(S-A)*(S-B)*(S-C))
220 GO TO 280
230 REM
240 PRINT "TYPE THE DIAMETER"
250 INPUT D
260 LET Z=3.141592*D↑2/4
270 REM
280 REM FLOWS MERGE HERE
290 PRINT
300 PRINT "AREA OF "; S$;" IS"; Z
310 GO TO 20
320 END
RUN

***AREA CALCULATOR***

TYPE: RECTANGLE, TRIANGLE OR CIRCLE
? RECTANGLE
TYPE BREADTH & DEPTH
? 14.6   10

AREA OF RECTANGLE IS 146

TYPE: RECTANGLE, TRIANGLE OR CIRCLE
? NO
NO              MEANS STOP
```

GOES STRAIGHT TO "END"

SPACE

SPACE

ON-GO TO

THIS INSTRUCTION BREAKS THE ORDINARY SEQUENCE OF OBEYING INSTRUCTIONS

~ IT IS A MULTI-WAY SWITCH.

```
80  ON  D+1  GO TO  100,110,120,130
```

- VARIABLE OR EXPRESSION
- ONE WORD OR TWO
- LIST OF LINE NUMBERS (NOT EXPRESSIONS) ALL NUMBERED LINES MUST EXIST

BASIC EVALUATES THE EXPRESSION AND:

- SOME *BASICS* "ROUND" THE RESULT TO THE *NEAREST INTEGER*.
- SOME *BASICS* TAKE THE *INTEGRAL PART*.

IF THE RESULT IS 1 THEN *BASIC* USES THE *FIRST* NUMBER IN THE LIST (GO TO 100). IF THE RESULT IS 2 THEN *BASIC* USES THE *SECOND* NUMBER (GO TO 110) AND SO ON.

```
10   PRINT  "TYPE A DIGIT FROM 0 TO 3"
15   PRINT  "PRESS 'BREAK' KEY TO STOP"
30   INPUT  D
40   IF D-INT(D)<>0 THEN  140
50   IF D<0 THEN  150
60   IF D>3 THEN  150
65   REM   NOW CERTAIN D IS  0,1,2 OR 3
70   PRINT  "YOU  TYPED ";
75   REM
80   ON  D+1  GO TO  100, 110, 120, 130
85   REM   CAN'T GET HERE
100  PRINT   "ZERO"
105  GO TO  10
110  PRINT   "ONE"
115  GO TO  10
120  PRINT   "TWO"
125  GO TO  10
130  PRINT   "THREE"
135  GO TO  10
140  PRINT   "NON INTEGRAL"
145  GO TO  10
150  PRINT   "OUT OF RANGE"
160  GO TO  10
170  END
```

(CONTINUED OPPOSITE)

```
RUN

TYPE A DIGIT FROM 0 TO 3
PRESS 'BREAK' TO STOP
? 0
YOU TYPED ZERO
TYPE A DIGIT FROM 0 TO 3
PRESS 'BREAK' TO STOP
? 6
OUT OF RANGE
TYPE
```

THIS IS A USEFUL INSTRUCTION, BUT BE CAREFUL ABOUT ITS SPECIAL *INTERPRETATIONS* BY DIFFERENT VERSIONS OF *BASIC*.

- ☆ BECAUSE SOME *BASICS* USE THE *NEAREST* INTEGER AND OTHERS THE *INTEGRAL PART* OF THE EXPRESSION, ENSURE YOUR OWN EXPRESSIONS CAN ONLY YIELD INTEGRAL RESULTS (SEE LINE 40 OPPOSITE).

- ☆ SOME *BASICS* REPORT AN ERROR AND STOP THE RUN IF THE RESULT OF THE EXPRESSION IS OUT OF RANGE. BUT OTHER *BASICS* GO TO THE *FIRST* LINE IN THE LIST IF THE RESULT IS LESS THAN 1 AND TO THE *LAST* IF THE RESULT IS GREATER THAN THE NUMBER OF NUMBERS IN THE LIST. YET OTHER *BASICS* JUMP TO THE LINE FOLLOWING "ON" (LINE 85 OPPOSITE) IF THE RESULT IS OUT OF RANGE. SO FOR THE SAKE OF "PORTABILITY" *PUT IN YOUR OWN TESTS FOR RANGE* (SEE LINES 50 & 60 OPPOSITE).

BELOW ARE SHOWN OTHER (LESS COMMON) FORMS OF THIS INSTRUCTION AS USED IN DIFFERENT VERSIONS OF *BASIC*.

```
80 ON D+1 THEN 100, 110, 120, 130
```

```
80 GOTO 100, 110, 120, 130 ON D+1
```

```
80 GOTO D+1 OF 100, 110, 120, 130
```

THE INSTRUCTION BELOW MAY BECOME UNIVERSAL *IN ADDITION* TO THE "ON ≈ GO TO" DESCRIBED ABOVE. THE MEANING OF "ON ≈ GO SUB" WILL BE CLEAR WHEN YOU REACH PAGE 55.

```
80 ON D+1 GO SUB 100, 110, 120, 130
```

In praise of Pascal

by Francis Cox

MOST READERS will be acquainted with Basic, which nearly every microcomputer available today supports. Readers will not be so familiar with Pascal and I shall try to describe some of its features and explain why it has claim to be the programming language of the future.

To begin, why another language? There are several reasons. Firstly, a need was felt for a language well-defined in its syntax—the grammar which defines valid statements in the language—and in its semantics—the meaning or procedures implied by a statement in the language.

This means that there should be no "versions" of Pascal as there are with Basic, where every machine has a different Basic and a program written for Basic A will not run under Basic B without modification. Essentially, Pascal programs, unlike those in Basic, should be transportable from one machine to another.

Secondly, a language was needed which would enable programming in a structured manner, leading to faster and more error-free solutions to problems, together with easier maintenance of large programs.

Finally, the language had to be easy to teach—and learn—in a logical and systematic manner.

Popular

Those requirements led to the definition of Pascal by Professor Niklaus Wirth of the University of Zurich in 1968. Since then, the language has been implemented on nearly all mainframe types, and on many mini- and microcomputers. The language has become popular, particularly in educational institutions. It is, however, unlikely to take over in commercial installations from Cobol, which even IBM with PL/1 failed to kill.

A language rather like Pascal, Algol 60, existed before Pascal, but it had a crucial weakness in the area of data structures. Pascal, like most other languages, has the fundamental data types of integer and real numbers, characters (strings) and Boolean (logical). In Pascal, however, these and other (programmer-defined) data types may be structured in arrays, sets, records, files and lists.

An array is a structure where an individual element is accessed by a simple data type, e.g., integer. A declaration of a 20-element array A of real numbers would look like.

```
VAR A: ARRAY[1..20]O F REAL;
```

A set is an aggregate of data of one type, e.g., a set of characters. One cannot access individual elements of the set, but perform operations only on the set as a whole. Valid set operations are union, intersection, set difference, equality and membership. For instance, if we want to see whether the value of the character variable X is in the set of alphabetic characters, we write:

```
VAR ALPHAB: SET OF 'A'..'Z';
IF X IN ALPHAB THEN ---action---
```

The double dots can be read as "to", i.e., 'A'..'Z' means 'A','B',—etc—,'Z'. A set may also be denoted by brackets; this can help to avoid complicated conditional tests, e.g., to decide if variable P is 3, 17 or 35 instead of

```
IF (P=3) OR (P=17) OR (P=35) THEN ---action---
```

we may write:

```
IF P IN [3,17,35] THEN ---action---
```

which is much clearer.

Next we come to the record type. This is perhaps the most powerful and flexible data structure in Pascal. The components which make up a record can be of any type mixed together and additionally parts of the record, known as variants, can be dependent on other parts at execution time: see Ref. 1 pp. 42–47 for a fuller description of the record data type.

The file data structure is the method used to communicate data to and from external devices such as keyboards, discs and printers. All types of data structure may be read from or written to disc files, but only characters are valid for printer and keyboard I/O. The Pascal specification (Ref. 1) does not define random (or direct access) files, only sequential ones, but most implementations of the language have included this facility.

An unusual feature of Pascal worthy of comment is the pointer data type. This defines a variable not to have a value as all others do, but solely to point to another (conventional) variable, which can be of any type.

Primitives

Although Pascal does not include the list-processing primitive functions like FIRST, LAST and APPEND, found in languages like Lisp and Pop-2, this is not a problem, since one writes these primitives using the simple pointer-moving techniques of Pascal only once, and includes them in a common shared program library for future use.

- Every variable and procedure used in a program must be declared before use. This means it is impossible to sit at a terminal and key-in a program straight from one's head as is possible with Basic.
- There are NO statement numbers. These are an unmitigated pain in Basic, I feel.
- Variable names can be essentially of any length, which helps to make programs you can read six months after you have written them.
- There is no GOTO statement. This is not strictly true, but Pascal makes it so awkward to use labels and gotos (deliberately) that they may as well not be there.
- Multiple-line statements are the rule, not the exception. In particular, the begin block statement: BEGIN statement; statement; ---END is useful in many contexts.
- Most Basics do not permit passing of parameters to subroutines. Parameter passing by reference and/or value is fully-supported in Pascal; also, Pascal functions may return any simple data type. These procedures and functions support local (and global) variables fully and can be fully recursive.
- There are few built-in mathematical functions like RND and there is no exponentiation operator; the programmer is expected to write those features he needs and include them in a library file for use as required. Similarly there are no matrix manipulation statements built-in.
- The FOR statement in Pascal may only have steps of +1 or −1 and may not be executed at all if the loop variable is outside the valid bounds.

Here are two sample programs, one in Basic and one in Pascal, to perform a sort (the bubble sort) on an array A.

```
(★L+★)
PROGRAM SORTEX;
CONST X = 50;
TYPE LIST = ARRAY[1..X] OF REAL;
VAR A: LIST;
    J: INTEGER;

PROCEDURE BUBSORT (VAR L: LIST; N: INTEGER);
VAR I, M: INTEGER;
    T: REAL;
    SORTED: BOOLEAN;
BEGIN SORTED := FALSE; M := N;
  WHILE (SORTED = FALSE) AND (M >=2) DO
    BEGIN SORTED := TRUE;
      FOR I := 2 TO M DO
        IF L[I—1] > L[I] THEN BEGIN T := L[I—1];
                                    L[I—1] := L[I];
                                    L[I] := T;
                                    SORTED := FALSE
                              END; (★ END FOR LOOP ★)
      M := M—1
    END (★ BEGIN BLOCK ★)
END; (★ BUBSORT ★)

