Practical Computing

50p

July 1979

An ECC Publication Volume 2 Issue 7

Microcomputer Show Issue

Two reviews: Aim-1 & Sol-20

The Nascom Story

Computing history in school

Going on-line with Pet

Choosing your first computer– eight-page guide

EUROC

-Simplicity is the watchword

EUROC is a new, simple to use, fast, powerful micro-computer system for business. It's British, the programme tried and tested.

EUROC is already being talked about by bankers, accountants and businessmen. See it on Stands 1 & 2 at the Micro Computer show – Bloomsbury Centre, July 5th to 7th.

EUROC hardware is manufactured exclusively for Euro-Calc Ltd., by Plessey Micro Systems Ltd. EUROC will be on permanent display at Euro-Calc's branches at 55, High Holborn, London, W.C.1., and at 224, Tottenham Court Road, London, W.1.

For further information and trade-distribution enquiries, talk to Peter Ingoldby, Managing Director, Euro-Calc Ltd., 55, High Holborn, London, W.C.1., telephone 01-405 3223 or Anthony Manton, Sales Director at Tottenham Court Road on 01-636 5560.

EUROC

● Circle No. 101

Practical Computing

Managing Editor
Dennis Jarrett

Editor
Peter Laurie

Features Editor
Robert Walczy

Computabits Editor
Nick Hampshire

Staff Writer
Kay Floyd

Production Editor
Harold Mayes

Advertisement Manager
Erica Gibson

Advertisement Department
Tom Moloney
Tina Roberts

Subscription Manager
Annabel Hunt

Publisher
Wim Hoeksma

Company-Secretary
Carole Fancourt

Managing Director
Richard Hease

Editorial: 01-359 8451
Advertising: 01-359 8151

Production and Subscriptions: 01-359 7481

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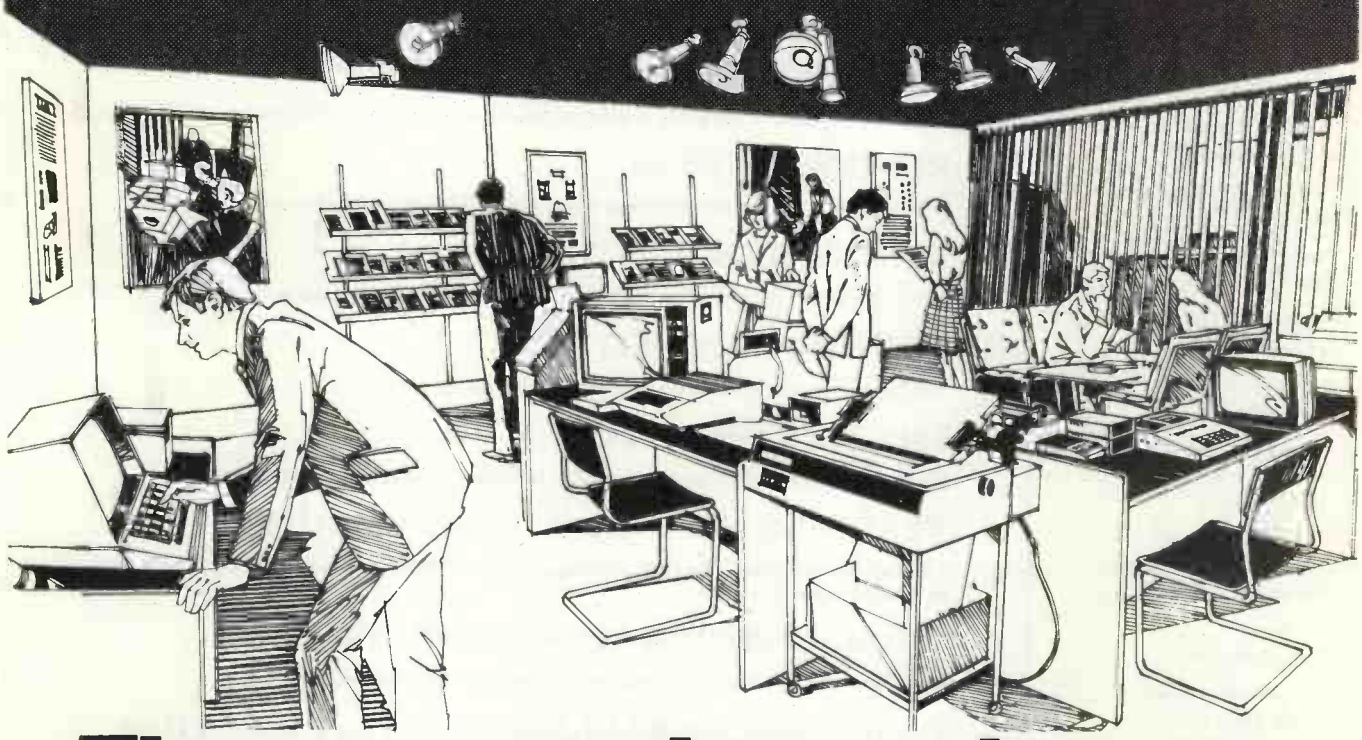
AUGUST ISSUE ON SALE JULY 11 – ORDER NOW

Thinking Computers?



Then come to the number one micro-computer centre

If you're wondering if a micro-computer can help you, we are here to advise you.

At Lion House–London's leading centre for micro-computers–you'll find:

* Experts who'll explain the equipment in a way you can easily understand, showing how and where it applies to *your* work.
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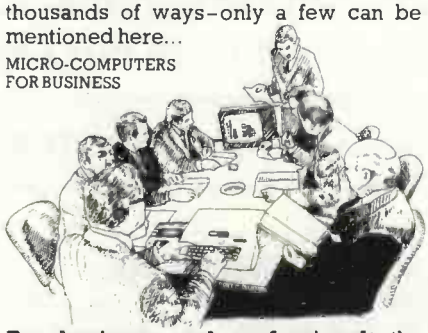
* A computer book section with publications that give you new insight into the world of micro-computers.

How will micro-computers help you? In thousands of ways–only a few can be mentioned here...

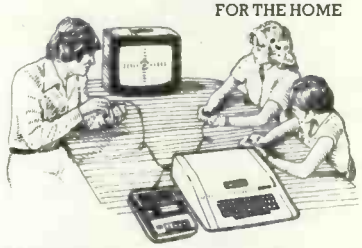
MICRO-COMPUTERS FOR BUSINESS



For business and professional, the versatility of compact micro-computers means that all the benefits of big computers are made available to **all** at low cost. The businessman can now computerise his accountancy, his stock control, his records and much more–cutting his overheads and improving his efficiency.

For the home, micro-computers have innumerable uses and considerable value too–sometimes in unexpected ways.

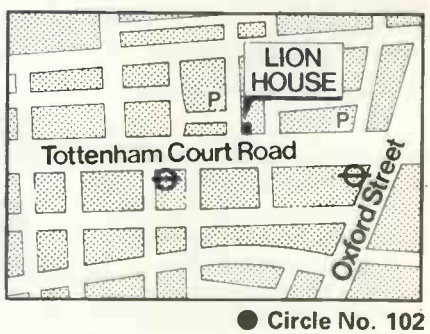
MICRO-COMPUTERS FOR THE HOME



Budgeting . . . investments . . . controlling heating or security . . . storing information on things like recipes . . . designing complex and fascinating games . . . education . . .

Come and see. We invite you to visit us and investigate the possibilities and the potential. If you're too far away, phone or write and we'll send you more information.

You need a micro-computer. We can supply it.



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SMALL COMPUTERS–TO MAKE YOUR BUSINESS BIGGER

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Telex: 28394 Lion G.

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● **Circle No. 102**

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A complete Business Program Package free with the purchase of a 32-40K computer system. At stand 46 Microprocessor Show only.

Approx 60 entries * updates require only 1-2 hours weekly and your entire business is under control.

*** PROGRAMS ARE INTEGRATED**

1=ENTER NEW NAMES/ADDRESSES
2=* ENTER/PRINT INVOICES
3=* ENTER PURCHASES
4=* ENTER A/C RECEIVABLES
5=ENTER A/C PAYABLES
6=ENTER/UPDATE STOCKS REC'D
7=ENTER ORDERS REC'D
8=EXAMINE/UPDATE BANK BALANCE
9=EXAMINE SALES LEDGER
10=EXAMINE PURCHASE LEDGER
11=EXAMINE ORDER BOOK
12=EXAMINE PRODUCT SALES
WHICH ONE (ENTER 1 TO 24)

SELECT FUNCTION BY NUMBER

13=PRINT CUSTOMER STATEMENTS
14=PRINT SUPPLIER STATEMENTS
15=PRINT AGENTS STATEMENTS
16=PRINT VAT STATEMENTS
17=PRINT WEEK/MONTH SALES
18=PRINT WEEK/MONTH PURCHASES
19=PRINT YEAR AUDIT
20=PRINT PROFIT/LOSS ACCOUNT
21=UPDATE ENDMONTH FILES
22=PRINT CASHFLOW ANALYSIS
23=ENTER PAYROLL
24=RETURN TO BASIC

EACH PROGRAM GOES IN DEPTH TO FURTHER EXPRESS YOUR REQUIREMENTS.

FOR EXAMPLE (9) ALLOWS: a. list all sales; b. monitor sales by stock code; c. invoice search; d. amend ledger files; e. total all sales.

THINK OF THE POSSIBILITIES, AND ADD TO THOSE HERE IF YOU WISH

Note programs 19, 20, 22, 23 not linked at time of going to press; estimated completion July. Price for current package £275 plus VAT, improved version – inc aged debtors analysis etc. £375, or full listing plus manual to be typed-in on most computer systems £150. Barclaycard enquiries welcome.

Hardware systems tailored to your requirements (SWTP and PET) from £600 to £5,000 approx. Above package is intended to work with processor, twin-floppy and printer.

LIST OF FUNCTIONS AND FILES IN THIS PACKAGE

Program 1	BUS	displays above options
Program 2	TRANSAC1	creates invoice file containing all sales information
Program 3	TRANSAC2	creates accounts received file
Program 4	TRANSAC3	prints sales invoices and credits
Program 5	TRANSAC4	enters invoice details to monthly ledger
Program 6	TRANSAC5	enters invoice details to 2nd ledger for payment
Program 7	TRANSAC6	links current invoice files to old file for third copy purposes
Program 8	TRANSAC7	updates payment ledger with monies received and rejects discrepancies
Program 9	TRANSAC8	prints final total outstanding and enters to liquidity
Program 10	PURCHAC1	enters purchases made and creates ledger file
Program 11	PURCHAC2	enters monies to be paid out, with a check against discrepancies
Program 12	PURCHAC3	updates purchase ledger file with new entries
Program 13	PURCHAC4	evaluates old creditors balances and updates to include purchases
Program 14	PURCHAC5	updates creditors balance to include payments made out
Program 15	PURCHAC6	evaluates and prints new ledger balances and gives final liquidity balance
Program 16	ADDRESS	examines, adds, amends, prints lists of address files (up to 999)
Program 17	STOCK	examines, adds, amends, prints lists, gives valuations of stocks on hand
Program 18	ORDER	examines, adds, amends, prints lists, valuations and confirmations to clients
Program 19	TRANSPRT	examines, adds, amends, prints lists of ledger entries and stocks sold
Program 20	PURCHPRT	examines, adds, amends, prints lists of ledger files
Program 21	VATPRT	lists ledgerfiles for three months and prints vatform entries
Program 22	CUSTPRT	prints customer statements with aged debtor analysis for 1 or all clients
Program 23	AGENTPRT	prints agent statements for 1 or all, with 4 commission rates presented
Program 24	SUPPRT	prints suppliers statements
Program 25	ENDMTH	updates all files for month end, to clear files to another disc
Program 26	BANK	examines, adds, amends, totals bank transactions
Program 27	AUDIT	(in work) prints years audit
Program 28	PROFIT	(in work) prints years profit/loss account
Program 29	CASHFLOW	(in work) prints years calendar of cashflow to include standing orders etc
Program 30	PAYROLL	(in work) evaluates weekly payroll and taxation applied to record files

FINAL 4 OPTIONS WILL ADD APPROX. £200 TO ABOVE

Please telephone for appointment – Tony Winter on 01-636 8210

GRAMA (WINTER) LTD **21B Dryden Chambers, 119 Oxford St., London W1.**

● Circle No. 103

THE NEW HORIZON

The microcomputer for those who need more than the minimum. The right processor for business, scientific and educational use. Proven applications include Games • Educational • Word Processing • Invoicing • Stock Control • Sales Ledger • Purchase Ledger • Mailing • Scientific.