BEGIN (★ MAIN PROCEDURE ★)
  FOR J :=1 TO X DO A[J] :=51—J;
  BUBSORT (A,X)
END.
```

```
10 ! BUBBLE SORT DEMONSTRATION
20 DIM A(50)
30 FOR J = 1 TO 50
40 A(J) = 51 — J
50 NEXT J
55 M = 50
60 GOSUB 1000
70 STOP
80 REM
1000 ! BUBBLE SORT ROUTINE
1010 S = O
1020 M = N
1030 IF S = 1 THEN 1999
1040 IF M < 2 THEN 1999
1050 S = 1
1060 FOR I = 2 TO M
1070 IF A(I—1) <= A(I) THEN 1130
1080 T = A(I—1)
1090 A(I—1) = A(I)
1100 A(I) = T
1120 S = O
1130 NEXT I
1140 M = M — 1
1150 GOTO 1030
1999 RETURN
```

References

1. *Jensen, K. and Wirth, N., Pascal User Manual and Report, Springer-Verlag, 1978.*
2. *UCSD Pascal Reference Document, University of California at San Diego, 1978.*

U.K. DISTRIBUTORS

Airamco, Ltd. Ardrossan, Ayrshire
Computer Center Fleet, Hants.
Computerland, Ltd. Gerrards Cross, Bucks.
Factor One Penzance, Cornwall
Leenshire, Ltd. Winchester, Hampshire
Newbear Computing Store Newbury, Berks.
Sirton Products Coulsdon, Surrey
Teleplay New Barnet, Herts.

JADE

MEM-2
16K Static RAM Board

S-100, fully buffered, with PHANTOM and bank addressing capabilities, can be addressed at 4K boundaries.

250ns Kit	$285.00
450ns Kit	$250.00
250ns A&T	$350.00
450ns A&T	$325.00

EPROM BOARD KITS

EPM-1 (uses up to 4K of 1702)	$59.95
JG8/16 (uses 2708 or 2716)	$69.95

MICROPROCESSORS		
F8	$16.95	
Z80 (2MHz)	$20.00	
Z80A (4MHz)	$25.00	
CDP1802CD	$17.95	
6502	$11.95	
6800	$16.95	
6802	$25.00	
8008-1	$12.95	
8035	$20.00	
8035-8	$21.00	
8080A	$10.00	
8085	$23.00	
TMS9900TL	$49.95	
8080A SUPPORT DEVICES		
8212	$2.90	
8214	$4.65	
8216	$2.75	
8224 (2MHz)	$4.30	
8224-4 (4MHz)	$9.95	
8226	$2.75	
8228	$6.40	
8238	$6.40	
USRT		
S2350	$10.95	
UARTS		
AY5-1013A	$5.25	
AY5-1014A	$8.25	
TR1602B	$5.25	
TMS6011	$5.95	
IM6403	$9.00	
BAUD RATE GENERATORS		
MC14411	$10.00	
14411 Crystal	$4.95	
6800 PRODUCT		
6810P	$4.00	
6820P	$6.60	
6821P	$6.60	
6828P	$11.25	
6834P	$16.95	
6850P	$8.65	
6852P	$11.00	
6860P	$9.25	
6862P	$12.00	
6871P	$28.75	
6875P	$8.75	
6880P	$2.50	
KIM SUPPORT DEVICES		
6502	$11.95	
6520	$10.00	
6522	$9.25	
6530	$15.95	
6530-002	$15.95	
6530-003	$15.95	
6530-004	$15.95	
6530-005	$15.95	
CHARACTER GENERATORS		
2513 Upper (-12+5)	$6.75	
2513 Lower (-12∓5)	$6.75	
2513 Upper (5 volt)	$9.75	
2513 Lower (5 volt)	$10.95	
MCM6571 up scan	$10.95	
MCM6571A down scn	$10.95	
PROMS		
1702A	$8.00	
2708	$9.95	
2716 (5+12) TI	$25.00	
2716 (5v) INTEL	$60.00	
2758 (5v)	$23.40	
DYNAMIC RAMS		
416D/4116 (250ns)	$12.50	
2104/4096	$4.00	
2107B-4	$3.95	
TMS4027/4096 (300ns)	$4.00	
STATIC RAMS	1–15	16-100
21L02 (450ns)	$1.50	$1.20
21L02 (250ns)	$1.75	$1.50
2101-1	$2.95	$2.60
2111-1	$3.25	$3.00
2112-1	$2.95	$2.65
FLOPPY DISK CONTROLLERS		
1771B01	$39.95	
KEYBOARD CHIPS		
AY5-2376	$13.75	
AY5-3600	$13.75	
MM5740	$18.00	

EXPANDOR'S BLACK BOX PRINTER

This 64-character ASCII impact printer with 80-column capability is portable and uses standard 8½" paper and regular typewriter ribbon. Base, cover and parallel interface are included. Assembled and complete with manual and documentation.

only $430.00
(90 day manufacturer's warranty)

TRS–80 Interface Cable for Black Box Printer
with mating connectors: $48.00
(must be used with expansion module, +8v/1 amp power supply required).

Power Supply for TRS–80/Black Box Printer $49.00

Look!

DYNAMIC RAM BOARDS EXPANDABLE TO 64K

32K VERSION • KITS

Uses 4115 (8Kx1, 250ns) Dynamic RAM's, can be expanded in 8K increments up to 32K.

8K	$199.00
16K	$255.00
24K	$310.00
32K	$369.00

64K VERSION • KITS

Uses 4116 (16Kx1, 250ns) Dynamic RAM's, can be expanded in 16K increments up to 64K.

16K	$292.00
32K	$432.00
48K	$578.00
64K	$721.00

★ STATIC RAM SPECIALS ★

2114's, low power (1024x4)

	1-15	16-99	100 +
450ns	8.00	6.95	5.50
250ns	9.00	8.00	6.50
TMS4044/MM5257, low power			
450ns	8.00	7.50	6.50
250ns	9.95	8.75	8.00
4200A (4Kx1, 200ns)			
	9.95	8.50	8.00

STATIC RAM BOARDS

JADE 8K

Kits: 450ns	$125.95
250ns	$149.75
Assembled & Tested:	
450ns	$139.75
250ns	$169.75
Bare Board:	$25.00

16K - Uses 2114's (low power)

Assembled & Tested:	
RAM 16 (250ns)	$375.00
RAM 16B (450ns)	$325.00

16K with memory management

Assembled & Tested:	
RAM 65 (250ns)	$390.00
RAM65B (450ns)	$350.00

32K Static

Assembled & Tested:	
250ns	$795.00
450ns	$725.00
250ns Kit	$575.00

S–100 MOTHER BOARDS

JADE 6-SLOT

Kit	$41.95
Assembled & Tested	$56.95
Bare Board	$24.95

9–SLOT "LITTLE MOTHER"

Kit	$85.00
Assembled & Tested	$99.00
Bare Board	$35.00

13–SLOT "QUIET MOTHER"

Kit	$95.00
Assm. & Tested	$110.00
Bare Board	$40.00

22–SLOT "STREAKER"

Assm. & Tested	$149.00

JADE PARALLEL/SERIAL INTERFACE

S-100 compatible, 2 serial I/O ports, 1 parallel I/O.

Kit JG-P/S	$124.95
Ass. & Tested JG-P/SA	$179.95
Bare Board with manual	$30.00

TRS-80 apple II
MEMORY EXPANSION KITS

4116's

8 for $85.00
(16Kxl, 200ns)
includes dip plugs and instructions

★TRS-80 Kit ★
(16Kxl, 300ns)
includes connectors and instructions
$90.00

JADE 8080A

with full documentation

Kit	$100.00
Assm. & Tested	$149.95
Bare Board	$30.00

JADE Z80

with provisions for ONBOARD 2708 and POWER ON JUMP

2 MHz	
Kit	$135.00
Assm. & Tested	$185.00
4 MHz	
Kit	$149.95
Assm. & Tested	$199.95
Bare Board	$35.00

JADE VIDEO INTERFACE

S-100 Compatible Serial Interface with Sockets Included.

Kit	$117.95
Assm. & Tested	$159.95
Bare Board with manual	$35.00

FLOPPY DISK INTERFACE

JADE FLOPPY DISK (Tarbell board)	
Kit	$175.00
Assm. & Tested	$250.00
S.D. Computer Products "Versa Floppy"	
Kit	$159.95
Assm. & Tested	$189.95

DISK DRIVES

MINI DISK DRIVE $295.00
Model B51 by Micro Peripherals, Inc. will operate in either single density (125KB, unformatted) or double density (250KB, unformatted) modes, up to 40 tracks, with a track-to-track access time of only 5ms.

SA801R $495.00
Shugart single-sided 8 in. floppy disk drive.

DM 2700-S $750.00
Includes SA801R disk drive, 10 in. x 10 in. x 16 in. cabinet, power supply, data cable, fan AC line filter.

VERBATIM FLOPPY DISKS

5¼ in. Minidiskettes
Soft sector, 10-sector, or 16-sector
$4.40 each or box of 10 for $40.00

8 in. Standard Floppy Disks
Soft Sector
$4.75 each
10 for $42.50

JADE
Computer Products

4901 W. ROSECRANS AVENUE
Department "U"
HAWTHORNE, CALIF. 90250
U.S.A.

Telephone: (213) 679-3313
Telex: 18-1823

Discounts available at OEM quantities. All prices above are quoted U.S. $ F.O.B. Hawthorne, Calif., U.S.A. To expedite shipments please include international money order or bankers check payable against any U.S. bank in U.S. $, or use your Barclay, Access or American Express credit card (include card number, expiration date, and signature). Add 20% of total order for postage.

WRITE FOR OUR FREE CATALOG

All prices subject to change without notice.

● Circle No. 145

Opening new worlds for physically handicapped

by J. R. and G. Seagrave

MICROCOMPUTERS offer many opportunities of great significance in business and administration, research and teaching. The greatest relative benefit, however, compared to what was available before, must surely be the application of the analytical power of the microcomputer to the rehabilitation of severely handicapped people into the mainstream of society.

Our application is, therefore, aimed at the most basic part of that task, the link between man and machine, so that the user can write, and edit what is written, faster and more accurately than was previously possible.

Our project is based on the known needs of two spastics, one aged 11 years—George; the second aged 17—Martin; the actual names are fictional to preserve individual confidence. The project is designed to have a considerably wider application than the two individuals, and to open possibilities for further development in due course.

Familiar method

The traditional approach, used now by both these lads, is Possum, and its equivalents by other makers. These use a target board, an 8 × 8 matrix, made of perspex with letters and other characters marked on. The board is scanned and each character lit from behind. The user has a switch, operated by suck–blow, joystick or other microswitch input which, when operated, feeds the appropriate character to an electric typewriter. More complex models operate with two inputs and code but the most handicapped users can manage only one, and this is what principally we describe here.

The following sketch shows how this usually works:

/	:	!	(	+	@	)	IS
K	Q	6	0	%	z	?	IN
W	V	J	5	9	=	'	THAT
U	M	B	;	4	8	←	WAS
&	R	D	Y	,	X	3	OF
*	N	C	F	·	–	I	AND
T	A	S	H	P	G	7	TO
SPACE	E	O	I	L	RET	2	THE
							∧

TEXT IS SET UP HERE AT THE BOTTOM OF THE SCREEN. THE REQUIRED LETTER MAY BE ENTERED WHEN THE ARROW POINTS TO IT.

This method is familiar and well-tried and has served a generation of severely disabled people well, but it has fundamental drawbacks. The first of them is that it is not possible normally to edit; there is no way of correcting a mistake, let alone changing a line or a paragraph. Secondly, it is often very slow. The tracking rate of electromechanical target board systems can be varied by a switch, but clearly those handicapped users who are spastics or otherwise have limited muscle control and increasing the speed-rate is bound to increase the error-rate dramatically.

Our proposals are twofold. For the most severely handicapped user, Martin, who has no speech and very limited side-to-side head movement, and further can use only one input, we propose to reproduce the target board on the screen, using a moving cursor. The lower six lines on the screen will display the text typed so far, held in strings scrolling upwards as each line is set. The user will therefore see both text and board together, and not separately as at present.

Major innovation

Our major innovation specifically for Martin will be to introduce a 'homing' routine which we believe will enable him and other users to achieve substantially faster speeds. This will take advantage of the paddle control facility of the Apple.

The electromechanical system makes use of a microswitch which gives a simple on/off message to the typewriter controller. In our version, we assume the

(continued on next page)

The smile which says "It's mine". The *Practical Computing* Apple II competition winner, J. R. Seagrave, with his prize.

(continued from previous page)

user will use the switch two-way, i.e., he will enter one character for a traverse in either direction and we will program accordingly.

Thus, when PDL (N) + 128, i.e., when the paddle is in the middle of its slide, the currently-selected character will be entered into a string. Martin has, in fact, slightly more control than is used by the 'on-off' switch, and can control the speed of movement of the paddle. So we will program a progressive slowdown in the tracking speed of the target board as the paddle approaches PDL(N) = 128, the switch. A changing tone will also indicate the approach to the switch.

More accurate

This will enable a much higher tracking rate to be used—Martin is at present desperately slow—but enable the rate to be slowed as the paddle is moved towards the switching point in anticipation of the tracking cursor reaching the desired character. Because it will be slow when tracking across the desired character, accuracy should increase dramatically, as well as speed. Further, the addition of word processing facilities will make full editing possible.

A further development we envisage is the extended use of word storage. Some word storage is possible in electromechanical systems. Apple, however, can do better than this, by storing a whole range of 'stored word' target boards to meet different subject needs, e.g., a board with program words for programming—words such as hypotenuse, triangle, sine, cosine for someone doing maths, and valley and stream for someone studying geography, and so on.

These different pages of target board could be selected in the same way as the number which leads to the display of the target characters, by selecting an appropriate board with the specialised vocabulary.

Ultimately, we would hope that Martin might be able to do simple clerical jobs and data entry via the machine.

Our second subject, George, is younger but has more control. In fact, with one foot he is able to control a linear paddle accurately. He is much faster than Martin using a double input to a selector device.

We believe that if we constructed a linear paddle, he would be faster still by using the linear paddle to point to characters displayed on a linear keyboard on screen. His other foot, or perhaps one of his hands, could then enter each letter, either by a second paddle input used as a simple switch, or by using the 'press any key on the keyboard' facility for his somewhat uncontrolled hands.

As an extra, we would like to use the speechboard option. We have tried this briefly and, despite slightly slurred speech, George can control the machine effectively. This could be another way of entering text but we particularly envisage using this as a way of controlling games such as Star Wars, and adapting colour sketch routines, in conjunction with his 'good' foot and a paddle.

We believe that the kind of routine we have described will have a beneficial effect on the development of skills, as they offer rewards for better motor co-ordination. The existing interrupt systems do not have the same stimulus to physical improvement.

Individual handicapped people vary very widely in ability to control the various possible inputs to a microcomputer. We believe we have identified two ways in which the input rate for the most severely handicapped could be speeded—the 'homing' routine and additional stored target boards.

Speech input

Retention of the target board format has the great advantage of familiarity for those accustomed to electromechanical equipment, an advantage not to be underrated for those who are understandably cautious.

Speech input offers considerable scope for controlling games and we would like to explore this and many other possibilities. At present, however, we would want to focus on the central task of making fast and accurate communication possible for the most severely handicapped.

With the great barrier of communication broken, we believe new worlds will open up for the two lads and many others like them.

INTRODUCING THE SLAVE

A truly commercial computer printer at a personal computing price.

Some of the features:

- ★ 80 columns, 112 cps
- ★ 84 lines per minute, bi-directional
- ★ 100 million characters printhead life
- ★ Sprocket feed, multi-copy
- ★ V24 interface

Special PRACTICAL COMPUTING introductory offer which ends January 30, 1979 **£546**

COMPUTRADE

Silverwood House, Oxshott Road, Leatherhead, Surrey
Tel. No. 03723 77374

● **Circle No. 146**

224 ARTICLES