The Horizon computer includes:-

Specification

Zilog Z80A MPU • S-100 bus (12 slots) • Solid well-built case • Up to four Shugart mini-floppy disc drives. 180KB each • Serial port for CRT or Teletype • Real-time clock on motherboard • Optional additional serial port and parallel port • Powerful operating system and monitor • Access to wide range of S-100 special application boards.

Languages

Powerful Basic including sequential and random access disc files • formatted output • strings • line editor • machine language CALL • many other facilities. Optional additional software (under CP/M operating system) includes BASIC compiler, FORTRAN and COBOL.

Horizon Z80A computer with 2 double-density disc drives and 24K RAM £1,823 (exclusive of VAT and carriage).

Equinox Computer Systems Ltd.
"Kleeman House"
16 Anning Street,
New Inn Yard,
London EC2A 3HB.
Tel: 01-739 2387/9.
01-729 4460.

For North Star Horizon systems and software contact the people with experience:

LONDON
Equinox Computer Systems Ltd., 16 Anning Street, New Inn Yard, London. EC2A 3HB. (Tel: 01-739 2387/9–01-729 4460)

SCOTLAND
Scotia Software Services, 95 Woodfield Avenue, Edinburgh. (Tel: 031-441 603).

DEVON
J.A.D. Integrated Services (Plymouth) Ltd. 21 Market Avenue, City Centre, Plymouth, Devon. (Tel: 0752-62616).

HUNTS
Paxton Computers, 26 High Street, Great Paxton, Huntingdon, Cambs. PE19 4RF. (Tel: 0480-213785).

SURREY
Radix 2 Technology Ltd., 92 Wimbledon Hill Road, Wimbledon, S.W.19. (Tel: 01-946-8887).

MIDDX
Jacobs Computer Systems Ltd., 36 Bengeworth Road, Harrow, Middx. HA1 3SE. (Tel: 01-908-1134).

HANTS
Claisse-Allen Computing, 5 Upper High Street, Winchester. (Tel: 0962-69368).

DORSET
Blue Chip Microsystems, Market Place, Sturminster, Newton, Dorset. DT10 1BB. (Tel: 0258-72946).

SOUTH WALES
Micro Media Systems, 12 Clarence Place, Newport, Gwent. (Tel: 0633-50528).

LANCS & NORTH WALES
Cortex Computer Centre, 25/35 Edge Lane, Liverpool. (Tel: 051-263 5783).

CAMBS
Wisbech Computer Services Ltd., 10 Market Street, Wisbech, Cambs. (Tel: 0945-64146).

LINCS
Loveden Computer Services, 167 Bartowby High Road, Grantham, Lincs. (Tel: 0476-72000).

KENT
Microtek Computer Services, 50 Chislehurst Road, Orpington, Kent. (Tel: 66-26803).
Tor Business Systems, 83 Timberbank, Vigo Village, Meopham, Kent. (Tel: 0732-822956).

ESSEX
Micro Software Systems Ltd., Stanhope House, High Street, Stanford-le-Hope. (Tel: 03756-41991/2).

EQUINOX

COMPUTER SYSTEMS LTD.

"Kleeman House" 16 Anning Street, New Inn Yard, London EC2A 3HB.
Tel: 01-739 2387/9. 01-729 4460.

● Circle No. 110

O.K. so you've got a computer.

So we've got all the add-ons!

Floppy Disks

Micropolis drives are available in 143K and 315K (formatted) versions expandable from one to four drives in various packaging options. Prices quoted below are for single 143K units including 240V power supply and case.

For S100 computers: Cromemco, Vector, Horizon, SOL, Sourcerer with S100 expansion.

1042-1 Master unit; includes controller card and Micropolis system software **£499**
CP/M **£100**
1022-1 Add-on unit **£339**
COBOL **£400**

For NASCOM and other small Z80 configurations:

143BZ Master unit; includes controller card and Raindos system firmware **£499**
1022-1 Add-on unit **£339**

For Motorola D1/D2, SWTPC MP-68 and other small 6800 configurations:

143BM Master unit; includes controller card and RPDOS system firmware **£499**
1022-1 Add-on unit **£339**

For TANDY TRS 80 with expansion interface:

1027 (T) Drive 1, 2, 3 or 4 **£339**

Memories

For S100 computers:

Vector 8K Static	**£150**
Vector 16K Static with bank switching	**£300**
Vector 48K Dynamic, Z80 refresh	**£500**

For SS50 (SWTPC, MSI) computers:

4K Static	**£ 80**
8K Static	**£140**
32K Dynamic, Onboard refresh	**£495**

Microspeech

For SS50 (SWTPC, MSI) computers:

Microspeech analogue speech synthesiser converts text strings in phonetic spelling to audio output. Complete with special BASIC interpreter **£295**

SINTROM GROUP

All prices exclude VAT and carriage
Dealer enquiries welcome
Please send for complete shortform catalogue
Please enquire for add-ons to computers not mentioned above

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● **Circle No. 114**

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Microcomputers from the world's largest full-line manufacturer

The C2-4P Mini Floppy

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See your nearest authorised dealer for full price list and catalogue, of Challenger I, II, III, series.

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Thames Personal Computers
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U Microcomputers
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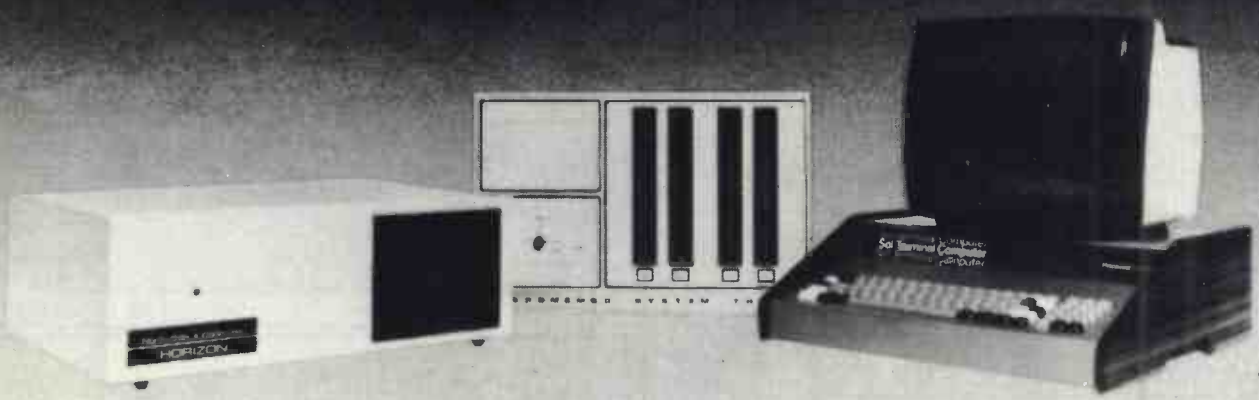
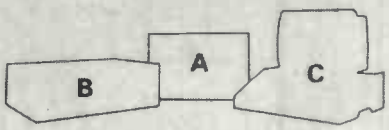
Cheshire CW8 1RS
Tel: 0606-75627

● Circle No. 119

comart
...the specialists





A Cromemco System 3/64 Computer
B The North Star Horizon
C Processor Technology's SOL

All the small computers you need!
Micro computers for scientific research, control, educational and commercial applications. Comart have single card computers for control; development systems and interface boards for research; multi-user systems for education and word processing for commercial users.

The computer systems are modular and flexible – you choose only those facilities you need.

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Microcomputermart Ltd., Manchester. Tel: 061-832 2269
Crayworth Ltd., Camberley, Surrey. Tel: (0776) 34044
Digitus Ltd., London W.1. Tel: 01-636 0105
Holdene Ltd., Leeds. Tel: (0532) 459459
Isher-Woods Ltd., Luton, Beds. Tel: (0582) 424851
Newbear Computing Store, Newbury, Berks. (0635) 30505
Xitan Systems Ltd., Southampton. Tel: (0703) 38740

comart specialists in microcomputers

Comart Ltd., P.O. Box 2, St. Neots, Huntingdon, Cambs, PE19 2AF. Tel: (0480) 215005 Telex: 32514

● **Circle No. 123**

If you can buy more on one board for under £300~ buy us one too!

In about the same area as this advertisement, we have designed a microcomputer with 20K of addressable memory ON-BOARD. With Kansas City standard cassette interface ON-BOARD. With TV/monitor interface ON-BOARD. With control decoding ON-BOARD. With all bus lines fully buffered ON-BOARD.

We call this microcomputer **Nascom-2**. And for under £300 this is what it has:

Microprocessor

Z80A. 8 bit CPU. This will run at 4 MHz but is selectable between 1/2/4 MHz.

This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.

The software library for the Z80, with its base around the 8080, has rapidly expanded with the increasing use of its more powerful instruction set.

Hardware

12"×8" Card

All bus lines are to the Nasbus specification.
All bus lines are fully buffered.

PSU +12v, +5v, −12v, −5v.

Memory

On-board, addressable memory:–

2K Monitor – Nas-Sys I (2K ROM)
1K Video RAM (MK4118)
1K Work space/User RAM (MK4118)
8K Microsoft Basic (MK36000 ROM)
8K Static RAM/2708 EPROM

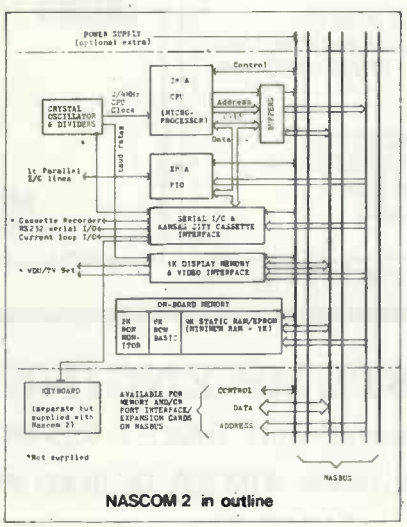
INTERFACE

Keyboard

New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.

T.V.

The 1v peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.



NASCOM 2 in outline

I/O

On-board UART (Int.6402) which provides serial handling for the on-board cassette interface or the RS232/20mA teletype interface.

The cassette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the NASCOM-2.

The RS232 and 20mA loop connector will interface directly into any standard teletype. .

The input and output sides of the UART are independently switchable between any of the options – i.e. it is possible to use input on the cassette and output on the printer.

PIO

There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2×8 bit ports with complete handshake controls.

On-board Decoding

The NASCOM-2 makes extensive use of ROMS for on-board control decoding. This reduces the chip count and allows easy changes for specialised industrial use of the board.

Link options are on-board to allow the Reset control to be reassigned to an address other than zero.

Character Generators

The 1K video RAM drives a 2K ROM character generator providing the standard ASCII character set with some additions, 128 characters in all. There is also a socket for an optional graphics ROM on-board.

The PCB is, of course, of industrial standard, through hole plated, masked and screen printed.

Documentation

Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

We think no other board has quite so much on it for £295 (plus 8% VAT). If you find a board that has more, buy one for us too!

Nascom Microcomputers
121 High Street Berkhamsted Herts.
(04427) 74343

● **Circle No. 128**

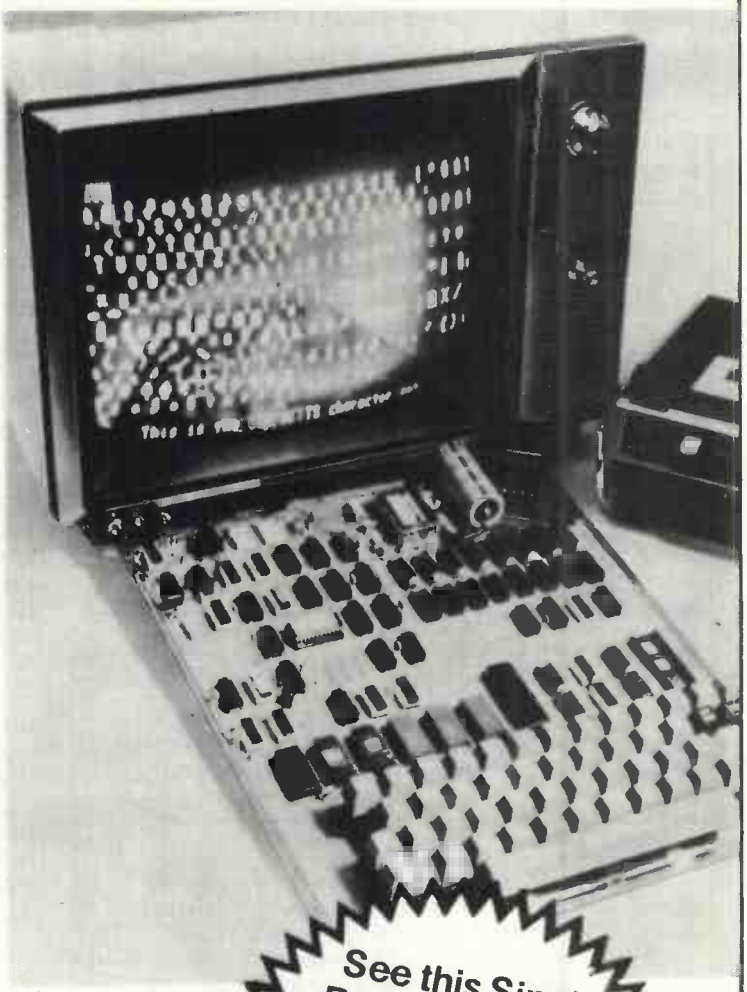
P.E. SINGLE BOARD COMPUTER

In the August issue of PE, we will be presenting *COMPUKIT UK 101*. It compares very favourably with machines three times its price and is similar to Superboard II (recently reviewed by us) using the same *8K Microsoft, full feature, BASIC* which runs faster than other currently available personal computers. Faster than some business computers. Its features are:

- **Up to 8K RAM on board.**
- **Fully expandable via on board sockets.**
- **Cassette interface (CUTS).**
- **VDU—with its own dedicated RAM (1K).**
- **Full ASCII keyboard.**
- **U.H.F. modulator on board.**
- **P.S.U. on board, transformer included in kit.**
- **Full machine code monitor (2K) and I/O utilities in ROM.**
- **Upper and lower case plus graphics and gaming characters.**

It will mate with all Superboard extras. For example:

- **Expander board for up to 24K static RAM.**
- **Mini-floppy interface.**
- **Port adaptor for printer and modem.**
- **OSI 48 line expansion interface.**



Compukit UK 101 will sweep the board in the hobby computer field. It is an excellent design with full feature (not Tiny) BASIC. A complete kit will be available from *Computer Components* for £219+VAT.

See this Single Board Computer on stand 28 at the Microcomputer Show or on the PE stand at Bazaar, June 28-30 at Alexandra Palace.

FULL CONSTRUCTIONAL DETAILS STARTING IN

PRACTICAL ELECTRONICS

AUGUST ISSUE ON SALE FRIDAY, 13 JULY

DE BOER

TAKE A NEW LOOK AT SC/MP

Our new SC/MP NIBLE-BASIC Microcomputer kit system is available.

This new National Semiconductor SC/MP-based microprocessor is more versatile than many similar systems. The CPU board includes a pre-programmed 4K Nible-Basic interpreter ROM in conjunction with the SC/MP II. The board also incorporates RS232C/V24 input and output buffers.

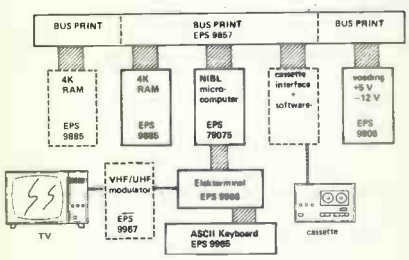
Full kit price, including PCB and instructions £50.95.

SC/MP microprocessor board plus 4K RAM board. Special Price £139.00

When used with our other kits you will have a useful and reliable computing system with plenty of scope for expansion. To launch this new board we are offering a special package deal on a complete system.

This package includes:
SC/MP Microcomputer Board (79075); ASCII Keyboard (9965); 4K RAM (9885); Power supply (9066); TV Display terminal (9966); BUS Board (9857); TV Modulator (9967) inclusive of VAT£275.00

Compare this to other systems available as KITS. Remember that we sell only first-class components and PCBs. We do not try to cut corners by supplying inferior keys or flimsy unmarked boards. Most of the boards are standard Eurocard size for rack-mounted systems. A cassette interface card with built-in control software will be available shortly.



MODULAR MICROCOMPUTER SYSTEM KITS

These kits are based on the National Semiconductor SC/MP microprocessor. They offer a unique stage-by-stage building and learning system which develops from a simple digital display unit, through a HEX address and display stage, to a complete minicomputer with ASCII Keyboard and TV display. The system is robustly constructed, which makes it ideal for use in Schools and Colleges where microcomputer techniques are now part of the syllabus. Many of the kits can be used to supplement other systems.

SC/MP Board and RAM Input/Output Board
These demonstrate the working of the SC/MP chip. Data is fed in using digital switches and read out on LEDs
9846-1/2 £26.75

CPU Board
This is used in conjuction with the RAM board and contains all the devices needed to control the overall system.
9851 £42.90

Memory Extension Board
This contains 3/4K of RAM and ½K of PROM. It also houses the multiplexer and the priority decoder. This enables the SC/MP to handle interrupt requests from more than one peripheral device.
9863 £38.50

BUS Board
Simple interconnection system for the Eurocards
9857 £3.00

HEX input/output board
Used in place of the RAM input/output board, this unit enables the SC/MP to be addressed in hexadecimal. The board also displays Hexadecimal output using seven-segment LED displays.
9893 £62.55

ELBUG
Three pre-programmed EPROMS designed to control the system.
9800E £37.00

Power Supply
Designed to power all the units in the system with room to spare to power additional boards. +5 Volts 3 Amps, -12 Volts 0.5 Amps.
9066 £19.50

4K RAM Card
Full 4096 × 8-bit RAM capacity. More than one of these cards can be added to the system using a simple buffer circuit.
9885 £92.55

Cassette Interface
Record and replay your programs using this Kansas City format interface. Transfer rate up to 1,200 baud.
9905 £16.50

ASCII Keyboard
Uses the AY-5-3276 encoder to provide all the alphanumerics and control functions for the microprocessor system. Full-size keyboards.
9965 £46.50

TV Display Terminal board
Used in conjuction with a TV modulator, this board enables a display format of 16 lines of 64 characters per page to be displayed on a normal television set. Cursor and scrolling functions are included. The unit also offers a choice of six baud rates.
9966 £69.00

TV Modulator
For use with the display board
9967 £6.45

Microprocessor Interface
Input/output buffer to interface RS232C and V24 type equipment with either KIM or our SC/MP system.
79101 £6.75

Further details of this system on request.

TV GAMES COMPUTER KIT

Most TV Games fall into one of two catagories. Either their programs are fixed by the type of control IC which generates a few simple ball games, or they can be re-programmed by plug-in modules. The modules for the latter type tend to be expensive and it is always uncertain just how long the manufacturer will issue new games.

This TV GAMES COMPUTER overcomes these problems by enabling the owner to take advantage of the software available and to devise new games using the keyboard. These programs are then transferred to tape for future use. The game is controlled by the Signetics 2650 Microprocessor IC and offers up to eight colour variations in the display, together with a score count system and sound effects. The unit also includes joystick control for two players.

Full data supplied with the kits.

Keyboard (79073-2) £26.10; Main Board (79073) £166.40; Power Supply (79073-1) £14.20; Modulator (9967) £6.45; Joystick Controls £5.50 each

Special package price of all these kits plus Software record. £215.00.

Individual components for all these projects are available, send SAE for prices.

All our prices *include* VAT rate applicable at the present time. We reserve the right to change our prices should this rate be altered.

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U.K. Orders: Send Cheque or Postal Order payable to DE BOER ELEKTRONIKA, 2 Lynn Road, Grimston, Kings Lynn, Norfolk, PE32 1AD. Add 50p for postage and packing. Telephone Hillington (04856) 553. Office hours Mon-Fri 9.00am-5.00pm.

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DETAILED SPECIFICATION

MODEL VDP 10

VIDEO

- **One page memory**
  *64 characters per line *16 lines per page
- **Full 128 ASCII character set**
  *96 upper and lower case characters *32 control symbols
- **Comprehensive cursor controls**
  *Left/right/up/down *CR/LF *Clear/home/line-erase
- **PROM translation from inbound characters, giving:-**
  *Programmable coding for cursor commands
  *Programmable display control for each input code
- **Cursor command codes can be displayed using:-**
  *'Display' key for protocol debugging *V28 input bit 8 under remote software control
- **European compatible composite video out for:-**
  *TV monitor, or *Modified TV set.

V28 I/O

- **High/low rates externally switchable and jumper selectable from:-**
  *9600/4800/2400/1200/600/300/150/75 bits/sec.
  *220/110 bits/sec. (NOTE: at high receive speeds, remote software should allow 8.3 ms for CR, LF and 132 ms for Clear)
  *Odd, Even or No Parity *Full duplex or local mode
  *One or two stop bits *V24 serial I/O using standard 25 pin socket

KEYBOARD

- **72 key ultra-reliable solid state contactless keyboard**
- **Standard ASCII layout plus programmable cursor control keypad**
- **QWERTY standard, AZERTY optional extra**
- **Full N key rollover**
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- **Repeat key.**

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- **Built-in – needs 220-240V 50Hz.**

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- **Tailor-made to house all electronics, keyboard, video and V24 sockets, switches and power supply.**

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- **Display Key**
  *Displays control characters for easy protocol debugging

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QTY.				
	1N914	100v	10mA	.05
	1N4005	600v	1A	.08
	1N4007	1000v	1A	.15
	1N4148	75v	10mA	.05
	1N4733	5.1v	1 W Zener	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25

SOCKETS/BRIDGES

QTY.					
	8-pin	pcb	.20	ww	.35
	14-pin	pcb	.20	ww	.40
	16-pin	pcb	.20	ww	.40
	18-pin	pcb	.25	ww	.95
	20-pin	pcb	.35	ww	.95
	22-pin	pcb	.35	ww	.95
	24-pin	pcb	.35	ww	.95
	28-pin	pcb	.45	ww	1.25
	40-pin	pcb	.50	ww	1.25
	Molex pins	.01	To-3 Sockets		.25
	2 Amp Bridge		100-prv		.95
	25 Amp Bridge		200-prv		1.50

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QTY.			
	2N2222	(2N2222 Plastic .10)	.15
	2N2222A		.19
	2N2907A	PNP	.19
	2N3906	PNP (Plastic Unmarked)	.10
	2N3904	NPN (Plastic Unmarked)	.10
	2N3054	NPN	.45
	2N3055	NPN 15A 60v	.60
	T1P125	PNP Darlington	1.95
	LED Green,	Red, Clear, Yellow	.15
	D.L.747	7 seg 5/8" High com-anode	1.95
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9301	.85	9322	.65
9309	.35	9601	.20
9316	1.10	9602	.45