Kilobaud has more articles than any other microcomputer magazine. During 1977, for instance, there were 224 articles in Kilobaud—880 pages of articles—that's like a very large encyclopedia of microcomputing. There will be even more articles in 1978.

FOR THE BEGINNER

Though Kilobaud covers both the technical and programming sides of microcomputers, each article is written with the beginner in mind. No other magazine makes it as easy to understand microcomputers

THE BEST PROGRAMS

Only Kilobaud offers programmers both the publication of their programs in the magazine plus a large royalty for the program if it's issued on cassettes. Is it any wonder all of the really good programs are being published in Kilobaud? You'll find the best in games, diagnostics, teaching, music, business, etc., programs in Kilobaud. We're very heavy on programs.

HOBBY OR BUSINESS?

Both businessmen and hobbyist want the same thing: to understand microcomputers . . . and this is the purpose of Kilobaud. KB also has articles aimed at the businessman to help him know what is available and what it will do.

THE PUBLISHER

Kilobaud is published by the same people who put out 73 Magazine—the largest of the amateur radio magazines.

MONTHLY COLUMNS

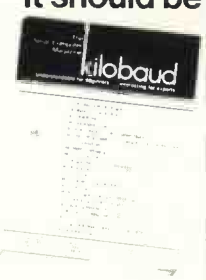
Keep up with the latest developments and readers' programs through the letters column . . . a KIM column . . . one on the TRS-80 . . . a column on BASIC . . . etc. The editorials will keep you up to date on money-making ideas, the progress of the industry and more. The New Products column is particularly useful, including the results of tests of the latest equipment in the Kilobaud microcomputer laboratory—the most complete in the industry.

SUBSCRIBE TO KILOBAUD

You can get Kilobaud fast. Copies are flown to Europe immediately upon publication and mailed directly from the United Kingdom, so your copies are current. Send subscription orders for United Kingdom and Europe, £20 sterling per year, to:

If you only read ONE American computer magazine...

it should be

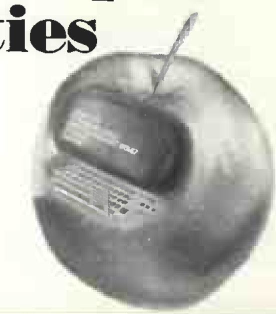


L. P. Enterprises
313 Kingston Road, Ilford, Essex. 01-553 1001
Barclay Card, VISA, Diner's Club and American Express, Access Card honored.

● **Circle No. 147**

£1 a day keeps your Apple in play

A 48K Apple II microcomputer will cost you less than £1 per day under our lease or lease/purchase facilities



Send for details

PADMEDE COMPUTER SERVICES
Agents for the
SOUTH/HOME COUNTIES
for the
APPLE II

The Tuns, High Street, Odiham,
Nr Basingstoke, Hants.
Tel: Odiham (025-671) 2434

To obtain your Apple II manuals please complete the details below:

Please send me:	*Each*	*Qty*	*Total*
Apple II reference manual	£5	....	....
Applesoft extended BASIC manual (includes a summary of commands and procedures for the disc operating system, new major commands, and high resolution graphics commands)	£5	....	....
Teach-Yourself BASIC programming manual	£5	....	....

Add 50p p&p to each order.

Name ....
Address ....
....
....

I enclose cheque to PADMEDE Ltd for £...............

Signed.. PC2/1

Call in to see us in Odiham soon

10 miles south of READING
2 minutes from M3 EXIT 5

● **Circle No. 148**

LP ENTERPRISES

Room PC/Ja
313 Kingston Road, Ilford,
Essex, IG1 1PJ, England

From Adam Osborne Associates	
INTRODUCTION TO MICROCOMPUTERS	
Volume 0: The Beginners Book	£ 5.95
Volume 1: Basic Concepts	£ 5.95
Volume 2: Some Real Microprocessors (without binder)	£18.95*
Volume 3: Some Real Support Devices (without binder)	£11.95*
Updating Subscriptions for Vol 2 and 3	£18.95 each
Updating Subscriptions for Vol 2. and 3	£30.00 together
Single issue of updating Subscription	£ 4.00
6800 Programming for Logic Design	£ 5.95
8080 Programming for Logic Design	£ 5.95
Z80 Programming for Logic Design	£ 5.95
8080A/8085 Assembly Language Programming	£ 6.95
6800 Assembler Language Programming	£ 6.95
Some Common BASIC Programs	£ 5.95
General Ledger (Available from late summer 1978)	£10.95
Payroll with Costing Accounting	£10.95
Accounts Payable & Accounts Receivable	£10.95

From Basic Software Library (from Scientific Research Instruments)	
Vol 1: Business and Personal Booking Programs	£17.50
Vol 2: Maths and Engineering Programs	£17.50
Vol 3: Advanced Business Programs	£26.95
Vol 4: General Purpose Programs	£ 7.95
Vol 5: Experimenters Programs (General Purpose)	£ 7.95
Vol 6: General Ledger Program	£32.50
Vol 7: Professional Programs	£26.95

From Kilobaud/73 Magazine Inc.	
Hobby Computers Are Here	£ 3.95
New Hobby Computers	£ 3.95

TV Typewriter Cookbook by Don Lancaster	£ 7.50
TTL Cookbook	£ 7.50
CMOS Cookbook	£ 7.95
IC Timer Cookbook	£ 7.50
IC OP-AMP Cookbook	£ 9.50
RTL Cookbook	£ 4.25
Z80 Microprocessor Handbook	£ 7.50

Magazines: Back Issues	
Personal Computing	£ 1.75
Interface Age	£ 2.25
Dr. Dobbs Journal	£ 1.75
Computer Music Journal	£ 2.50
Peoples Computers	£ 1.75
BYTE	£ 2.25
Creative Computing	£ 1.75
Calculators & Computers	£ 1.75
ROM	£ 1.75
Kilobaud	£ 2.25
73	£ 2.25
MICRO-6502 Journal	£ 1.50

From BYTE Publications Inc.	
Paperbytes:	
Tiny Assembler for 6800 Systems	£ 5.75
Bar Code Loader for 6800, 8080, Z80 & 6502 Micros	£ 1.75
Best of BYTE Volume 1	£ 8.95

From Scelbi Computer Consulting Inc.	
6800 Software Gourmet Guide & Cookbook	£ 7.95
8080 Software Gourmet Guide & Cookbook	£ 7.95
8080 Programmers Pocket Guide	£ 2.25
8080 Hex Code Card	£ 2.25
8080 Octal Code Card	£ 2.25
8080 Guide and One 8080 Code Card	£ 4.20
8080 Guide and Both Code Cards	£ 6.00
Understanding Microcomputers & Small Computer Systems	£ 7.95
SCELBI 'BYTE' Primer	£ 9.95
8080 Standard Monitor (In Book Format)	£ 9.95
8080 Standard Assembler (In Book Format)	£15.95
8080 Standard Editor (In Book Format)	£ 9.95
8080 Galaxy Game	£ 7.95

From Creative Computing Press:	
Best of Creative Computing Volume 1	£ 6.95
Best of Creative Computing Volume 2	£ 6.95
BASIC Computer Games	£ 5.50
The Colossal Computer Cartoon Book	£ 3.95
Computer-Rage (A Board Game)	£ 6.95
Artist and Computer	£ 3.95

Sybex: Introduction to Personal & Business Computing	£ 4.95
Sybex: Microprocessors from Chips to Systems by R. Zacs	£ 7.95
Sybex: Microprocessors Interfacing Techniques by R. Zacs	£ 7.95
Dilithium: Home Computers Volume 1: Hardware	£ 6.50
Dilithium: Home Computers Volume 2: Software	£ 5.95
Getting Involved with your Own Computer	£ 4.75
Best of MICRO	£ 6.95

From Dymax Inc.	
Instant BASIC by Jerald R. Brown	£ 7.95
Your Home Computer by James White	£ 7.95
My Computer Like Me. . . When I speak BASIC by Bob Albrecht	£ 2.75
Games with a Pocket Calculator by Thaigarajan & Stilovitch	£ 1.75
Games, Tricks and Puzzles for a Hand Calculator by W. Judd	£ 2.49

From Peoples Computer Company	
Reference Books of Personal & Home Computing	£ 4.95
What to Do After You Hit Return	£ 7.00
Dr. Dobbs Journal Volume 1	£10.00

Subscriptions start within 3 weeks.	**U.K. PRICE**	**OVERSEAS PRICE**
MAGAZINES: Subscriptions		
Personal Computing (Twelve Issues Yearly)	£16.00	£17.00
Interface Age (Twelve Issues Yearly)	£20.00	£20.50
Dr Dobbs Journal (Ten Issues Yearly)	£13.00	£13.50
Computer Music Journal (Four Issues Yearly)	£ 8.50	£ 9.00
Peoples Computers (Six Issues Yearly)	£ 8.00	£ 8.50
Kilobaud (Twelve Issues Yearly)	£20.00	£21.00
Creative Computing (Twelve Issues Yearly)	£16.00	£16.50
Calculators & Computers (Seven Issues Yearly)	£10.00	£10.50
73 (Twelve Issues Yearly)	£20.00	£21.00
BYTE (12 Issues Yearly)	£21.00	£21.00
MICRO-6502 Journal	£ 7.50	£ 8.50
Magazine Storage box (holds 12 minimum)	£ 1.25	

HOW TO ORDER

Please note our prices include postage and packing, but not insurance, if wanted add 12p for every £10 of books ordered. Make cheques, PO's etc. payable to:-

L.P. Enterprises.
CREDIT CARDS accepted
BARCLAYCARD VISA/ACCESS
DINERS CLUB/AMERICAN EXPRESS

Phone: 01-553 1001 for Credit Card orders (24-hour service)

Send to address above — All Orders must be Prepaid
Indicate Payment Method: — Total Enclosed £. . . . .

. . . . My cheque, P.O., I.M.O. is enclosed in **Sterling** on **U.K. Bank**

. . . . Charge to Barclaycard/Visa/Access/Diners/American Express

Credit Card No . . . . Expiry Date . . . .

Name . . . .

Address . . . .

. . . . POSTCODE . . . .

Signature . . . .

All publications are published in U.S.A. and shipped air-freight by **L. P. Enterprises**. In unusual cases, processing may exceed 30 days.
* At time of going to press, price of binders unknown. Telephone enquiries welcome.

TRADE ENQUIRIES WELCOME

● **Circle No. 149**

Simplifying business in Basic

This is the second part of a two-part article describing a simple program written in Basic to print quotations, invoices and order forms.

by NICK HAMPSHIRE

IN THE first part of this article last month, we looked at some of the problems faced by a businessman considering the purchase of a computer. The main source of problem lies in the need to justify economically the purchase of such a machine. Having considered the various points, we concluded that he should look at applications which could easily result in improved efficiency and reduced effort, both for himself and his employees.

A prime example of such an application is the writing of quotations, orders and invoices—jobs which consume a large amount of time and are prone to a considerable degree of error.

We looked at how such a simple system could be created and how it could be expanded to incorporate more advanced functions at a later date.

The hardware used in the system was a Cromemco Z2-D with two 5in. disc drives and 32K of memory running standard Cromemco disc Basic. This system was interfaced to a Teletype 43 which performs the dual functions of printer and console. The function of printing and calculating invoices, orders and quotations is performed by a set of seven programs.

We looked at the first four of them—Pick, a program select routine, which is used to tie the other six programs together; New, which is used to create the database used by the other programs—this database can be dumped on to the printer to give a written record by List. The last of the four programs in last month's article performed the actual printing of a quotation and was called Quotation.

Invoice

The first of the three running programs is called Invoice and , as its name implies, its function is to calculate and print an invoice. Because it performs a very similar function to Quotation, the two programs are almost identical. Lines 70 to 420 comprise the data input section of the program—we thus are asked by the program to input the recipient's name, address and the date. We are also asked to input the number of items on the invoice and for each item we then input the item number and the number of units of that item.

The remaining section of the program from line 430 to 1000 performs the actual printing, formatting and calculation of the invoice.

In line 630, record number three in the file Pointer is read. This contains the invoice number; the following two lines increment this number and save it on the disc. This number is printed on the invoice in line 660 and is positioned beneath the recipient's address and the date, printed by lines 460 to 600. Lines 680 and 690 print the invoice column headings.

The data on each item is stored as a record on the file Stock; when we wish to use that data it is extracted as a 128-byte string, the required numeric variables being obtained by use of the VAL function.

The various calculations are performed and the totals kept in lines 830 to 880. Having printed the data for all the items on the invoice, those totals are printed on the invoice by lines 920–950. The program concludes by printing the terms and conditions of business on the bottom of the invoice. If no more invoices are to be printed, then program control returns to PICK.

Update

This program is an amalgam of List and New and allows the user to examine and, if required, change the data on any record in the Stock file. The program is in two parts. The first allows examination of a particular record and the second, which is optional, permits new data to be inserted in the record examined in the first part.

The data is accessed by inputting the record number. This is checked against the contents of record two of Pointer to ensure that we do not try to access a record number above the highest record number in the file.

All the data then is extracted in its alphabetic or numeric form and printed under the relevant headings by line 310. The program then asks the user if he wishes to change this data; if not, we branch to the end of the program. If the entry is to be changed, the program asks us

(continued on next page)

(continued from previous page)

to input a description and all the relevant data on the item to be placed in the record examined previously. The data, if numeric, is converted to string format and the various substrings re-assembled in their allotted positions to produce the 128-byte record, which is placed on the Stock file in line 550.

Order

This program, which performs the function of printing-out and calculating an order to a particular supplier, is a modified version of Invoice and Quotation. The first difference is that the program asks the user to input the code number of the supplier to whom the order is to be sent.

That number, as you will remember, contained the data on each item and its purpose is to check that only items from the specified supplier are placed on the order. You will note that record four of Pointer is used to contain the current order number.

The order is printed-out in the same way as in the invoice and quotation programs; you will notice, however, that the unit price is the trade price and not the retail price.

Before the data is printed-out, the supplier code for that item is compared to the code entered in line 260. If the code is different, the data on that item is not printed and the record number is stored as an entry in a list. Having finished printing the order, this list of record numbers is printed-out as being items which are not available from the specified supplier.

Initialising

We have examined and given the listings of all seven programs in the suite. Before we can use all of them we must set up and initialise the data files. The first stage is to use the CREATE statement of Cromemco Basic to create two DOS files on a disc in drive B; the two files are called "B:STOCK" and "B:POINTER". Having created the files, we must place the correct entries on the four records in the file B:POINTER; thus the highest record number on the file B:STOCK held on record two of B:POINTER must be set to one.

Since at the same time we want to start creating the data file, the easiest way of placing a 1 in record two of B:POINTER is to run a modified version of NEW. If we load NEW into the computer and enter the following line in place of line 120:

```
120 LET A=1
```

line 130 then loads the value 2 into record two of B:POINTER and the remainder of the program loads the first data entry into record one of B:STOCK.

If we then re-load an unmodified version of NEW into the computer, the next data entry will be placed automatically in record two of B:STOCK, assuming, of course, that the alphabetical sorting section of the program does not re-order the two records. If we do not want our invoice, order and quotation numbers to start at zero, then similar procedures can be used when running the respective programs.

Running

The system utilises two disc drives; on drive A are the seven programs and on drive B is all the data required by those programs. The program which ties everything together is the menu-picking program, entitled PICK, and is our natural entry point.

Thus, assuming that all the programs have been entered and are stored on disc in drive A, and that the data files on drive B have at the very least been initialised, we load PICK and run it; and, as the sample run shows, we are given a choice of six operations—each has a number which, if entered in response to the question Operation? will load the program automatically from disc to perform that operation. To give an idea of how the various operations are performed, I have included sample runs from three of the six programs.

List—Example Run

```
ITEM NO     DESCRIPTION
1           Z-80 COMPUTER ASSEMBLER
PRICE R        PRICE P        VAT%      SUPPLIER
575            400            8         4
2           Z-80 COMPUTER RACK MOUNT
395            275            8         4
```

Pick—Example Run

```
QUOTATION, INVOICE AND ORDER PROGRAM.
FUNCTION SELECT.
1 PRINT QUOTATION.
2 PRINT ORDER.
3 PRINT INVOICE.
4 PRINT TOTAL STOCK LIST
5 INPUT DATA ON NEW STOCK ITEM
6 EXAMINE AND UPDATE STOCK DATA.
OPERATION?     5
```

Update—Sample Run

```
ENTER NUMBER OF STOCK LINE YOU WISH TO
EXAMINE      1
ITEM NO  DESCRIPTION
1        ANOTHER ITEM
PRICE R        PRICE P        VAT%      SUPPLIER
4              4              4         4

DO YOU WISH TO CHANGE THIS ENTRY?
Y OR N     Y
DESCRIPTION                  CHANGED ITEM
PRICE RETAIL (POUNDS)           1
TRADE PRICE                     1
VAT RATE %                      1
SUPPLIER CODE                   1
IS THIS CORRECT Y OR N      Y
MORE?  Y OR N     Y
ENTER NUMBER OF STOCK LINE YOU WISH TO
EXAMINE      1

ITEM NO  DESCRIPTION
1        CHANGED ITEM
PRICE R        PRICE P        VAT%      SUPPLIER
1              1              1         1

DO YOU WISH TO CHANGE THIS ENTRY?
Y OR N     Y
DESCRIPTION          ANOTHER NEW PRODUCT
                     FROM PRACTICAL
                     COMPUTING.
         ****DESCRIPTION TOO LONG****
DESCRIPTION                 NEW PRODUCT
PRICE RETAIL (POUNDS)          156
TRADE PRICE                    123
VAT RATE %                     8
SUPPLIER CODE                  9
IS THIS CORRECT?  Y OR N      N
DESCRIPTION                 NEW PRODUCT
PRICE RETAIL (POUNDS)          123
```

(continued on next page)

(*continued from previous page*)

```
TRADE PRICE                       78
VAT RATE %                        8
SUPPLIER CODE                     8
IS THIS CORRECT?  Y OR N     Y
MORE   Y OR N      N
>>
```

Invoice—Example Run

```
NAME?                J SMITH,
ADDRESS?             123 ANYSTREET,
                     LONDON.

DATE? (EG 12.8.78) 1,11,78
IS THIS CORRECT?  Y OR N     Y
NUMBER OF DIFFERENT ITEMS IN INVOICE
(MAX 10)?     4
INPUT THE ITEM NUMBER FOLLOWED BY THE
QUANTITY IN THE FORM —1,2
1? 5,1
2? 2,3
3?-1,1
4? 8,2
IS THIS CORRECT?  Y OR N     Y
MOVE PAPER TO TOP OF FORM THEN TYPE 'G'G

PRACTICAL COMPUTING, 2 DUNCAN TERRACE,
LONDON N1. TEL 01-278 9517
TO:  J SMITH,
     123 ANYSTREET,
     LONDON.

1,11,78

      INVOICE NUMBER 3
QUANTITY        DESCRIPTION
   1        Z2 DISC ENHANCEMENT KIT
   3        Z80 COMPUTER RACK MOUNT
   1        Z80 COMPUTER ASSEMBLED
   2        16K 4MHZ DYNAMIC RAM ASS.
UNIT PRICE        VAT          TOTAL PRICE
   650             52              702
   395            94.8            1279.8
   575             46              621
   450             72              972
                         TOTAL VAT 264.8
                             TOTAL 3574.8

          TERMS AND CONDITIONS
STRICTLY NETT 30 DAYS. IN THE EVENT OF
NON-DELIVERY OR UNSATISFACTORY GOODS
PLEASE ADVISE US WITHIN 10 DAYS OF INVOICE
DATE. VAT REG. NO:231 647182
```

Order

```
20 DIM A$(135)
30 DIM B$(128)
40 DIM X$(100)
50 M=1
70 INPUT"NAME?                ",A$(1,25)
90 INPUT"ADDRESS?             ",A$(26,50)
100 INPUT"                   -",A$(51,75)
110 INPUT"                   -",A$(76,100)
130 INPUT"                   -" A$(101,125)
210 INPUT"DATE? (EG 12.8.78) ",A$(126,135)
230 INPUT"IS THIS CORRECT? Y OR N",G$
240 IF G$="N"THEN 70
260 INPUT"SUPPLIER CODE?     ",D
280 INPUT"NUMBER OF DIFFERENT ITEMS IN
    ORDER?     ",T
300 @"INPUT THE ITEM NUMBER FOLLOWED BY
    THE QUANTITY IN THE FORM -1,2 "
330 FOR A=1 TO T
340 @A; : INPUT B(A),C(A)
350 IF B(A)=0 THEN 370
360 NEXT A
370 INPUT"IS THIS CORRECT? Y OR N ",G$
380 IF G$="N"THEN 260
390 INPUT"MOVE PAPER TO TOP OF FORM THEN
    TYPE 'G'",G$
400 IF G$="G"THEN 420
410 GOTO 390
420 @ : @ : @ : @ : @ : @ : @
430 @" PRACTICAL COMPUTING, 2 DUNCAN
    TERRACE, LONDON N1. TEL 01-278 9517."
440 @ : @ : @"  TO:  ";
450 @A$(1,25)
460 @TAB(9);A$(26,50)
470 @TAB(9);A$(51,75)
480 @TAB(9);A$(76,100)
500 @TAB(9);A$(101,125)
590 @TAB(9);A$(126,135)
610 OPEN/1,10/"B:POINTER"
620 GET/1,4,1/W
630 PUT/1,4,1/W+1
640 CLOSE/1/
650 @ : @ : @"          ORDER NUMBER   ";W
660 @ : @ : @
670 @"--------------------------------------------"
680 @"QUANTITY   DESCRIPTION   UNIT PRICE
    VAT   TOTAL PRICE"
690 @ : @
700 U=0 : Y=0
710 OPEN/1,128/"B:STOCK"
720 FOR A=1 TO T
770 GET/1,B(A)/B$(-1)
780 N$=B$(61,70)
790 N=VAL(N$)
800 IF N<>D THEN GOTO 1130
810 P$=B$(51,60)
820 V$=B$(41,50)
830 P=VAL(P$)
840 V=VAL(V$)
850 S=INT((P★C(A))★100)/100
860 O=INT(((S/100)★V)★100)/100
870 S=S+O
880 X$=B$(0,29)
890 @TAB(3);C(A);TAB(10);X$;TAB(40);P;TAB(50);
    O;TAB(60);S
900 Y=Y+O : U=U+S
910 NEXT A
920 CLOSE/1/
930 @ : @
940 @TAB(40);"----------------------"
950 @TAB(40);"TOTAL VAT   ";Y
960 @
970 @TAB(50);"TOTAL      ";U
980 @ : @ : @ : @ : @
990 @ : @ : @ : @ : @
1000 INPUT"                ",G$
1010 IF G$="G"THEN 1030
1020 GOTO 1000
1030 @"THE FOLLOWING ITEMS CAN NOT BE
     OBTAINED FROM SUPPLIER";D
1040 FOR A=1 TO M-1
1042 @E(A)
1044 NEXT A
1050 INPUT"MORE? Y/N   ",X$
1070 IF X$="Y"THEN 70
1110 RUN"PICK"
1120 END
1130 E(M)=B(A)
1150 M=M+1
1160 GOTO 910
>>
```

Update

```
10 DIM A$(128)
20 DIM X$(30)
110 OPEN/1,10/"B:POINTER"
120 GET/1,2,1/A
130 CLOSE/1/
140 INPUT"ENTER NUMBER OF STOCK LINE YOU
    WISH TO EXAMINE      ",N
150 @ : @ : @
160 IF N<A THEN 180
170 @"ITEM NUMBER TOO LARGE"
175 GOTO 140
180 OPEN/1,128/"B:STOCK"
190 GET/1,N/A$(-1)
200 CLOSE/1/
210 P$=A$(31,40)
220 C$=A$(51,60)
230 V$=A$(41,50)
240 S$=A$(61,70)
250 P=VAL(P$)
260 C=VAL(C$)
270 V=VAL(V$)
280 S=VAL(S$)
290 X$=A$(0,30)
300 @"ITEM NO   DESCRIPTION   PRICE R
    PRICE P   VAT %   SUPPLIER"
310 @Q;TAB(10);X$;TAB(41);P;TAB(52);C;TAB(63);
    V;TAB(74);S
320 @
330 INPUT"DO YOU WISH TO CHANGE THIS
    ENTRY?  Y OR N  ",G$
340 IF G$="N"THEN 1000
350 INPUT"DESCRIPTION                 ",A$
360 L=LEN(A$)
370 IF L<=29 THEN 400
380 @"   ****DESCRIPTION TOO LONG****"
390 GOTO 350
400 INPUT"PRICE RETAIL (POUNDS)       ",B
410 INPUT"TRADE PRICE                 ",C
420 INPUT"VAT RATE %                  ",V
430 INPUT"SUPPLIER CODE               ",S
440 INPUT"IS THIS CORRECT?   Y OR N   ",G$
450 IF G$="N"THEN 350
460 LET B$=STR$(B)
470 LET S$=STR$(S)
480 LET V$=STR$(V)
490 LET C$=STR$(C)
500 A$(31,40)=B$
510 A$(51,60)=C$
520 A$(41,50)=V$
530 A$(61,70)=S$
540 OPEN/1,128/"B:STOCK"
550 PUT/1,N/A$(-1)
560 CLOSE/1/
1000 INPUT"MORE?   Y OR N   ",G$
1010 IF G$="Y"THEN 110
1020 RUN"PICK"
1030 END
```

Invoice