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8T23	1.50	2114	9.50
8T24	2.00	2513	6.25
8T97	1.00	2708	10.50
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		6800	13.95
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4012	.20
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4015	.75
4016	.35
4017	.75
4018	.75
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4020	.85
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LM201	.75	LM339	.75	LM711	.45
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LM318	1.75	LM340K15	1.25	LM1458	.65
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LM320K12	1.65	78L05	.75	NE565	.95
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LM320T12	1.65	78M05	.75		
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7400	.10	7482	.75	74221	1.00	74LS02	.30
7401	.15	7483	.75	74367	.95	74LS04	.30
7402	.15	7485	.55	75108A	.35	74LS05	.35
7403	.15	7486	.25	75491	.50	74LS08	.35
7404	.10	7489	1.05	75492	.50	74LS09	.35
7405	.25	7490	.45	74H00	.15	74LS10	.35
7406	.25	7491	.70	74H01	.20	74LS11	.35
7407	.55	7492	.45	74H04	.20	74LS20	.30
7408	.15	7493	.35	74H05	.20	74LS21	.35
7409	.15	7494	.75	74H08	.35	74LS22	.35
7410	.15	7495	.60	74H10	.35	74LS32	.35
7411	.25	7496	.80	74H11	.25	74LS37	.35
7412	.25	74100	1.15	74H15	.45	74LS38	.45
7413	.25	74107	.25	74H20	.25	74LS40	.40
7414	.75	74121	.35	74H21	.25	74LS42	.75
7416	.25	74122	.55	74H22	.40	74LS51	.45
7417	.40	74123	.35	74H30	.20	74LS74	.45
7420	.15	74125	.45	74H40	.25	74LS76	.50
7426	.25	74126	.35	74H50	.25	74LS86	.45
7427	.25	74132	.75	74H51	.25	74LS90	.65
7430	.15	74141	.90	74H52	.15	74LS93	.65
7432	.20	74150	.85	74H53	.25	74LS107	.50
7437	.20	74151	.65	74H55	.20	74LS123	1.20
7438	.20	74153	.75	74H72	.35	74LS151	.85
7440	.20	74154	.95	74H74	.35	74LS153	.85
7441	1.15	74156	.70	74H101	.75	74LS157	.85
7442	.45	74157	.65	74H103	.55	74LS160	.95
7443	.45	74161	.55	74H106	.95	74LS164	1.20
7444	.45	74163	.85	74L00	.25	74LS193	1.05
7445	.65	74164	.60	74L02	.20	74LS195	.95
7446	.70	74165	1.10	74L03	.25	74LS244	1.70
7447	.70	74166	1.25	74L04	.30	74LS367	.95
7448	.50	74175	.80	74L10	.20	74LS368	.95
7450	.25	74176	.85	74L20	.35	74S00	.35
7451	.25	74180	.55	74L30	.45	74S02	.35
7453	.20	74181	2.25	74L47	1.95	74S03	.25
7454	.25	74182	.75	74L51	.45	74S04	.25
7460	.40	74190	1.25	74L55	.65	74S05	.35
7470	.45	74191	1.25	74L72	.45	74S08	.35
7472	.40	74192	.75	74L73	.40	74S10	.35
7473	.25	74193	.85	74L74	.45	74S11	.35
7474	.30	74194	.95	74L75	.85	74S20	.25
7475	.35	74195	.95	74L93	.55	74S40	.20
7476	.40	74196	.95	74L123	.85	74S50	.20
7480	.55	74197	.95	74LS00	.30	74S51	.25
7481	.75	74198	1.45	74LS01	.30	74S64	.15
						74S74	.35
						74S112	.60
						74S114	.65
						74S133	.40
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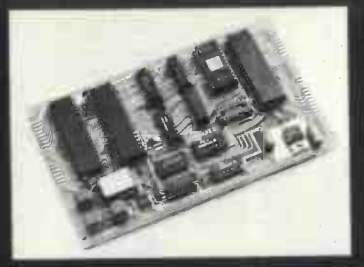
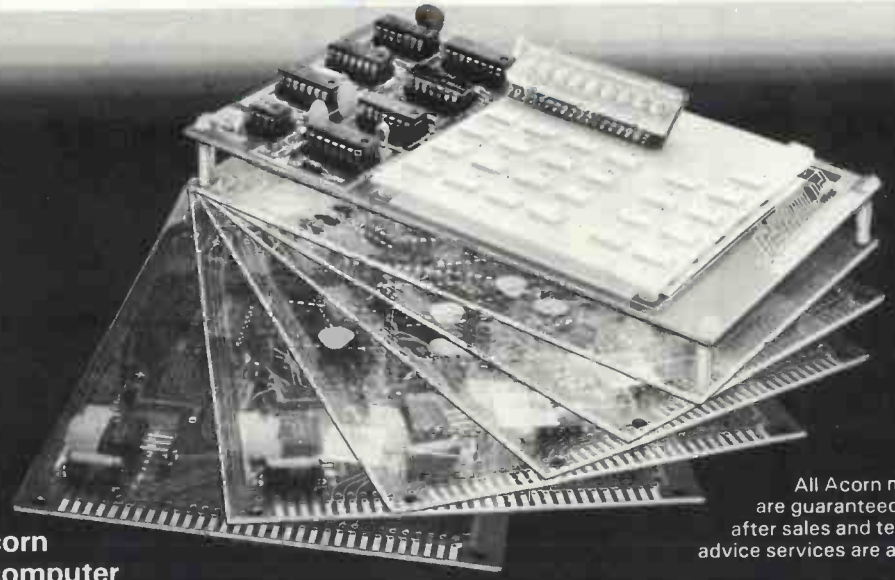


Acorn Controller

Designed as an industrial controller module, it is based on the 6502 CPU with 2K Eprom, 1.25K ram and 32 I/O lines. In eurocard format it is provided with an onboard monitor (2 x 74S571) giving comprehensive development and debugging facilities. Also available in minimum configuration for low cost OEM applications.



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Set of sub-routines for use in programming
Powerful de-bugging facility displays all internal registers
Tape load and store

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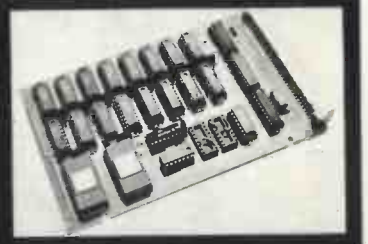

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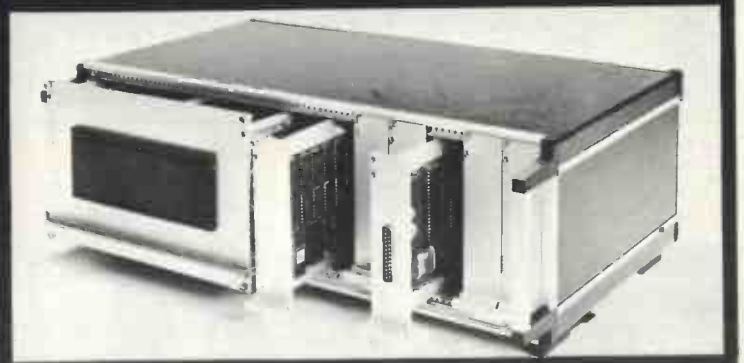

Software available soon includes 4K-Editor-Assembler-Disassembler, 4K Proprietary Fast Basic, Disc operating system with full file handling.
Although a standard strip of veroboard is all that is required for a full backplane, a racking system can be made available by Acorn Computers. The rack shown includes the VDU interface, two memory cards and dual floppy disc interface.

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Basic in Rom: a powerful 2k Tiny basic resident on board, makes Triton unique, easy to use and versatile.

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● **Circle No. 150**

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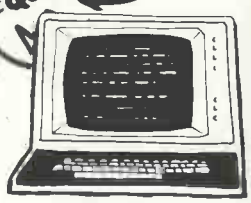

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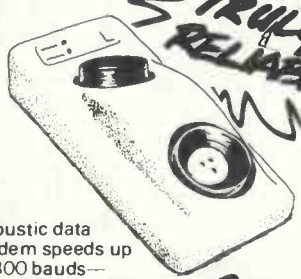

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PRICE: £1,360

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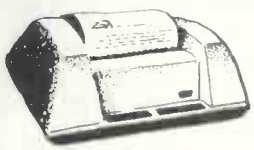

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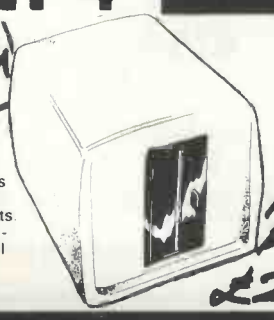

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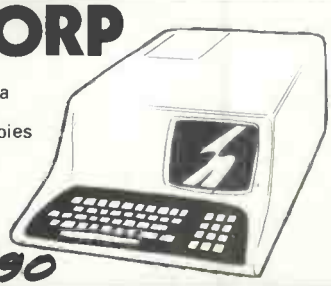

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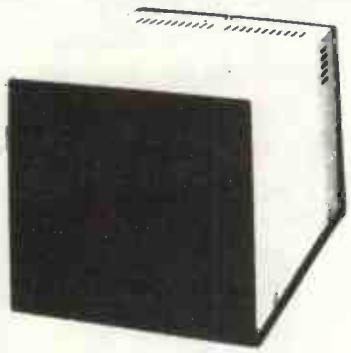

Dual Drive Floppy Disk

£840 +VAT

- ✱ Diskman operating system
- ✱ Random & sequential access
- ✱ 100k on each drive (200 k on double density)
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24k – £320 +VAT

16k and 32k also available

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Undirectional interface I-EEE to RS232 £89 + VAT
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We also supply:

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Apple II 16k, 32k or 48k mini-disk drives, interface cards and software.

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Printers Centronics 779, Perkins Elmer Pussycat Teletype 43 etc., including interfaces and stationery.

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● Circle No. 154

Publisher's Letter

READERS whose memories stretch for a year – a long time in microcomputers – will recall that what is now the Microcomputer Show was last year the Do-It-Yourself Computer Show. Then, too, *Practical Computing* contained the official Show Guide.

That 60-page issue was sold out very quickly and is now a much-sought-after collectors' item. This year's bumper Show Edition contains 136 pages but the price remains at the original 50p.

It is not just *Practical Computing* which has grown so dramatically in the last year but also, as will be particularly obvious to Show visitors, the whole microcomputer industry.

You will be faced with a tremendous choice of very sophisticated hardware. To some it might seem a bewildering choice, and it would be worthwhile studying our guide to buying your first computer (page 53) before making such a momentous decision.

Assimilating the latest *Practical Computing* Buyers' Guide (page 125) and stand-by-stand review (page 63) should then enable you to focus your attention on where your time, and eventually your money, is best spent at the Bloomsbury Centre from July 5–7.

Enjoy the show, buy wisely, and by all means visit our stand to browse through the back numbers or to talk to the people who make this your magazine.

The Publisher

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.

User groups

WE are aware that there are about 30 members of the ACC in our area but from the regular appearance of your magazine in newsagents we suspect that there are many people "going it alone".

We would find regular exposure in a "User Groups Page" very helpful. If space is a problem a diary would be acceptable.

Our one Tandy owner was pleased to find the TRS-80 Forum in *Practical Computing* and in view of this I am surprised that you do not exploit the 10K or so Nascom owners – not me, I have a 6800 – by having regular programs for them; likewise, the other popular systems.

On the subject of software, would it not be possible to have all machine code cross-compiled to cover all the common processors, and also to detail changes of Basic programs for different machines?