```
20 DIM A$(135)
30 DIM B$(128)
40 DIM X$(100)
70 INPUT"NAME?                 ",A$(1,25)
90 INPUT"ADDRESS?              ",A$(26,50)
100 INPUT"                    -" A$(51,75)
110 INPUT"                    -",A$(76,100)
130 INPUT"                    -",A$(101,125)
210 INPUT"DATE? (EG 12.8.78) ",A$(126,135)
230 INPUT"IS THIS CORRECT? Y OR N ",G$
240 IF G$="N"THEN 70
280 INPUT"NUMBER OF DIFFERENT ITEMS IN
    INVOICE (MAX 10)?      ",T
290 IF T>10 THEN 280
310 @"INPUT THE ITEM NUMBER FOLLOWED BY
    THE QUANTITY IN THE FORM -1,2"
340 FOR A=1 TO T
350 @A; : INPUT B(A),C(A)
360 IF B(A)=0 THEN 380
370 NEXT A
380 INPUT"IS THIS CORRECT? Y OR N ",G$
390 IF G$="N"THEN 340
400 INPUT"MOVE PAPER TO TOP OF FORM THEN
    TYPE 'G'",G$
```

continued on next page)

(continued from previous page)

```
410 IF G$="G"THEN 430
420 GOTO 400
430 @ : @ : @ : @ : @ : @ : @
440 @"  PRACTICAL COMPUTING, 2 DUNCAN
    TERRACE, LONDON N1. TEL 01-278 9517"
450 @ : @ : @,"  TO:  ";
460 @A$(1,25)
470 @TAB(9);A$(26,50)
480 @ TAB(9);A$(51,75)
490 @ TAB(9);A$(76,100)
510 @ TAB(9);A$(101,125)
600 @ TAB(9);A$(126,135)
620 OPEN/1,10/"B:POINTER"
630 GET/1,3,1/W
640 PUT/1,3,1/W+1
650 CLOSE/1/
660 @ : @ : @"         INVOICE NUMBER   ";W
670 @ : @ : @
680 @"---------------------------------------------------"
690 @"QUANTITY  DESCRIPTION  UNIT PRICE
    VAT  TOTAL PRICE"
700 @ : @
710 U=0 : Y=0
720 OPEN/1,128/"B:STOCK"
730 FOR A=1 TO T
780 GET/1/,B(A)/B$(-1)
790 P$=B$(31,40)
800 V$=B$(41,50)
810 P=VAL(P$)
820 V=VAL(V$)
830 S=INT((P★C(A))★100)/100
840 0=INT(((S/100)★V)★100)/100
850 S=S+0
860 X$=B$(0,29)
870 @ TAB(3);C(A);TAB(10):X$;TAB(40);P;TAB(50);
    O:TAB(60);S
880 Y=Y+0 : U=U+S
890 NEXT A
900 CLOSE/1/
910 @ : @
920 @ TAB(40);"-------------------"
930 @ TAB(40);"TOTAL VAT     ";Y
940 @
950 @ TAB(50);"TOTAL     ";U
960 @ : @ : @ :@ :@
970 @"       TERMS AND CONDITIONS"
980 @"STRICTLY NETT 30 DAYS.IN THE EVENT OF
    NON-DELIVERY OR UNSATISFACTORY GOODS"
990 @"PLEASE ADVISE US WITHIN 10 DAYS OF
    INVOICE DATE. VAT REG NO:231 647182"
1000 INPUT"            ",G$
1010 IF G$="G"THEN 1030
1020 GOTO 990
1030 INPUT"MORE? Y/N ",X$
1040 IF X$="Y"THEN 70
1080 RUN"PICK"
1090 END
```

Conclusion

The aim of the two articles as been to show that business software does not have to be complex and difficult to write. It can, in fact, be written easily by anyone prepared to put a little time and effort into gaining some practical experience.

The main problem in writing any program, but especially one designed for business applications, is deciding how one constructs a program to undertake a particular job.

In writing business software, this task is made more difficult by the necessity to ensure that the chosen application is a cost-effective and economic candidate for computerisation.

The program to write and calculate orders, invoices and quotations which I have used as an example obeys those criteria. The programs are far from being perfect but they will, I hope, provide some ideas which can be applied to your own machines and your own applications.

I hope that it will also persuade some businessmen to embark on a course of computerisation and, by removing some of the drudgery and boredom from work, make life more pleasant.

Fixed-frequency audio function generator

A FIXED-FREQUENCY audio function generator is a useful item for laboratory work. Ordinarily, high-stability oscillators require complex, temperature-compensated circuit design. Quality waveforms can, however, be built from many discrete steps.

While the number of steps is large compared to the cycle length, distortion can be kept to a low level. The main peak in the distortion power spectra appears at the harmonic equivalent to the number of digitisation steps per cycle.

A Kim-1 microprocessor card can be used to generate each of the steps in any desired waveform cycle. Data from one of the system PI ports is fed into an eight-bit digital-to-analogue converter to provide the output voltage waveform. Temperature stability is very good, as the 6502 processor chip is crystal-controlled. Four waveform patterns can be generated by the program.

In a sinewave, of course, each cycle is split into 127 discrete steps. To keep the number of machine program cycles to a minimum, each of the steps is stored in a look-up table. This is not derived from a sinewave which has been digitised. Each of the 127 steps was computed and rounded to the whole number nearest to the exact value of the sinewave at the point of calculation.

By calculation

A squarewave is produced, not by table look-up, but by calculation. Two is added to the X-register. This gives a cycle length of 127, the same as the sinewave. Whenever the X-register equals zero, it is loaded into the output port, which falls to zero volts. After each increment of the X-register by two, it is compared to the contents of RATIO. If they are equal, FF is loaded into the output port and the output rises to its maximum voltage. It will fall again to zero when the value in the X-register wraps around to zero.

The value in RATIO determines the

(continued on next page)

(continued from previous page)

mark-space ratio of the waveform; the higher the value the longer the output remains at zero. One hundred and twenty-seven waveforms are available, with varing degrees of asymetry.

When RATIO is set to its mid-point a symmetric square-wave is produced. RATIO is located at 0100; it starts at 80, the mid-point, but may be changed before the square wave function is called. Before it is used the bottom bit it set to zero, by ANDing it with 11111110, ensuring that it is always an even number, and that the comparison with the X-register will always succeed once in the cycle.

A ramp waveform is generated by loading the contents of the A-register into the output port and then adding two to it. This is made into a loop. It therefore counts from 0 to 255, outputting 127 evenly-spaced voltage steps to the D-A converter before returning to zero to start again.

A triangle waveform is generated by adding the contents of location FOUR in a loop, outputting the value to the port each time. Initially, FOUR contains the number 4 and the output will rise. When it reaches its highest value the contents of four are replaced by minus 4. Each addition in the loop then reduces the value put to the output port. Every time the A-register reaches one of its extremes the contents of FOUR are swapped between 4 and – 4.

The longest computation loop was required for the triangle waveform, taking a total of 17 machine cycles. Any of the other waveforms which required fewer cycles had to be 'padded out' so that the loop times for all the waveforms were equal—notice the two 'NOP's in the ramp waveform.

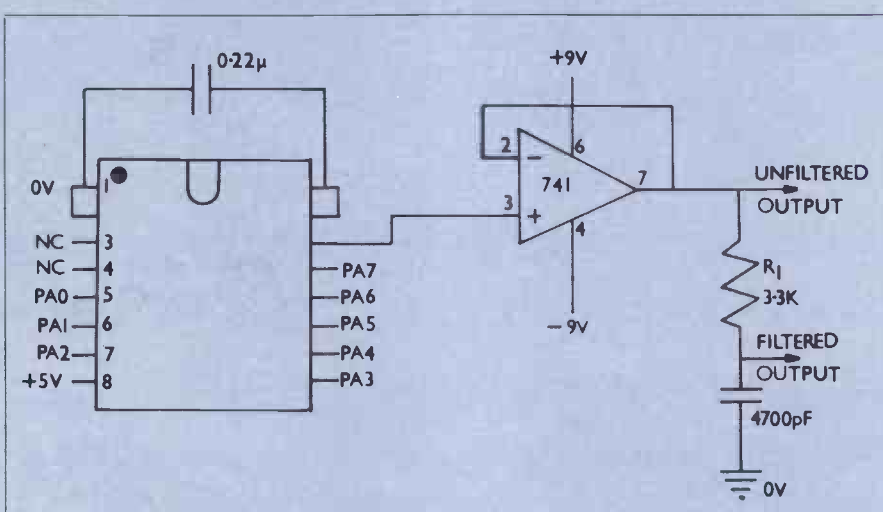
Each machine cycle takes one microsecond, and there are 17 cycles in each of the 127 steps in each waveform cycle. Therefore the expected output frequency should be 459·55Hz. In fact, the sinewave was measured at 459·65, the squarewave at 458·54, the ramp at 458·7 and the triangle waveform at 459·65Hz. A maximum deviation of 0·242 percent is accounted for by the slight differences in computation required by each of the waveforms.

Displaying the waveform on an oscilloscope shows clearly the discrete steps in the sine, triangle and ramp waveforms. Because they represent distortion at such a high-order harmonic they may be filtered-out by the simplest of filter circuits; the filtering is done by R1 and C1.

The values are chosen to reduce the distortion, so it is invisible on the oscilloscope display, and so as not to degrade the rise and fall times of the squarewave any more than is needed. The 741 op-amp acts as a buffer, so that the output of the ZN425E D-A converter is loaded as little as possible (see fig.).

To operate the function generator, '0000' is loaded into the address display and the GO button is pressed. The four keys along the bottom can then be used to select the desired waveform—'0' for a sinewave, '1' for the squarewave.

If an asymetric squarewave is required, the contents of RATIO at location '0100' determine the mark:space ratio. The triangle is selected to key '2' and the ramp by '3'. Changing between waveforms is a matter of re-setting, and then pressing the 'GO' key immediately so the start address is not lost. A new waveform is selected as before. The output waveform voltage is between zero and 2·2 volts.



PA0 — PA7 users output port on Kim-1

```
; A KIM-1 AUDIO FUNCTION
GENERATOR
; AT 460 HZ USING D TO A CHIP
; ON PA0-7 USER PORT.
;
;
; GO AT 0000; TYPE:
; 0 FOR SINEWAVE
; 1 FOR SQUAREWAVE
;    MARK-SPACE RATIO IN 0100
     (X:256)
; 2 FOR SAWTOOTH
WAVEFORM
; 3 FOR RAMP WAVEFORM
; RESET AND GO FOR NEXT
WAVEFORM.
;
DA          =$1700
DDA         =$1701
GETKEY      =$1F6A
;
```

(continued on next page)

(continued from previous page)

```
0000  A9 FF     START LDA #$FF
0002  8D 01 17        STA DDA
0005  20 6A 1F        JSR GETKEY
0008  C9 00           CMP #0
000A  F0 0F           BEQ SINE
000C  C9 01           CMP #1
000E  F0 1A           BEQ SQUARE
0010  C9 02           CMP #2
0012  F0 45           BEQ SAWT
0014  C9 03           CMP #3
0016  F0 34           BEQ RAMP
0018  4C 00 00        JMP START
                  ;
001B  A2 00     SINE LDX #0
001D  BD 00 02  SE1   LDA SINEW,X
0020  8D 00 17        STA DA
0023  E8              INX
0024  E0 80           CPX #ESINE-SINEW
0026  F0 F3           BEQ SINE
0028  D0 F3           BNE SE1
                  ;
002A  AD 00 01  SQUARE LDA RATIO
002D  29 FE            AND #%1111110
002F  8D 00 01         STA RATIO
0032  A0 FF            LDY #$FF
0034  A2 00            LDX #0
0036  8E 00 17  SPACE STX DA
0039  E8        SQ1   INX
003A  E8              INX
003B  EC 00 01        CPX RATIO
003E  F0 06           BEQ MARK
0040  E0 00           CPX #0
0042  F0 F2           BEQ SPACE
0044  D0 F3           BNE SQ1
0046  8C 00 17  MARK  STY DA
0049  18              CLC
004A  90 ED           BCC SQ1
                  ;
004C  A9 00     RAMP  LDA #0
004E  18        R1    CLC
004F  69 02           ADC #2
0051  8D 00 17        STA DA
0054  EA              NOP
0055  EA              NOP
0056  18              CLC
0057  90 F5           BCC R1
                  ;
0059  A9 04     SAWT  LDA #4
005B  8D 01 01        STA FOUR
005E  AD 01 01  SW0   LDA FOUR
0061  18        SW1   CLC
0062  6D 01 01        ADC FOUR
0065  C9 00           CMP #0
0067  F0 05           BEQ MFOUR
0069  8D 00 17        STA DA
006C  D0 F3           BNE SW1
006E  AD 01 01  MFOUR LDA FOUR
0071  49 FF           EOR #$FF
0073  8D 01 01        STA FOUR
0076  EE 01 01        INC FOUR
0079  18              CLC
007A  90 E2           BCC SW0
                  ;
007C                  *=$100
0100  80        RATIO .BYTE 128
0101            FOUR  *=*+1
                  ;
0102                  *=$200
0200      7F    SINEW .BYTE 127,133,139,146,152
0201      85
0202      8B
0203      92
0204      98
0205      9E          .BYTE 158,164,170,176,181
0206      A4
0207      AA
0208      B0
0209      B5
020A      BB          .BYTE 187,192,198,203,208,
                      212
020B      C0
020C      C6
020D      CB
020E      D0
020F      D4
0210      D9          .BYTE 217,221,225,229,233
0211      DD
0212      E1
0213      E5
0214      E9
0215      EC          .BYTE 236,239,242,244,247
0216      EF
0217      F2
0218      F4
0219      F7
021A      F9          .BYTE 249,250,252,253,253,
                      254
021B      FA
021C      FC
021D      FD
021E      FD
021F      FE
0220      FE          .BYTE 254,254,253,253,252
0221      FE
0222      FD
0223      FD
0224      FC
0225      FA          .BYTE 250,249,247,244,242
0226      F9
0227      F7
0228      F4
0229      F2
022A      EF          .BYTE 239,236,233,229,225,
                      221
022B      EC
022C      E9
022D      E5
022E      E1
022F      DD
0230      D9          .BYTE 217,212,208,203,198
0231      D4
0232      D0
0233      CB
0234      C6
0235      C0          .BYTE 192,187,181,176,170
0236      BB
0237      B5
0238      B0
0239      AA
023A      A4          .BYTE 164,158,152,146,139,
                      133
023B      9E
023C      98
023D      92
023E      8B
023F      85
0240      7F          .BYTE 127,121,115,108,102
0241      79
0242      73
0243      6C
0244      66
0245      60          .BYTE 96,90,84,78,73
0246      5A
0247      54
0248      4E
0249      49
024A      43          .BYTE 67,62,56,51,46
024B      3E
024C      38
024D      33
024E      2E
024F      2A          .BYTE 42,37,33,29,25
0250      25
0251      21
0252      1D
0253      19
0254      15          .BYTE 21,18,15,12,10
0255      12
0256      0F
0257      0C
0258      0A
0259      07          .BYTE 7,5,4,2,1,1,0
025A      05
025B      04
025C      02
025D      01
025E      01
025F      00
0260      00          .BYTE 0,0,1,1,2,4,5,7
0261      00
0262      01
0263      01
0264      02
0265      04
0266      05
0267      07
0268      0A          .BYTE 10,12,15,18,21
0269      0C
026A      0F
026B      12
026C      15
026D      19          BYTE 25,29,33,37,42,46
026E      1D
026F      21
0270      25
0271      2A
0272      2E
0273      33          BYTE 51,56,62,67,73,78
0274      38
0275      3E
0276      43
0277      49
0278      4E
0279      54          .BYTE 84,90,96,102,108,115
027A      5A
027B      60
027C      66
027D      6C
027E      73
027F      79          .BYTE 121
0280      14    ESINE .BYTE 20
0281
SECOND PASS FINISHED O.K.
SYMBOL TABLE
      20
DA      1700    DDA     1701
GETKEY  1F6A    START   0000    SINE    001B
SE1     001D    SQUARE  002A    SPACE   0036
SQ1     0039    MARK    0046    RAMP    004C
R1      004E    SAWT    0059    SW0     005E
SW1     0061    MFOUR   006E    RATIO   0100
FOUR    0101    SINEW   0200    ESINE   0280
END OF ASSEMBLY
;160000A9FF8D0117206A1FC900F00FC901F01AC902F04
5C9030974
;170016F0344C0000A200BD00028D0017E8E080F0F3D0F3
AD00010A3E
;17002D29FE8D0001A0FFA2008E0017E8E8EC0001F006E0
00F0F20B54
;170044D0F38C001718 90EDA9001869028D0017EAEA189
0F5A9040A44
;16005B8D0101AD0101186D0101C900F0058D0017D0F3
AD0101070A
;0B007149FF8D0101EE01011890E204CD
;010100800082
;1602007F858B92989EA4AAB0B5BBC0C6CBD0D4D9DD
E1E5E9EC1023
;160216EFF2F4F7F9FAFCFDFDFEFEFEFDFDFCFAF9F7F4
F2EFEC157E
;16022CE9E5E1DDD9D4D0CBC6C0BBB5B0AAA49E989
28B857F790FDC
;160242736C66605A544E49433E38332E2A25211D191512
0F0C0546
;1602580A07050402010100000001010204050 70A0C0F121
5190107
;13026E1D21252A2E33383E43494E545A60666C73791405
A1
;00000D000D
```

Address State Analyser

FOR an Address State Analyser, the problems of locating and correcting hardware and software faults within a monitor-based computer can at times be enormous, writes **Norman Parron**. The monitor provides the power-up bootstrap, controls the systems I/O, and provides the user with the ability to look at and alter the contents of memory locations and registers.

If the monitor program, the processor or I/O is faulty, however we cannot use the monitor to locate that fault. Similarly, if we run a program which, for example, gets stuck in an endless loop, we have no way of knowing where in the program this is occurring.

In earlier machines which employed a front panel with data and address entry switches and lights, one could test a machine by entering a small test program using the switches, and check the output from the LEDs. With those machines one could see if a program was in a loop and where that loop was, simply by looking at the address lights.

The circuit I describe is an add-on to an ordinary oscilloscope and is based on an idea proposed by Steve Carcia in *Byte* (February, 1978). It uses the display on the oscilloscope to produce a "map" or "signature" of what the address lines are doing while executing a program. The "signature" is a pattern of lines on the display produced by the two digital-to-analogue converters of the circuit. Each D/A is an independent circuit and feeds either the X or Y axis inputs of the oscilloscope; the digital inputs to the D/A come from either the top or bottom eight address lines.

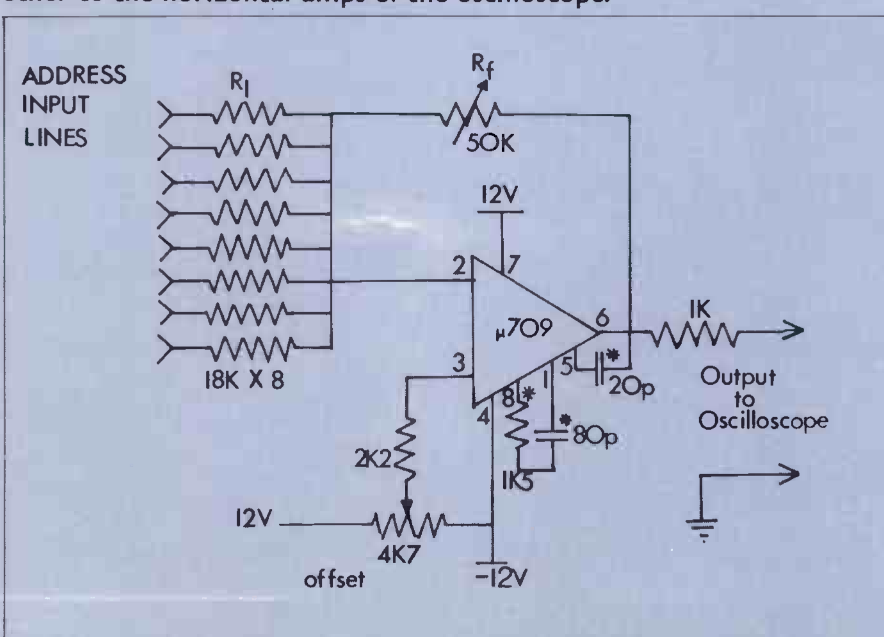
Address map

The oscilloscope thus displays a 256 × 256 point map of the entire 65,536 possible addresses of the computer memory, where each point represents one byte of memory. Thus, if we have, for example, a 50-byte loop within our program, the display will show one or two short lines, depending whether the 50 bytes was within or across a 256 byte boundary. This program will thus allow us to see the program working and detect which part of the program, if any, is at fault.

The circuit used—note that you will need two of these curcuits—is a "summer"; this means that it adds all the '1's in the eight-bit pattern to produce an analogue signal whose amplitude varies with the pattern. The components required are an op-amp and a few resistors; none of the component values are very critical. The resistors can be any convenient value, although the summing resistors should be greater than 10K to

(*continued on next page*)

Address State Analyser. Parts with * can be eliminated with 741 op amps. Two of these circuits are needed; one connects to the vertical and the other to the horizontal amps of the oscilloscope.



(continued from previous page)

prevent loading of the address lines.

The only limit to the maximum size of the resistors is the response characteristics of the op-amps and the summing formula:

$$E_0 = \frac{R_c}{R_1}(E_1) + \frac{R_f}{R_2}(E_2) + \frac{R_f}{R_3}(E_3) + \ldots \frac{R_f}{R_8}(E_8).$$

The formula states that the values of the input resistors and the feedback resistor and the sum of the eight inputs should be of such values that the op-amp does not saturate. Do not let the formula scare you. It is not as bad as it may seem. If the input resistors are put to the same values, the formula reduces to:

$$E_0 = \frac{R_f}{R_2}\left(E_1 + E_2 + E_3 + \ldots E_8\right)$$

If the feedback resistor is changed to a pot, the formula can just about be ignored, because you can trim the op-amp gain to suit the circuit values.

The offset pots are included to enable you to use the full range of the op-amps. Without the offset, the usable range of output is 0-10v—we are summing positive voltages only. With the offset, the range of the output increases to –10 to 10v—20v peak-peak.

By using the offset and the feedback (gain) pots you can trim the response of the circuit for optimum display on your particular oscilloscope.

Some of the simpler scopes have no X-Y mode and their horizontal inputs are limited, so being able to adjust the peak-peak output of the address state analyser can be useful.

Identical circuits

The op-amps can be of any type available. Although the 741 type is satisfactory, I chose the 709. Its frequency response can be trimmed to optimum performance. Besides, I had a dozen or so in my junk box. The 1K resistor on the output of the op-amp is to prevent the op-amps being harmed by an accidental short-circuit.

The address state analyser consists of two identical circuits, one for each set of eight address lines, A0-A7 on one summer and A8-A15 on the other. The board can be made small and can be placed anywhere convenient, but it is advisable to keep the wires to the address lines as short as possible to prevent noise pick-up.

My system is based on the M6800 and one of its undocumented instructions is HCF $9D_{16}$, which causes the processor to address all its address lines repeatedly until the M6800 is re-set.

This is a convenient program, because using it I can adjust the op-amp gain and offset until the "map" just fills the oscilloscope screen.

If your system has no HCF or some equivalent instruction, use the oscilloscope in the usual manner and look at the output of each circuit. Adjust the offset and gain pots until the signal is between 10 to 20v peak-peak. Then connect one circuit to the vertical amp and the other to the horizontal amp. Adjust the oscilloscope position and gain controls until the display is satisfactory.

As an example of the usefulness of this circuit, I had to write a short program which had a different beginning and end-point. Since I had been using the circuit for some time I was familiar with the "maps". I knew that when I ran my program I should get three maps, the triangular computer ready, the program running map and the single dot produced by a halt.

The oscilloscope display did not do this; instead, it went from the ready map to a small box-shaped map at the top of the scope. This indicated that at the beginning of the program there was an error which caused the program to lock-up in a small loop at a high memory location.

After a few minutes' search at the beginning of the program, I found an incorrect branch instruction; without the address state analyser circuit it could have taken a very long time to find the error.

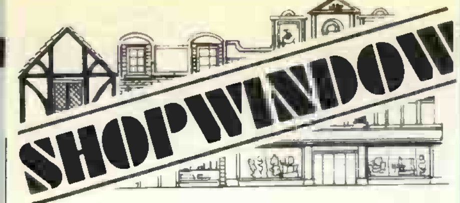
```
                  ;DEFINE SYSTEM LOCATIONS AND
                  ROUTINES
                  DA          =$1700
                  DDA         =$1701
                  DB          =$1702
                  DDB         =$1703
                  SCANS       =$1F1F
                  DISP         $F9
                  PLOW        =$00
                  PHIGH       =$02
0000              TEST        *=*+1
0001              MASK        *=*+1
0002              SUM         *=*+1
0003              POINTH      *=*+2
0005              SYNCL       *=*+1
0006              SYNCH       *=*+1
                  ;
                  ;TEST DECMAL—DISPLAYS
                  ;NUMBER IN LOCATION 0000
                  ;USING SCANS.
                  ;
0007  A5 00       TESTD       LDA TEST
0009  20 5C 00                JSR DECMAL
000C  20 1F 1F    PDLY        JSR SCANS
000F  4C 0C 00                JMP PDLY
                  ;
                  ; DIGITAL VOLTMETER USING
                  ;RAMP A:D
                  ;
0012  20 51 00    DVM1        JSR SETUP
                                CONFIGURE PORTS
0015  20 8C 00    DVM1A       JSR A2DHMP
                                    GET VOLTAGE
0018  C9 00       CMP #0      IS IT VALID?
001A  F0 12       BEQ VALID   YES
001C  A9 AB       LDA #$AB
001E  85 FB       STA DISP+2
0020  A9 CD       LDA #$CD
0022  85 FA       STA DISP+1
0024  A9 EF       LDA #$EF
0026  85 F9       STA DISP
0028  20 1F 1F    JSR SCANS   DISPLAY "ABCDEF"
002B  4C 15 00    JMP DVM1A
002E  A5 02       VALID LDA SUM
0030  20 5C 00    JSR DECMAL
0033  20 1F 1F    JSR SCANS DISPLAY DATA
0036  4C 15 00    JMP DVM1A
                  ;
                  ;DIGITAL VOLTMETER USING
                  ;SUCCESSIVE APPROXIMATION
                  ;TECHNIQUE.
                  ;
0039  20 51 00    DVM2        JSR SETUP
003C  20 B1 00    DVM2A       JSR A2DSAT
003F  20 5C 00                JSR DECMAL
0042  20 1F 1F                JSR SCANS
0045  4C 3C 00                JMP DVM2A
                  ;
                  ; DIGITAL STORAGE SCOPE
                  ;
0048  20 00 01    SCOPE       JSR RECORD
004B  20 33 01    SCOPEA      JSR PLAY
004E  4C 4B 00                JMP SCOPEA
```

(continued on next page)

(continued from previous page)