Finally, since several of our members know nothing of the general electronics hobby press, it might be helpful if components suppliers advertised in your magazine.

N. P. Butcher
Bushey Heath, Watford.

Initial system

I WOULD be grateful for your advice on an initial computer system for hobby/scientific/possible commercial use which may be expanded into a multi-user system at a later stage:
Cost, £2,000 including VAT;
Memory initially 32K, expandable to 64K;
Fortran IV, Assembler, Basic, Algol and, eventually Cobol;
Dual floppies, CP/M operating system, file-orientated, IBM-compatible, 8in or 256K to run reasonable-size Fortran programs;
To reduce initial costs, printer and possibly VDU to be added later; if a VDU has to be obtained – no UHF TV output – which ones are best suited to 80-character screen width?

Graphics capability later, high resolution; later, input/output paper tape or cassette; good quality documentation, reliability – little or no maintenance costs; low power consumption – not affected by mains variation;
Where can discounts be obtained?

Summing up, maximum reliability and expansion, plus performance, for minimum cost.

M. J. Stalker
Farnborough, Hants.

Bank switching

I WAS interested to note Allen Secker's letter in your April issue and your comment concerning the availability of bank switching boards.

I am a main importer for Imsai in South-east England and can confirm that Imsai has now discontinued manufacturing the IMM bank switching board which permitted megabyte addressing.

As I understand it, there was insufficient demand on the American market for such a facility on microcomputers. There are, however, doubtless dealers in the U.S. who have stocks of this board; and if any individual or company requests it, I will gladly attempt to trace one.

Imsai is concentrating on the VDP and PCS microcomputers.

Graham Jenkins
Corner Computing Services
Epsom.

● **Apart from that, we hear also that Imsai recently filed for Chapter 11 bankruptcy protection. This is a provision in the U.S. legal code which gives a company a few months to put its affairs into order, if it can.**

On the other hand, we have also heard from another Imsai distributor, Computer Mart of Norwich. "In answer to your comments on bank-switched memory boards, we handle all products made by Imsai.

"Bank-switched memories are available in three sizes: 16K @ £500 + VAT; 32K @ £867 + VAT; 64K @ £1698 + VAT. Please check with our office for prices".

Educational software

I AM a psychologist working in the field of employment rehabilitation and am seeking information on educational software packages suitable for commercially-available micros. My interests range from computer-assisted education in simple arithmetical skills to the teaching of basic computer programming. Any information would be most gratefully received.

Peter Spencer
Employment Rehabilitation Centre
Dovedale Avenue
Ingol, Preston.

(continued on page 35)

Pet Expansion

Computhink
Dual drive
minifloppy

Complete with 4K disk operating system in ROM, plugs into Expandapet memory. Adds 15 new commands to Pet's Basic to give full disk extended Basic. Loads 8K in 2.6 seconds. Automatic reorganisation of free space. Utility Disk

£833 + V.A.T.

Expandapet memory
Powered by Pet's own powersupply and mounted internally in 5-10 minutes without special tools.

16K..... **£261** + V.A.T.

24K..... **£320** + V.A.T.

32K..... **£374** + V.A.T.

All units are fully built and tested.

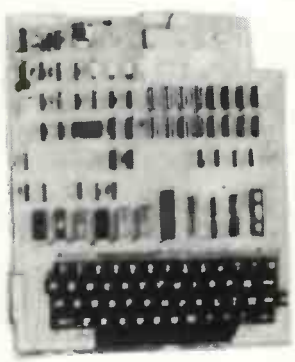
Apple II

Apple II was the original with full colour high resolution microcomputer Basic, and it is still the best. With a very wide range of expansion available, including disk drive, interface cards, voice recognition card, light pen and many others.

Apple II has been well tried and approved by the public (over 200,000 sold) because of its thoroughly professional design and high quality engineering. You cannot get better value for money. Please send us a large s.a.e. for further details.

With 16K user RAM only **£820** + V.A.T.

Super Board II



This 6502 based microcomputer comes with a full 8K Microsoft basic in ROM. Full keyboard. 4K static user RAM (on board expandable to 8K). Kansas City standard interface for use with an ordinary cassette recorder. Machine code monitor and I/O utilities in ROM. Direct Video access with 1K dedicated RAM (besides 4K user RAM) and full graphics set.

Fully built and tested only needs a 5V 3amp power supply and T.V. Monitor or R.F. modulator to be up and running.

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Save Over £100

TRS 80 and Apple II memory expansion kits. Fully guaranteed and with full specification 4116 16K RAMs.

Kits come with full instructions and new jumper sets where necessary. Fitting takes 5-10 minutes, or bring along your Apple or TRS 80 and we will fit it for you for £5.

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● Circle No. 155

(continued from page 33)

North Star plea

HAVING had certain problems with understanding North Star Basic manuals, it occurs to me that it would be useful to get in touch with other North Star users so that there may be a pooling of experience and ideas.

If any of your readers would be interested, please could they contact me?

J. L. A. Cary
Venture Capital Report Ltd
2 The Mall
Clifton, Bristol BS8 4DR.

Unsung

THIS neat Basic game arrived without a covering letter but it should help while away the occasional wet evening:

```
10   REM NPBF11 SEQUENCE GAME.
20   PRINT "TYPE ME FIVE NUMBERS IN A SEQUENCE"
30   PRINT "I WILL GUESS THE SIXTH. EXAMPLE 2, 4, 6, 8, 10"
40   DIM X (10)
50   INPUT A, B, C, D, E
60   F=(0- (X(1) *2)) + (X(2) *5) + (0- (X(3) *2)) + (0- (X(4) *4)) +
(X(5) *4)
51   X(1) = A
52   X(2) = B
53   X(3) = C
54   X(4) = D
55   X(5) = E
70   PRINT A; B; C; D; E; "(";F;")"
80   PRINT TAB (23);" MY GUESS";" IS IT RIGHT?
     TYPE YES OR NO"
90   INPUT AS
100  IF A$ = "YES" THEN I 40
110  PRINT
120  PRINT "SORRY YOU ARE TOO CLEVER FOR ME
GOODBYE"
130  STOP
140  PRINT
150  PRINT "THAT WAS EASY"
160  PRINT
170  PRINT "DO YOU WANT ANOTHER GO? TYPE YES OR NO"
180  INPUT AS
190  IF AS = "NO" THEN I 30
200  PRINT
210  PRINT "TYPE ME ANOTHER SEQUENCE"
220  GOTO 50
65   PRINT
35   PRINT
230  END
```

B. H. Field
Fordingbridge, Hants.

Far and wide

HAVING just received a copy of the March, 1979 issue, I decided a personal subscription was essential. I especially enjoyed reading *Tandy Forum*. I have a TRS-80 Level II 16K microcomputer – believe it or not there are three such units in Tripoli.

I have a few comments and questions:

- Is it possible to have a series of articles on assembly language programming for the beginner?
- *Tandy Forum* refers to Optronics and J & J Electronics. For readers outside the U.K. an address or two would be helpful.
- Is an index available for Volume 1 of *Practical Computing?*

Dr Anthony P. Schmitt
Petroleum Research Centre
Tripoli, Libya.

● Having readers in Tripoli must be akin to success. We are considering authors for a series on assembly language programming which we would start in the Autumn. We are also computerising our index and will print a cumulative index soon. We take the point about addresses; in future we will give them.

Bewildered

HAS Commodore boobed? I refer to the new 16K Pet with large keyboard. Certainly I like the look of the machine, and the resident monitor is most useful for anyone in the machine code environment, although the manual I had with the unit didn't explain how to call Monitor.

I must thank my local supplier, HB Computers of Kettering, for help in finding the magical instruction which is SYS (64785) – and also for explaining that some of the Basic subroutines are different on the new models.

After finding that several programs written for the 8K Pets didn't work on the 16K, however, I looked closer at the memory map to find that most of the zero-page locations have been changed.

Perhaps Commodore was aiming for an improved ROM – but it has proved to be a disaster for me and, I suspect, other users. Any machine code programs which change various pointers in zero-page or programs which make use of free areas of zero-page will almost certainly go haywire. Microchess 2, for instance, does not work.

Another annoying fact is that the upper- and lower-case configuration has been changed. On the 8K models, a POKE 59468,/4 will change graphics into lower-case and leave the upper-case characters as they were, but on the new 16K model the same command causes graphics to become upper-case and the upper-case to become lower-case. A program containing lower-case output really looks odd on this machine.

If you are now suitably confused, join the club; I'm still bewildered and would look forward to any comments from Commodore.

V. A. Withnall
Rushden, Northamptonshire.

For new owners

I HAVE recently started a club for owners of SC/MP based machines like the Mk 14. Initially, the club consists of a circulating newsletter to which ideas and programs can be added by members.

For anyone who is interested, I would be glad to add names to the existing circulation list. The object of the newsletter is to help new owners to get to grips with their machine and provide a means of communication between members.

Geoff Philips
8 Poolsford Road
London NW9 6HP.

Suggestions

I WOULD like to suggest two additions to your magazine – a Hardware at Chip Level section for those who wish to build or modify their own computers, and a readers' advertisements section for those wishing to buy or sell computers, chips or software.

I have a personal interest in both of these since I have acquired for £10 a 16-bit minicomputer complete with high-speed optical paper tape reader but without keyboard, VDU, printer, or other human interfaces. There is one major snag – all the manuals are in Japanese, so I am thinking of taking out the CPU and replacing it with a micro (Z-80) but using the existing power supplies and memory – 12K x 16 bits = 24K x 8 bits of old-fashioned non-volatile core memory.

I have a Honeywell 8100 instrumentation tape deck which needs attention/rebuilding of the signal processing circuits. It is a ½in. wide tape, 10½in. NAB spool capacity, four-speed ($1\frac{7}{8}$, $3\frac{3}{4}$,15, 30 ips) eight-channel machine with fully working tape transport (three motors), but I haven't the time to do what is necessary.

If anyone would like to take it for the giveaway price of £60, including five tapes, I shall send a donation to *Practical Computing*. Two other damaged tape decks (three motors each) are also available for £15 the pair.

I enjoy the magazine and wish you well in your contribution to smashing the barriers of ignorance and fear about micros.

Finally, I would like to contact Jack Pike (Feedback, May) of Chawston, Bedfordshire about his Adventure II game and to inform him that I am working on a text-packing routine requiring two bytes per written word with automatic spacing and the facility to insert standard ASCII codes at any point in such text, except in mid-word.

John E. Foggitt
Stony Stratford
Milton Keynes, Bucks

Easy solution

IF SOME of your readers are, like myself, fellow Nascom users but are tired of waiting for Nascom to produce a decent-size Basic interpreter, as opposed to its Tiny Basic, they might be interested in an 8K Basic which I have found, available on tape, from my local computer shop – Crystal Electronics of Torquay.

Although not an ideal solution, it eats into RAM – the facilities of an 8K Basic, including extensive string handling and floating point maths, transforms Nascom to bring it on a par with Pet and/or Tandy TRS-80.

M. Dwyer
Malborough, Kingsbridge, Devon

Prepare for arrival of world's fastest eight-bit micro

INTEL is about to announce the 8088, the world's fastest eight-bit microprocessor. 'Fast' refers simply to the amount of work it can accomplish.

The point about the 8088 is that it combines some of the virtues of the Intel 16-bit chip set, the 8086, with many of the more desirable attributes of eight-bit Intel micros.

The 8086 has a 16-bit internal architecture – much faster internal operation than an eight-bit processor, full software compatibility with the 8086, and a clever instruction set which allows programs to be used with other eight-bit machines.

The 8088 can process eight- or 16-bit data in single, string, or block form; and 20-bit addressing means it can access directly up to one megabyte of memory. There are 24 addressing modes, which will ease the programmer's task and facilitate development of more efficient program code.

The 8088 contains many hardware arithmetic instructions but in addition to its number-crunching capabilities, there are many string operations specifically intended for alphanumerics – block moves, string comparisons, data scans, data translations. Internally, the 8088 looks well set-up for word processing and business equipment applications.

A 16-bit data bus has, in theory, twice the bandwith of an eight-bit bus; but, like the 8086, the 8088 has an 'instruction look-ahead' feature, an instruction queue which increases the efficient utilisation of the data bus. Throughout comparisons then become applications-dependent but Intel says that, typically, the eight-bit 8088 will manage 70 percent of the throughput of the 16-bit 8086.

Intel retained an eight-bit bus structure to maintain compatibility with existing hardware; an eight-bit board can be re-designed and upgraded without changing backplanes, connectors, memory structure, or peripheral controllers. A bus eight bits wide also offers savings in drivers, transceivers and board space. You can use the many multiple-function devices already available for the eight-bit family.

Despite the intellectual enthusiasm for 16-bit micros, there are many applications for which they are unnecessarily powerful – personal computing is probably one. On the other hand, it would be pleasant to have 16-bit throughput if you did not have to pay 16-bit prices and wait for the development of 16-bit support chips.

We expect to see the Intel 8088 appearing in many new products. ■

Over-the-counter market survey

THE Frost & Sullivan opus *The Over-the-Counter Computer Market* predicts an eight-fold growth in the business done by retail outlets, from $250 million in 1977 to $2 billion in 1985.

The researchers reckon that the so-called hobby shop will become the normal mode of distribution to end-users, although the hobbyist component among the customer base is about at its peak.

More growth is due from small business, the educational end, and other establishments; the big boom is forecast in the consumer sector.

This is how F&S sees the revenue split in percentage terms for the immediate future:

	1978	1981	1985
Establishments	66	48	55
Hobbyists	22	10	5
Consumer	12	42	40

Add-on purchases run from 1.5 times to twice the initial investment so there's an opportunity for peripheral makers. "Software is the crucial variable" in buying decisions, so there may be scope there, too.

F&S reckons that the average annual turnover of computer stores is about $255,000 now. Strategic Business Services agrees, more or less, with a 1977 figure at $220,000.

SBS isn't afraid to list the restricting factors, like capital limitations, geographic saturation, and the technological developments in distributed computing. It still estimates a 40 percent annual growth rate, to reach total revenues of $945 million by 1983. That's a little more pessimistic than Frost & Sullivan. ■

Infectious enthusiasm

ENTHUSIASM generated for the 6502 from the *6502 Program Exchange* is infectious, particularly if you possess a Sym, Kim, Pet, Apple ITT 2020, Jolt, or Ohio Scientific microcomputer.

The *Program Exchange* lives up to its name. The latest newsletter dwells at length on XPLO, a compiler language which outperformed the Ohio Scientific Basic dramatically in a 1977 *Kilobaud* test.

We like the look of XPLO because it has many of the virtues of Pascal – intermediate code, simple to understand the principles, highly structured format – without the disadvantages. It is easy to understand the code in XPLO – unlimited procedure names help, too – and in general it looks a friendly language.

Does anyone use it? If not, $50 buys a cassette and manual.

Other offerings from the Exchange include a kind of super-Focal called FCL-65 – a step up from Basic or Fortran. There is Tiny Basic, of course, for a bargain $10, and a good-looking *Experimenters Manual* for $15. There are several games and systems programs at bargain prices, including the classic Wumpus in machine language for Kim or Sym.

The 6502 Program Exchange is at 2920 Moana, Reno, NV89509, U.S. Contact the company before sending money. ■

Newsletter for Sorcerer

SUBSCRIPTION orders are being sought for what we understand to be the only independent user newsletter dedicated to the Exidy Sorcerer. The first issue will be available shortly. Its name is *Source* and its contents are promised to be items of general interest to Sorcerer owners, program listings, how-to-do-it articles, hardware and software reviews, and letters from readers.

The publisher is a Michigan firm which already produces *The Paper* for owners of the Commodore Pet, *Rainbow* (for Apple II owners) and *The Viper* (dedicated to the RCA Cosmac VIP).

"Our intention is to provide useful information at all levels of expertise," Aresco declares. "Many publications offer information incomprehensible to beginners and to intermediate level computerists.

"Aresco policy is that people have to start from the beginning and there's no place for them to obtain beginner-level information. Then the intermediate people are stuck, because the "hacker" information is too technical to be comprehended without an extensive knowledge of electronics machine language.

Orders for the *Source* should be sent to Aresco, PO Box 1142, Columbia MD 21044. Master Charge (Access) and Visa (Barclaycard) are accepted. Overseas subscriptions are $25 including airmail postage if desired.

Following our review of the Exidy Sorcerer in May, we hear that S Gimblett of HMS *Neptune*, Faslane, Helensburgh, Dumbartonshire G84 8HL is trying to start a U.K. user's group. Contact him if you want to participate. ■

All ship-shape and Bristol fashion for Image Data

BRISTOL seems rapidly to be becoming the Tottenham Court Road of the U.K. Image Data has opened a headquarters and manufacturing facility there.

The British-owned company will be manufacturing its Image Data Eight microcomputer and the facility is expected to create more than 100 jobs for electronic assemblers, all to be recruited locally.

The microcomputer was designed and produced originally as a development system for Image Data but it found market appeal, so the company decided to produce it in quantity and is increasing production from 20 to 100 systems a month.

It is built around a series of printed circuit boards and provides Motorola 6800 and Intel 8085 processors compatible with other PCBs in the bus system.

There are two systems accommodating six and 12 boards which offer 4K and 8K RAM, 1K increments of ROM, CRT, keyboard, Teletype I/O, cassette interfaces and line printer output. Maximum storage is 40K RAM and 24K ROM. A floppy disc board will follow.

The Image Data Eight houses the processor in a cage design which the company believes will appeal to the education market, where it can be sold as a construction kit. The end-user, OEM and "the high end of the hobbyist market" will provide the rest of the customer base.

Software includes 8K Basic, Editor and Assembler programs, resident monitor for all peripherals, and diagnostic support for cassettes. After-sales support is available with a 24-hour turnround of replacement boards.

Cost range is from £500 to £2,500, depending on peripherals and model size. Only a few PCBs are needed for a minimum system, and expansion does not enforce scrapping earlier investments.

The Image Data Eight is available only from Image Data at 1-4, Portland Square, Bristol, BS2 8RR. Tel 0272 40248/9. ■

Comart was neglected

OUR review of the North Star Horizon homed-in on one of the major U.K. dealers but neglected the other. Comart in Huntingdon has the Horizon; it also sells the Processor Technology Sol – reviewed in this issue – and the Cromemco range (the Z-2D was reviewed in February). ■

Comart offers nationwide maintenance cover by virtue of its contract with the specialist service organisation CFM. It also has nine distributors. ■

Motorola tests

FIRST successful tests on parts of the Motorola 64K RAM have been carried out at ICL. "The Motorola samples worked perfectly", said Bill Talbot, ICL technical director, who was described by a Motorola spokesman as "a hard man to please".

It looks as though Motorola will be first in the great 64K RAM race but industry pundits believe the device is not as far advanced as Motorola might suggest.

ICL admits that it will take some months before all checks have been carried out and it is totally satisfied with the product.

The Japanese firm, Hitachi, is likely to second-source M68000 microprocessor products. Hitachi will manufacture the range of products which the new processor will create.

The processor is of an advanced 16-bit design for high-level language implementation with 32-bit internal processing capability.

The second Motorola seminar, Microcomputer Forum – last year called Micro Forum until the Business Equipment Trade Association claimed copyright on the name, hence the change – took place last month at the Institution of Electrical Engineers, Savoy Place, London, and the focus of attention was the 6800 processor.

Five top Motorola men discussed all the latest microprocessors and memories, applications of the single chip 6801 microcomputer and the high-level 6809. ■

Converting I/O devices

PROLIFERATION of electric typewriters has for some time encouraged people to convert them for use as I/O devices on personal computers.

Now a U.S. company, Rochester Data, has a device, I/O Pak, which fits over a typewriter keyboard – you affix two mountings to hold it in place. The I/O Pak comprises a bank of solenoids mounted in an array which fits directly over the keyboard of the typewriter. Energising a specific solenoid causes a specific typewriter key to be depressed, thus printing a character.

Electrical actuation of the solenoid is done by self-contained drive electronics which operate in response to the selection of a pair of one-out-of-eight control lines.

The unit is claimed to operate virtually any electric typewriter with powered function keys with no mechanical modifications to the typewriter. All adjustments are self-contained in the I/O Pak, for which is claimed easy initial installation, "instant detachability and replacement", "modest power consumption and "high reliability".

The interface appears to be a six-bit parallel one, and naturally you, or your computer, have to provide some external timing.

The I/O Pak cost $395 from Rochester Data, 3100 Monroe Avenue, Rochester, NY 14618. ■

Pascal developed for SWTP 6800

THERE ARE many very clever and very enthusiastic micro-orientated people in the Netherlands. Some of them are part of Lucidata and they have developed a Pascal for the SWTP 6800.

By popular request, we are preparing an item on the pros and cons of Pascal as a high-level language; it does particularly well as an alternative to Basic, its advocates say.

For this one you need the SWTP system – or an equivalent M6800-based microcomputer – running the TSC FLEX 1.0 operating with a mini-floppy disc and 16KB (more memory means faster execution).

The run-time system interfaces with FLEX. It includes a paging facility which is invoked automatically if there is insufficient real memory for a large program.

In a 32KB system with dual floppy discs, Pascal programs can be compiled at more than 80 lines per minute according to Lucidata. With only 16K bytes, compilation is at 35 lines per minute under the paging mode. Programs are claimed to execute "tens of times faster" than with conventional interpreters.

Further details from Lucidata, Oosteinde 223, Vourburg 2271 EG (ZH), Netherlands. ■

Price list

RAPID RECALL has published a comprehensive price list which provides details of microcomputer, memory, analogue and data acquisition equipment from Digital Equipment Corporation, Intel, Intersil, Opto 22 and ITT.

The list is organised by product group rather than by manufacturer, which makes it easy for you to identify the system or component you might be seeking.

The price list is available at £1 from Rapid Recall, 6 Soho Mills, Wooburn Green, Bucks. If you buy something from Rapid Recall it is free. ■

AIM-65 only cheap built-in pri

WITH the introduction of higher-density memory components, a new group of single-board computers is emerging. They do not exactly constitute the method of operation, and designs are not so different from previous boards to justify this label.

The AIM-65, produced by Rockwell and available here from Pelco Electronics, is one of this group. Strangely enough, the newer systems, which include the Ohio Superboard II and the Synertek Sym 1, all use the 6502 microprocessor, as utilised in the Pet and Apple II.

Again, like the Ohio Superboard (reviewed in *Practical Computing*, June, 1979) the reputation of the AIM-65 precedes it to some extent. It has been hailed as "the best-engineered cheap 6502-based system".

Facilities

The AIM-65 is a single-board computer offering as the input device a 54-key alphanumeric keyboard in the standard QWERTY typewriter layout. Also on the board is a 20-character alphanumeric LED strip display and a column thermal printer.

The processor is the Rockwell 6502 running with a clock speed of 1MHz and an 8K monitor in ROM, plus 1KB of user RAM; the user memory is expandable on-board to 4K. An audio cassette interface programmable for two tape recording formats is also provided.

Setting-up

The AIM-65 is a fully-assembled unit. It requires only the connection of the keyboard to the computer board via a ribbon cable and i.c. 'headers' – they did not seem to be very robust and required careful handling.

For power, the AIM-65 requires a single 5V supply at two amps to work; but to have printer operation, a separate 24V supply at 2.5 amps is required, which is not very convenient.