```
                ;
                ;SETUP DATA DIRECTION
                ;REGISTERS
                ;
0051  A9 FF     SETUPLDA #$FF   OUTPUT
0053  8D 01 17          STA DDA
0056  A9 00             LDA #0  INPUT
0058  8D 03 17          STA DDB
005B  60                RTS
                ;
                ; CONVERTS NUMBER IN A REG
                ;TO DECIMAL IN DISP, READY
                ;FOR A CALL TO SCANS.
                ;
005C  48        DECMAL PHA
005D  A9 00       LDA #0        CLEAR DISP
005F  85 F9       STA DISP
0061  85 FA       STA DISP+1
0063  85 FB       STA DISP+2
0065  68          PLA
0066  C9 64     N100
                  CMP #100      BRANCH IF <=99
0068  90 08       BCC N10
006A  38          SEC-          NO BORROW
006B  E9 64       SBC #100      A LESS 100
006D  E6 FA     INC DISP+1      HUNDREDS + 1
006F  4C 66 00  JMP N100        AND AGAIN
0072  C9 0A     N10
                  CMP #10       BRANCH IF <=9
0074  90 08       BCC N1
0076  38          SEC
0077  E9 0A     SBC #10
0079  E6 F9       INC DISP      TENS + 1
007B  4C 72 00    JMP N10
007E  06 F9     N1
                  ASL DISP      SHIFT TENS TO
0080  06 F9       ASL DISP      UPPER DIGIT
0082  06 F9       ASL DISP      POSITION IN
0084  06 F9       ASL DISP      DISP.
0086  18          CLC
0087  65 F9       ADC DISP      ADD UNITS
0089  85 F9       STA DISP
008B  60          RTS
                ;
                ;ANALOGUE TO DIGITAL
                ; CONVERSION — 1 CLOCKS
                ;ZN325E D TO A CHIP UP TO 256
                ;TIMES. RAMP ALGORITHM
                ;
                ;IF VOLTAGE IN RANGE:
                ; RETURNS IN SUM, SETS A REG
                ;  TO 0
                ;IF VOLTAGE OUT OF RANGE:
                ;  SETS SUM TO 0 AND A REG TO
                ;  $FF
                ;
008C  A9 00     A2DRMP
                  LDA #0
008E  8D 00 17    STA DA        RESET ZN425
                                      COUNTER
0091  85 02       STA SUM       CLEAR SUM
0093  A9 02       LDA #2
0095  8D 00 17    STA DA        COUNTER READY
0098  EE 00 17  COUNT
                  INC DA
009B  AD 02 17    LDA DB        COMPARATOR
                                        STATE
009E  6A          ROR A         INTO C BIT
009F  B0 0A       BCS DONE IS HIGH
00A1  CE 00 17    DEC DA        CLOCK ZN425
00A4  E6 12       INC SUM       KEEP COUNT
00A6  F0 06       BEQ OVFLOW  VOLT
                                    OVERRANGE
00A8  4C 98 00    JMP COUNT
00AB  A9 00     DONE
                  LDA #0        IF A=0 SUM IS
                                        VALID
00AD  60          RTS
00AE  A9 FF     OVFLOW
                  LDA #$FF      IF A=-1 SUM IS
                                      INVALID
00B0  60          RTS
                ;
                ;ANALOGUE TO DIGITAL
                ;CONVERSIOM—2 SUCCESSIVE
                ;APPROXIMATION TECHNIQUE
                ;RETURNS IN A REG
                ;
00B1  A9 80     A2DSAT
                  LDA #$80      TOP BIT
00B3  85 01       STA MASK
00B5  8D 00 17    STA DA
00B8  EA          NOP
00B9  AD 02 17  NEXT
                  LDA D8        GET RESULT
00BC  6A          ROR A         INTO CARRY
00BD  90 0A       BCC ONE       LEAVE SET
00BF  A5 01       LDA MASK      ELSE CLEAR
00C1  49 FF       EDR #$FF
00C3  2D 00 17    AND DA        COMPLEMENT DA
00C6  8D 00 17    STA DA
00C9  46 01     ONE
                  LSR MASK
00CB  A5 01       LDA MASK
00CD  0D 00 17    ORA DA        SET NEXT BIT IN DA
00D0  8D 00 17    STA DA
00D3  90 E4       BCC NEXT      MASK INTO
                                       CARRY?
00D5  AD 00 17    LDA DA        YES!
00D8  60          RTS
                ;
00D9              *=$100
                ;
                ;CONTINUALLY SAMPLES AN
                ;INPUT WAVEFORM AND STORES
                ;IN A CIRCULAR BUFFER OF
                ;512 BYTES. IF PB1 GOES HIGH
                ;RECORDING STOPS, BUFFER
                ;POINTER IS STORED IN SYNCL &
                ;SYNCH.
                ;
0100  20 51 00  RECORD
                  JSR SETUP
0103  A9 00     RESET
                  LDA #PLOW
0105  85 03       STA POINTR      POINTER TO
0107  A9 02       LDA #PHIGH      BEGINNING OF
0109  85 04       STA PONTR+1     CIRCULAR
010B  A0 00       LDY #0          BUFFER
010D  20 B1 00  ACQUIRE
                  JSR A2DSAT      CONVERSION
0110  91 03       STA (POINTR),Y SAVE
0112  AD 02 17    LDA DB
0115  6A          ROR A
0116  6A          ROR A
0117  B0 11       BCS ENDFRC
0119  E6 03       INC POINTR
011B  D0 F0       BNE ACQUIRE     END OF PAGE
011D  E6 04       INC POINTR+1
011F  A5 04       LDA POINTR+1
0121  C9 04       CMP #PHIGH+2
0123  F0 DE       BEQ RESET
0125  85 04       STA POINTR+1
0127  4C 0D 01    JMP AQUIRE
012A  A5 03     ENDREC
                  LDA POINTR      SAVE SYNC
012C  85 05       STA SYNCL
012E  A5 04       LDA POINTR+1 POINTR
0130  85 16       STA SYNCH
0132  60          RTS
                ;
                ;REPLAYS CIRCULAR BUFFER
                ;FILLED BY RECORD. PB1
                ;SYNCONISES SCOPE TO START
                ;OF BUFFER
                ;
0133  A9 04     PLAY
                  LDA #4          PB2 AS SYNC
0135  8D 03 17    STA DDB         OUTPUT
0138  A9 00     RESTRT
                  LDA #PLOW
013A  85 03       STA POINTR
013C  A9 02       LDA #PHIGH
013E  85 04       STA POINTR+1
0140  A0 00       LDY #0
0142  B1 03     CONT
                  LDA (POINTR),Y
0144  20 72 01    JSR YOURS
0147  8D 00 17    STA DA          OUTPUT SAMPLE
014A  A5 15       LDA SYNCL
014C  C5 03       CMP POINTR
014E  D0 10       BNE NOSYNC
0150  A5 06       LDA SYNCH
0152  C5 04       CMP POINTR+1
0154  D0 0A       BNE NOSYNC
0156  A9 04       LDA #4          SYNC PLUSE TO
0158  8D 02 17    STA DB
015B  A9 00       LDA #0
015D  8D 02 17    STA DE          SCOPE
0160  E6 03     NOSYNC
                  INC POINTR      BUFFER
0162  D0 DE       BNE CONT        POINTER
0164  E6 04       INC POINTR+1  RESET
0166  A5 04       LDA POINTR+1
0168  C9 04       CMP #PHIGH+2
016A  F0 CC       BEQ RESTRT
016C  85 04       STA POINTR+1
016E  4C 42 01    JMP CONT
0171  60          RTS
                ;
                ;
                ;USER DEFINED ROUTINE
                ;
0172  60        YOURS   RTS
0173
SECOND PASS FINISHED O.K.
SYMBOL TABLE
      44
DA        1700    DDA       1701
DB        1702    DDB       1703    SCANS    1F1F
DISP      00F9    PLOW      0000    PHIGH    0002
TEST      0000    MASK      0001    SUM      0002
POINTR    0003    SYNCL     0005    SYNCH    0006
TESTD     0007    PDLY      000C    DVM1     0012
DVM1A     0015    VALID     002E    DVM2     0039
DVM2A     003C    SCOPE     0048    SCOPEA   004B
SETUP     0051    DECMAL    005C    N100     0066
N10       0072    N1        007E    A2DRMP   008C
COUNT     0089    DONE      00AB    OVFLOW   00AE
A2DSAT    00B1    NEXT      00B9    ONE      00C9
RECORD    0100    RESET     0103    AQUIRE   010D
ENDREC    012A    PLAY      0133    RESTRT   0138
CONT      0142    NOSYNC    0160    TOURS    0172
END OF ASSEMBLY
```

Note: Practical Computing has not tested the circuit. We trust it works.



Bubble Sort is easiest to program

by Paul Woolley

IN MANY commercial applications data is stored and processed sequentially. There are times when the data is in the wrong order and, before processing can take place, has to be sorted into the required sequence.

```
MONDAY                            FRIDAY
TUESDAY                           MONDAY
WEDNESDAY      SORTING            SATURDAY
THURSDAY       PROCESS            SUNDAY
FRIDAY                            THURSDAY
SATURDAY                          TUESDAY
SUNDAY                            WEDNESDAY
```

There are several ways of sorting data but I will discuss only one method, the BUBBLE SORT, which is the easiest to program. The set of data to be sorted comprises the days of the week, to be sorted from normal into alphabetical sequence:

Consider how this operation might be done manually with seven cards, each with a day printed on it. First, two cards are picked up and compared, the one which is first alphabetically is discarded and a third card picked up. Again, the two cards are compared, the one which is first alphabetically is discarded and another is picked up.

This process is continued until all seven cards have been picked up. The card held at the end will be WEDNESDAY, which is put to one side. The six discarded cards are re-processed in the same way as before; at the end, TUESDAY is left and is placed next to WEDNESDAY. The discarded cards are processed again and the operation continues until all the cards are in sequence.

Ideally, I should be able to write a program to go through similar actions to those in the manual method. In Basic, lists (DIM statement) are not able to be dynamic—to grow and shrink as required which is what happens in the manual example. One solution would be to have two lists of equal size. The sorted data is moved from one list to the other which, however, is a waste of valuable space.

The bubble sort requires only one list, which holds all the data, and movements of the data are performed using swapping variables.

The data stored within the list may be shown as:

```
        D$(7)
(1)     MONDAY
(2)     TUESDAY
(3)     WEDNESDAY
(4)     THURSDAY
(5)     FRIDAY
(6)     SATURDAY
(7)     SUNDAY
```

The following program will re-order the data and print the sorted results.

P1 controls the number of times the list is accessed.

P2 controls the number of comparisons made.

F is a two-state flag used to detect if the data is in sequence before the sort process reaches its natural end. In small lists it makes little difference but in a large list it could save some time.