In use

With the 5V supply attached, at switch-on the AIM-65 does a 'power-on re-set'. The display 'ROCKWELL AIM-65' appears momentarily on the LEDs, followed by 'PRINTER DOWN'. At that stage it is ready to accept commands via the keyboard or a Teletype – this is switch-selectable on the computer board.

The 54-key keyboard has a very good feel and because it is separate from the main board it can, in theory, be positioned for fast and comfortable typing. Because the connecting ribbon cable is very short, however, this is not so easy.

The 20-character alphanumeric display is clear in normal room lighting and the characters are easy to read, even if a few of them are a little contorted. The display uses 16-segment LEDs and for this reason is upper-case only.

Firmware

Two 4K-byte ROMs of the 2332 type contain the monitor and utility firmware. This monitor is very impressive. It does the usual display/change memory or registers, start execution and tape dump/load.

What makes the AIM-65 outstanding is its powerful debugging package. It allows the user to set up to four software breakpoints and under single-step operation – switch-selectable on the board – it can do an instruction trace and a register contents trace, with automatic disassem-

by Vincent Tseng

bly on the machine code into assembly instruction mnemonics, as the user program is stepped through.

There is also a program counter history command which lists the last four addresses executed. As it does this in the single-step mode and as both the instruction trace command Z and register trace V print the program counter address, it seems a little superfluous.

Entry of a program can be in mnemonics as there is a direct assembler. It makes life easier than entering machine hex code, although this is also available if you feel masochistic. Because it is a direct assembler, labels cannot be used; addresses, therefore, are absolute.

Text editor

To examine a program there is a disassembler, so that instructions can be displayed in the assembler mnemonics. As if all that was not enough, there is also a text editor with a reasonable set of commands. It allows the creation of text and message files, or it can cater for the preparation of assembler programs to use with the optional extra ROM assembler. The commands are limited but are certainly enough for use; there is a powerful 'find string' function, although operation will start only from the current line.

All this can make program preparation hard work – even though the commands worked at a fairly high level – if we were limited to the 20-character LED display. If you want to examine a program and have it disassembled for 10 instructions, the AIM-65 will do it, but the first nine of them will be flashed on to the display very quickly and only the tenth will be left in view.

To examine 10 instructions in a more leisurely manner you have to use the K command to disassemble and enter the hex address of the instruction; when the monitor returns with the prompt (a slash), you enter 01 for one instruction and repeat all this nine times.

So the AIM-65 really scores when the printer is operational, which means you hear that 24V power supply.

Printer

The 20-column thermal matrix printer uses a roll of 2 in. (50cm) wide paper. The print quality is good, and it can output at approximately 90 lines per minute.

Power consumption we metered was 0.05 amps when idle, peaking to approximately 0.25 amps during a print cycle. The meter may well have been slow in response but there's certainly a discrepancy between this and the Rockwell-specified power rating of 0.5A when idle and 2.5 amps.

Another point worth noting was that the 24V power supply used with the printer was limited by current on our system to 1A and at no time did it look distressed, even during a long print cycle. So the quoted power rating required for the printer may be something of an over-kill in the specifications, or perhaps Rockwell put the decimal point in the wrong place. Certainly a 24V 0.25 amp power supply is much more convenient than a 24V 25amp supply.

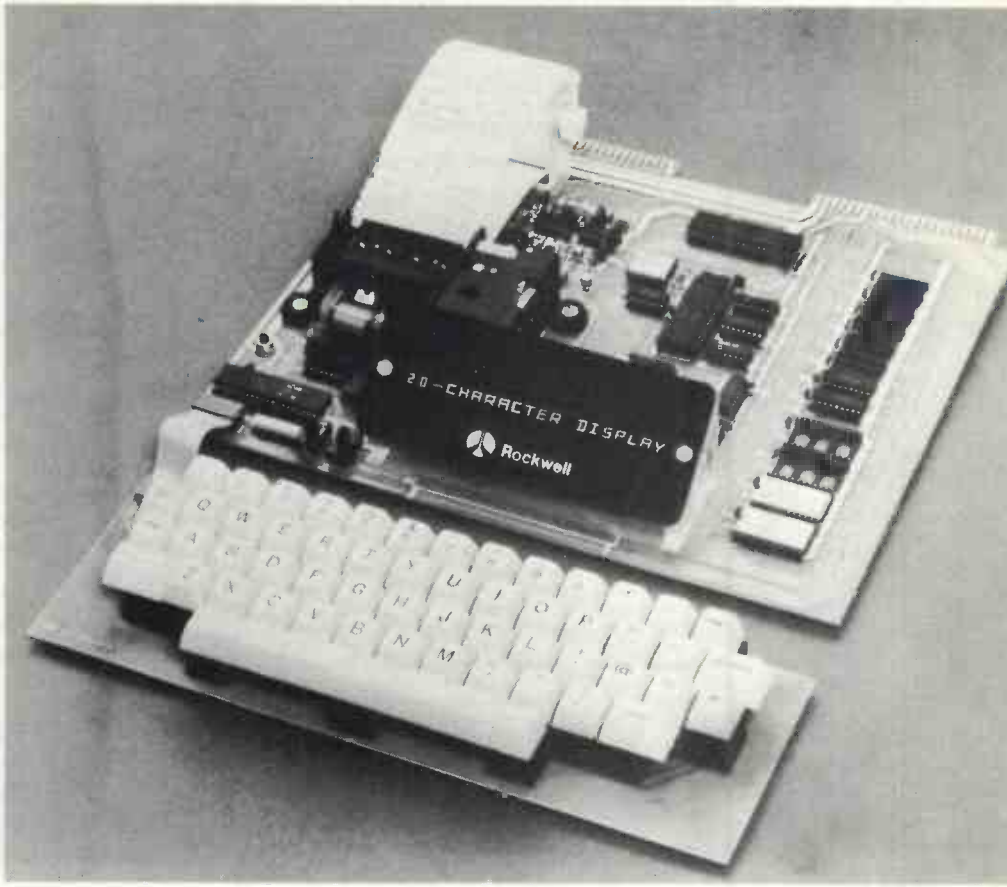
Paper loading

Paper loading is easy once you know how, but try to find out how in the users' guide and the roll seems to last and last.

One tends to forget how very useful it is to be able to refer back to what has been done – a printer allows you to do this. Messages and reminders can also be printed by involving the text editor – using a small buffer area if memory space is tight – editing and printing line by line.

The character set available to the printer is small and there is a wraparound. Our demonstration program of the printer output and character set also illustrates the use of the printer for printer comments and messages.

nicro with ter



Cassette interface

The audio cassette tape interface boasts two recording formats, one at a standard 1,200 baud and the other a Kim-1 compatible version. The tape recorder has to be connected via the board's 'application' edge connector J1 but sadly no edge connector socket was supplied on our kit, and it is not good practice to solder directly on to the board's edge connector gold-plated fingers. Your reviewer, fortunately, was able to commandeer an edge-connector socket from a Kim-1 and connected the AIM-65 to a cassette recorder.

The AIM-65 does not record and play back well with cassette recorders with automatic recording level controls. This restriction probably covers almost all the current cheap cassette units; it applied to ours, and we confirmed this with other users. Apparently, the AIM-65 needs a manual recording level to overcome the slow time response of the 'automatic level control' recorder.

Inconsistent

The setting-up procedure and 'Sync' program in Section 9 of the *Users' Manual* was tried. This could be set up – adjusting VR1 – so that almost the full range of the playback volume control was accepted by the 'Sync' program.

When data was recorded it was very inconsistent on loading and playback. Data recording was tried with both formats and various impedence-matching resistors were used, but all to no avail.

This was particularly disappointing because the AIM-65 has some file-handling capability we wanted to exercise. A user's file name can be given – up to five characters – and on playback the AIM-65 will search for the file name. At 1,200 baud, recording and playback for 256 bytes was fairly fast.

Two recorders

Remote start/stop controls are also available, so that two recorders can be used – one set to record, one for playback. This is suggested for use with the optional extra assembler in ROM. It is a pity it does not work well with cheap recorders.

The edge connector, incidentally, is the same as for the Kim-1 – a double-sided 44-pin connector with 4mm pitch.

There appears at first sight to be a fairly weighty documentation pack with the AIM-65, but the most useful and relevant ones are the *AIM-65 Users' Guide* of almost 500 pages, the 6500 programmers' reference card and the *AIM-65 Monitor Listings*.

The two other substantial books are reference manuals for the 6502 and not specifically for the AIM-65.

The *Users' Guide* has all the information, but it is not very well laid-out. For example, to try to find how to load printer paper from the index, you might reach page 1-14 by yourself; on it there are instructions on how to load the paper, but no diagram showing where the relevant parts are located. That is on pages 11–15 in the chapter covering troubleshooting, warranty and servicing.

Similarily for the cassette, Section 2.9 states: "We assume that the cassette recorder has been attached previously in position 1 *according to the instruction in section 9*".

There are, however, a few examples, but not enough programming examples, and a listing of a useful sub-monitor with many extra facilities, but it uses some 457 bytes; and as the available user's RAM area on a 1K model is only 512 bytes, memory expansion is needed for this to be useful.

Compensation

Overall, the documentation at least has all the relevant information but it is not easy to follow for a first-time user and is a headache for pure reference usage.

It's a pity we were not able to test the AIM-65 with the Basic-in-ROM option because this would have taken the programming to a quicker, higher level.

Ideally, we would prefer to have a TV interface as well, but the printer compensates to some extent for this.

It has been claimed that the AIM-65 is hardware-compatible with the Kim-1 – and therefore the Synertek Sym-1, too. This could mean that a TV interface available for the Kim-1 could be used with the AIM-65 but it is expensive and the software interfacing would be tedious.

The Kim-1 tape format is not that useful, either, because many of the better Kim programs use subroutines in the Kim-1 ROM monitor which is obviously different from the AIM.

Conclusions

●This is the only cheap microcomputer with its own built-in printer. It is a worthwhile microcomputer offering the right types of facilities. As it stands it could do with more RAM (expandable on board); then it becomes a reasonably useful tool to learn assembler programming for the 6502.

●With the Basic, which was not tested, it is certainly worth consideration for home use. The cassette interface could be improved to work with cheap recorders and the manuals could be made more readable, but the AIM-65 is a very pleasant system. ■

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Other games in preparation include Horse Race, Explore, Bagels × 2, Nim etc.

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GENPACKS 1–4 A package of four programs on individual cassettes, with full documentation, designed for the small businessman. Together they calculate the VAT, and store results on files, a customer list, cash-flow, debtor/creditor list, and other statistical information. £55 for 4 programs, or £15 each.

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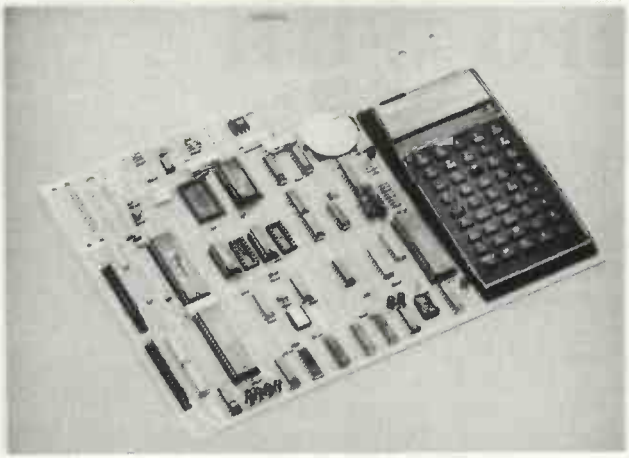

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Robust SOL-20 becomes competitive for the small business user

THE SOL-20 terminal computer is manufactured by Processor Technology Corporation of California and has been around for some three years. In the U.K. it is available from Comart, whose nine distributors include The Byte Shop, which loaned us the review system.