```
LISTNH
10  REM                                   ---BUBBLE SORT---
20  REM
30  REM                                   ----CONTROL----
40  DIM D$(7)
50  GOSUB 100                             !INPUT
50  GOSUB 200                             !SORT
70  GOSUB 400                             !PRINT
80  GO TO 600
100 REM                                   --INPUT ROUTINE--
110 For I = 1 TO 7
120      READ D$(I)
130 NEXT I
140 RETURN
200 REM                                   --SORT ROUTINE--
210 FOR P1 = 7 TO 2 STEP -1
220      LET T$=D$(P1)
230      ffET F=0
240      FOR P2=1 TO P1
250                IF T$>D$(P2) GO TO 290
260                LET T$=D$(P2)
270                LET T=P2
280                LET F=1
290      NEXT P2
300      IF F=0 GO TO 340
310      LET D$(T)=D$(P1)
320      LET D$(P1)=T$
330 NEXT P1
340 RETURN
400 REM                                   --PRINT ROUTINE--
410 FOR O=1 TO 7
420      PRINT D$(O)
430 NEXT O
440 RETURN
500 REM                                   --DATA SECTION--
510 DATA MONDAY, TUESDAY, WEDNESDAY,
    THURSDAY
520 DATA FRIDAY, SATURDAY, SUNDAY
600 END

READY

RUNNH
FRIDAY
MONDAY
SATURDAY
SUNDAY
THURSDAY
TUESDAY
WEDNESDAY

READY
```

This method of sorting works well on small quantities of data but on large quantities it is slower than other types of sort. For example, a set of data which took more than 24 hours to process using a bubble sort took an hour using a second sort method and six minutes using a third.

It is an interesting exercise to time the sorting of different sets of data such as lists of 50, 100, 150, 200 words of the same length, and then to compare the results.

Next month: Using the bubble sort with simple records.

Dual-density floppy disc

STRANGE but true. Digital Equipment, the biggest manufacturer of minicomputers in the world, has just produced its first dual-density floppy disc system.

It is designed for use with the Digital LSI-11 microcomputer and with double-density manages to cram a megabyte on to a single floppy disc. Called the RX02, it succeeds the RX01 single-density diskette which Digital has been marketing previously. At £2,635, it represents a 60 percent reduction in price compared to its predecessor.

Software enhancements are also promised to take full advantage of the new facilities. According to Edgar Valentine, the company's components group manager: "The data files on RX01 diskettes are exchangeable under program control. To prevent mixing densities on a newly-inserted diskette, using RX02, the controller reads the previous sector automatically for density and will write the subsequent sector only in the same density."

Data integrity is looked after by a power-fail feature, designed to detect an impending power loss, and prevents data being written to an unpowered disc subsystem.

Versatility

VERSATILITY is the name of the game in the micro business. And adding one more string to its bow is LP Enterprises, better-known to our readers as suppliers of numerous U.S. magazines on hobby computing.

The Essex-based company is now branching-out into the supply of software and is offering the CP/M operating system for Intel 8080 and Zilog Z-80-based systems using the North Star floppy disc system.

CP/M is becoming the *de facto* standard for microcomputer operating systems, and has many sophisticated features which make the system easier to run and debug.

It runs on 8080 and Z-80 systems with at least 20K bytes of read-write memory. It costs £99 plus VAT.

Further information: LP Enterprises, 313 Kingston Rd., Ilford, Essex. Tel: 01-553 1001.

Analogue I/O

A DEVICE has been launched by Burr-Brown which allows users of the Zilog Z-80 MCB and MCS microprocessors to take input from analogue devices, such as voltmeters.

The analogue input/out board is called the MP2216 and fits into the Zilog microcomputers without modification. It provides 32 single-ended or 16 differential voltage inputs and, optionally, two analogue voltage outputs.

Further information from Burr-Brown International, 17 Exchange Road, Watford, Herts WD1 7EB. Tel: 0923-33837.

Advertisement Index

A PRACTICAL GLOSSARY

Continuing the terminological gamut with E

Emulation

In this procedure one computer duplicates the instruction set of another. In practice, it usually involves using a large computer to develop programs for a smaller one. The full facilities and speed of the bigger system make for easier program development, and because it is emulating the smaller machine, the programs which result can be transferred to the target system and run happily.

Enable

Essentially to enable function is to switch it on. In literal terms, it is defined as setting the processor to accept interrupt signals.

END

All BASIC programs must end with an END statement. Forgetting this has caused the writer no little heartache.

Enquiry

As the word suggests, an enquiry is an operation which accesses a record or some other item in storage without altering the contents—that is called an update. There is an important distinction to be made between enquiries and updates, because the amount of processor effort required for an update is considerable, while an enquiry takes very little.

In a fairly simple multiple-terminal system; several terminals can be making enquiries on files and one can be updating. If you want more than one simultaneously-updating terminal, you will require a much more complicated operating system and generally a more complex computer.

EOB

End of Block, usually a special code defined by a mainframe to indicate the end of a transmission segment.

EOM

End of message. Someone's special control code.

EOT

End of text, an ASCII control code.

EPROM

Erasable programmable read-only memory. We'll deal with ROM and memory in more depth later but as a quick rule of thumb, ROM is read-only memory supplied as ready-programmed. PROM is read-only memory supplied empty and programmed by you, if you have the special tools. EPROM is PROM which can be erased and re-programmed.

The sharp-witted will spot that EPROM sounds a little like RAM, which is random-access memory (or read/write memory). RAM is the 'user' memory in a system; you can load programs into it and read from it at will.

The difference between EPROM and RAM is that with EPROM you need a special erasing device which utilises ultra-violet light—with RAM the new programming over-writes the old, as a rule. With EPROM you need a special re-programming device, the same 'PROM burner' required for non-erasable PROM.

Erasable memory

Memory of storage facilities which can be written, erased, re-written *ad infinitium*. Magnetic core, tape, and disc files are all erasable memory. You'll never hear this term but we thought it ought to be included.

ERCC

Error-checking and correcting memories are becoming more common on bigger minis; mainframes have had ERCC memories for some time. Each word stored is checksummed every time it is used—you remember Checksums from issue no. 2, don't you?—and the system makes sure that no unexpected alteration of its contents has occurred.

ERCC typically can detect and correct any and all single-bit errors; other errors are usually detected and logged, which helps at least. ERCC involves adding six bits to a 16-bit word; that's for the checksum and checking it can slow things a bit, which is why ERCC is limited normally to fast machines.

Error correction

As systems become more complex, it is important that errors are detected without stopping or re-running the whole thing. Facilities are being developed to effect local correction of errors without interrupting the major activities of the system, hence error correction.

ETB

End of transmitted block (ASCII again).

ETK

End of transmission—another ASCII control code.

Execution time

Not only the cold grey hour of dawn but also the time required for the computer to carry-out an instruction, or a sequence of instructions. It varies, of course, depending on the machine and the operation. It is generally expressed in terms of clock cycles (qv). Also known as Instruction Time. Or Instruction Execution (or Execute) Time.

Executive

Either the grey-suited individual concealing Bits 'n' Tums inside his *Financial Times* as he boards the 7.57 from Woking or, wait for it, the basic system software which runs a computer. The term 'executive' is used often as a synonym for 'operating system', which means that nobody really has a clear definition. Ours is as follows: the executive is that software which resides in main memory and provides control functions for the computer system.

In general, those functions would include handling interrupts (defined later), reading inputs from and despatching outputs to the control console, giving each component part of the computer circuitry a slice of the processor's attention, and so on.

Executive is not a term encountered frequently in the micro world. You are much more likely to encounter 'monitor', which as far as we can see means exactly the same (though usually implemented in ROM) or 'operating system' which, in practice, will incorporate many more system functions than something called an executive.

Exerciser

A 'prototyping' or 'development' system for a micro is a set-up which allows the user to write and debug programs, so usually it includes some kind of I/O device and local storage medium. Those programs, once they are working, can then be loaded into a micro configuration which probably does not need to have all those peripherals. The key point is that many applications for microprocessors are in systems which have no requirement for man-machine interaction, but to produce the software which drives those systems, you need such facilities.

An exerciser is the very simplest form of development system. Usually it consists only of a small display screen and a hex keyboard.

EXORciser

The Motorola development package for the M6800; it consists of several pre-tested modules and minimises the time needed to develop M6800 systems.

Extended BASIC

BASIC is beautiful, as readers of earlier glossary episodes—and anyone who takes up Donald Alcock's book—will know. It was designed as a fairly simple language for beginners and accordingly it is not as rich in facilities as some of the more complicated programming languages. Many people have been beavering away at BASICs to maximise the potential of the language on their own computers, so most of the BASIC implementations you'll meet have been somewhat enhanced by comparison with the original specifications.

There is no universally-agreed official definition yet for BASIC, though that is in the offing, so there is no officially-agreed definition of what an extended BASIC includes. Typically, though, a beefed-up BASIC will allow you to do clever output formatting and nice things with files (what is called Record I/O, for instance—look out for the provision of commands like GET and PUT). There will also be extensions to the existing facilities, like a greater range of line numbering, a greater range of permitted numbers, a greater range of permitted variable names and types of variable.

exB/2

Above all, though, the basic BASIC is generally not good enough to handle commercial applications even with difficulty. It can become very hard to do an invoice calculation and then to print an invoice. The extensions to BASIC generally are provided to simplify commercial programming.

That is a kind of superset of BASIC. There are also subsets of BASIC which provide some if not all facilities of the language in very small systems—Tiny BASIC is the best known example. You'll have to wait for us to reach 'T' for that, though.

Extender board (or chassis)

Computers are a collection of printed circuit boards which slot into a 'chassis' or 'mainframe'. The processor normally is one or two boards and so takes one or two slots. Depending on the supplier, one memory board occupying one slot can store from 4KB to 64KB or more; the controllers for disc, cassette and other peripherals are all implemented as circuit boards and take more slot positions.

Obviously you reach a limit to the number of PCB slots but some manufacturers will sell an extender or expansion board or chassis or cage. This is generally a separate chassis with more PCB slots and it plugs into the power supplies and data buses of the main chassis.

External storage

Speaks for itself, really; any type of memory which can be stored away from the computer. Like discs and tapes, internal memory is core or semiconductor storage.

THE SORCERER HAS ARRIVED

Introducing the personal computer you've waited for. The Exidy Sorcerer.

I didn't buy my personal computer until I found the one that had all the features I was looking for.
The Exidy Sorcerer does everything I wanted to do and a few things I never dreamed of.
It isn't magic. Exidy started with the best features of other computers, added some tricks of their own, and put it all together with more flexibility than ever before available. Presto! My reasons for waiting just disappeared.

I wanted pre-packed programs. Software on inexpensive cassette tapes for the Sorcerer is available from Exidy and many other software makers.

I wanted user programmability The Sorcerer's unique plug-in ROM PAC™ Cartridges contain programming languages such as Standard (Altair 8k*) BASIC, Assembler and Editor (so I can develop system software), operating systems such as DOS (so I can also use FORTRAN and COBOL) and applications packages such as Word Processor.

*Altair is a trademark of Pertec Computer Corp.

I wanted Graphics, and the Sorcerer is super. Its 256 character set – more than any other personal computer – includes 128 graphic symbols that I can define.

I wanted high resolution video. With 122,880 points in a 512 x 240 format, I get the most detailed illustrations.

I wanted to display more information. The Sorcerer displays 1920 characters in 30 lines of 64 characters – equal to a double-spaced typed page.

I wanted a full, professional keyboard. The Sorcerer's 79-key data processing keyboard provides designated graphics, the complete ASCII character set in upper and lower case, and a 16-key numeric pad.

I wanted memory. The 12k of ROM holds a Power-On Monitor and Standard BASIC; 32k of RAM is supplied on board.

I wanted expandability. Serial and parallel I/Os are built in, and the optional 6-slot S-100 expansion unit lets my system grow.

I wanted a computer that's easy enough for children to use. I just connect my Sorcerer to a video display and a cassette tape recorder, and if I have any questions the easy-to-understand Operation and BASIC Programming manuals have the answers.

I wanted to buy from an experienced Manufacturer. In five years Exidy has become the third largest producer of microprocessor-based video arcade games.

I wanted to spend less than £1,000. (This is where COMP does a little magic). My Sorcerer cost me £950!.

Now, what are you waiting for?
Call COMP. on 01-441 2922 or write to

COMP COMPUTER COMPONENTS
14 Station Road,
New Barnet, Herts. EN5 1QW.

(Price shown ex. VAT)

DEALER ENQUIRIES INVITED, A LIMITED NUMBER OF DEALERSHIPS STILL AVAILABLE.

● Circle No. 309