The system is built around an Intel 8080 microprocessor, with up to 64K bytes of user RAM, 1KB of system scratchpad RAM, another 1KB RAM for the display, and 2K bytes of ROM used for what Processor Technology calls a 'personality module', or monitor.

Personality module

The personality module supplied with our SOL was the SOLUS operating system. It allows the use of a bootstrap disc loader and can run SOL as a stand-alone system. Also available are a cassette-based version and a third alternative for user-programmed ROM applications.

The SOL resembles an enlarged keyboard unit, minus the display but provided with wooden side panels – they look not unlike teak. The keyboard is a standard QWERTY layout with a separate numeric pad. Built into the side panels are two carrying handles but the

by Jim Wood

unit is still fairly bulky; it is large enough for a display monitor to stand on and it contains a large power supply and a fan.

Interfaces are provided for video output, dual audio cassettes, an eight-bit parallel I/0 port, and an RS-232 serial interface. Both parallel and serial ports are 25-pin D-type sockets, the parallel one male and the serial female. All are located at the rear of the unit, easily accessible and marked clearly.

The back of the cabinet also contains a commendably large on/off switch, the small but clearly adequate fan, a power plug socket – it certainly helped being able to unplug the lead at both ends when moving the SOL – and a socket for the video monitor.

Keyboard

Despite the general air of substance and size of the SOL, the keyboard is a little cramped in its layout. The space bar is not separated but has cursor control keys on either side. The RETURN key is about half the normal size one would expect; it, too, is unfortunately surrounded by keys. It does not protrude enough and it is placed next to the @ key. In the SOLBasic this key has the effect of scratching the line being entered. Hitting it accidentally instead of RETURN happens far too often.

To balance those criticisms there are many good points about the keyboard. For instance, three colours are used to distinguish between the normal alphanumeric keys, the controls, and special keys. The keys to switch on-line/local, upper/lower-case and shift lock each have a small red light which shows when the key is depressed and locked.

(continued on next page)

(continued from previous page)
This is particularly helpful; so is the provision of a separate upper/lower-case key instead of having to use the more common shift operation.

Easy access

Including upper- and lower-case, the keyboard offers 85 standard characters. By the use of the control key, a further 36 Pet-style graphics characters are available.

The cover of the SOL is easy to remove. You slacken two butterfly nuts at the rear and lift the two dove-tailed sections clear. The S-100 bus and the plug-in printed circuit boards are simple to reach; the 22 internal control switches are within the reach of a not over-long fingernail. These switches determine the mode of operation, allowing changes to baud rate, display of control characters, solid or blinking cursor, and normal or inverse video.

Display

The monitor provided by Byte Shop with our SOL was a Sanyo Super 12 portable monochrome TV. It proved to be a rather cheap attachment to a system which otherwise qualifies as more expensive than most. The connectors benefitted frequently from judicious wiggling to find the best quality of display.

The characters are reasonably large, the level of contrast defining the clarity, but they tended to run into each other. The cursor may be selected as solid or blinking; and the inverse video certainly worked, though with the right-hand side of the characters tending to drift back to normal video.

Fourteen lines of 62 characters are allowed on the monitor. Lower-case characters have true descenders and there is a rub-out key to remove characters from the screen. A cover is also supplied to keep dust from the screen.

Manuals

The documentation supplied with the system was extensive and of high quality. The most important item was the *Systems Manual*. It contains easy-to-follow and well-structured sections covering almost everything the SOL user would require to know about the computer.

There is information on construction, hardware set-up, peripheral connections, wiring diagrams, hardware and software definitions and explanations – even an introductory letter to the (American) SOL users' society. The style is easy to follow and in general the contents are concise and to the point.

The manual we were given for the Basic was the *Users' Guide to North Star Basic* – SOLBasic is almost exactly the same as North Star Basic. It is sold separately and we are reviewing it separately. SOL is not the only computer which can attach North Star discs but the initial impression is that this is a well-written guide to a disc-based Basic.

Prices

These prices were quoted by the Byte Shop, which supplied the test system. All prices are exclusive of VAT.

Hardware	
SOL with 16KB	£1,785
SOL with 32KB	£2,060
SOL with 64KB	£2,610
12in. display monitor included in basic price	
North Star mini-floppy drive (80 or 160KB)	£635
Dual drives	£1,060
Hyterm 1610 printer	£2,220
Hyterm 1620 keyboard/printer	£2,400
Centronics printers	£950 upwards
Software	
SOL disc Basic	Included in the basic price
CP/M disc Basic	£150
Disc Word Processor (Electronic Pencil)	£135
APL	Not quoted
Cassette	
Extended cassette Basic	£35
Basic 5	£20
Focal	£25
ALS-8 (Assembly language)	Not quoted

More systems

A number of cassettes and manuals for FOCAL, Extended Cassette Basic and Basic 5 were provided. We could not attach a cassette recorder – we didn't have the proper leads – but we intend to review them at a later date. A cassette-based assembly language, ALS-8, is also available.

Two further disc-based systems are available – CP/M disc BASIC and a version of APL; we had neither for review but any readers with opinions on them are invited to send us a critique.

A single North Star mini-floppy disc drive and a Diablo printer were also supplied with our system. That occasions further criticisms. The on/off switch on the disc drive is not labelled and caused some confusion when switching-on; and we were unable to deduce how to send something to a printer from a SOLBasic program – the *Users' Guide* makes no mention of external printing.

Plus points

Points we liked about the Basic, a 16K version, were:

- string arrays with substrings.
- support for both sequential and random files.
- multiple statement lines.
- string length restricted only by the available memory size.
- a reasonable line editor, based on the use of control keys.
- a line number range up to 65535, with automatic line numbering available along with a simple re-numbering facility.

The Basic is straightforward to use and is definitely helped by the *Users' Guide*, which takes a humane step-by-step ap-

proach to mastering the system, but we have some criticisms:

- there is no PRINT USING statement.
- lack of printer addressing.
- not all errors are notified to the user – using a string variable with a length greater than that defined will cause the disappearance of the extra offending characters.
- Accuracy is limited to eight digits, although the range for a variable is $\pm 10^{62}$.

One pressing criticism of the Basic is that it is fairly slow. A standard simple benchmark, the loop FOR 1=1 TO 1000/ NEXT 1, takes 2.4 seconds; that is about the same as our Tandy TRS-80 and seems on the slow side for a considerably more expensive system.

Expansion

A less important and less annoying attribute is the necessity to drop into the operating system to create disc files; you cannot do this from Basic.

The SOL scores well when expansion is considered. Memory may be grown to 64KB – our system had 32KB – and up to four mini-floppy disc drives and two cassette units may be attached. As the system utilises the S-100 bus, there are several compatible devices which can be used. The basic system contains space for five expansion modules.

Conclusions

● SOL is well made and seems robust. The quiet back fan keeps it cool and there is much to be said for using standard technology (S-100 bus). There is a wide range of software, both cassette and disc-based. The 'personality module' is another plus.

● For an expensive personal computer system – £2,700 plus for the basic 32KB configuration and disc drive – the standard of monitor we tested is rather poor. That could easily be altered, of course.

● More important, the keyboard could certainly benefit from a redesign of the layout.

● Standard basic is easy to use, though we bemoan the lack of PRINT USING and an easy access to the printer. The *User Guide* we saw is good and in general the standard of the Processor Technology documentation is excellent, both for a reference user and the beginner.

● At the price, the SOL is moving out of the personal computer market and so must be aimed at the small commercial business user. There its price begins to appear reasonably competitive. In this context, being able to have four disc drives on-line is an advantage and while the Byte Shop doesn't offer 8in. floppies, someone else must do so.

● Even so, the SOL works with dual-density mini-floppies and so can access a minimum of 640,000 bytes of storage.

Practical Computing evaluation

	Yes/No NA	1	2	3	4	5
Ease of construction (where applicable)	NA					
Quality of documentation						✓
Dealer support/maintenance				✓		
Can handle 32K of memory	Y					
Quality of video monitor (consider resolution and screen size)			✓			
SS-50 Bus	N					
S-100 Bus	Y					
Sockets for chips	N					
Numeric, calculator-type pad on keyboard	Y					
Large amount of removable memory, randomly accessible	Y					
Cassette tape recorder capability: Own	N					
Built-in recorder	N					
Floppy disc capability	Y					
Communications capability (can talk to other computers)	Y					
Speed of instruction cycle	2mHz					
Ease of expansion					✓	
Lower power consumption					✓	

	Yes/No N/A	1	2	3	4	5
Assembly language				✓		
Basic language					✓	
Other languages	Y					
Compatiblity with other systems					✓	
Reputation of manufacturer				✓		
Appearance			✓			
Portability			✓			
No. of software applications packages available				✓		
Hobby use			✓			
Business use					✓	
Educational use					✓	
Suitability for: Commercial applications					✓	
Home applications					✓	
Educational applications					✓	
Ability to add printer(s)	Y					
Ability to add discs	Y					
Ability to add other manufacturers' plug-in memory				✓		

Ratings
1 = poor; 2 = fair; 3 = average; 4 = good; 5 = excellent. N/A = not applicable.

How to decide o file organisation

Mike Collier's introduction to systems analysis for the small computer user in business now looks at records and files.

HAVING carefully studied and, it is hoped, understood the requirements of the system being designed, the next step is to decide whether it is worthwhile maintaining a file for each type of information. If so, then we must also decide on the most suitable method of file organisation to use.

In small business systems the two files found most commonly are the product or item file and the customer file. The former will hold all the details of each item stocked or sold – part number, description, price, quantity in stock – and the latter the details of each of the customers or potential customers – address, terms of business.

Other files often will be necessary but all my comments relating to those two can be applied to any file of data.

For an order entry and invoicing system both a product file and a customer file may be needed but, we must not assume automatically that they must exist. A mail order company may have many customers, each one ordering once only with a very low likelihood of repeat business, so in that instance it would be better not to have a customer file but to type-in the customer details with each order.

Besides, it is unlikely that a small, floppy disc-based computer could handle the large volume of data required to create such a customer file – a reasonable size of file to consider handling would have a few hundred customer records rather than a few thousand.

Two approaches

Similarily, a business dealing in specialised, custom-designed products may well not justify the creation and maintenance of a product file. Anyway, for the purposes of this article it is assumed that both a customer file and a product file are needed and that, in addition, each transaction will be recorded for subsequent processing to produce accounting information.

On most small computers with floppy disc of one form or another there will be two possible approaches – sequential or direct files. The choice between them usually will be clear since sequential files, as the name implies, can be written to or read from only by starting at the first record on the file and then progressing to the next and so on.

This is obviously useless if we want rapid access to a particular record – even 10 seconds is a long time to wait when you are sitting in front of a computer terminal with fingers poised for the next entry.

If several hundred records have to be read before the correct one is found the delay could be an order of magnitude greater. Our transaction file would fit well on to a sequential file, though; it will be processed by the accounting program only in the same order in which it was written, so there will be no problem in finding records.

Both customer and product files need to be organised so that any record can be found with minimum delay. Direct files allow this and are simple in concept; the problems lie in the ways in which direct files can be used.

Stated simply, a direct file access method requires to be given a record number and will return with the contents of that record. The format of the Basic statement to do this will differ from machine but will probably be of the following form:

```
GET N,R,A£    to read from the file
PUT N,R,A£    to write to the file
```

where N is the file number and R is the record number and the contents of the string variable A£ are either read from or written to the record.

The required record can thus be found given its record number, but this is not a complete solution – the record number still has to be found. The user of the system cannot be expected to know the record number of each part or customer and to enter it each time access to a direct file is required.

As you will have read in last month's article, it is unrealistic to expect the person entering data to know any more than the part number or customer code to which he has always been accustomed. What has to be devised is some way of converting, within the computer, the part number into a record number on the product file and the customer code into a record number on the customer file.

There are several possible approaches to performing this conversion, which to choose depends on the circumstances and the size of the file. For reasonably small files – 200 to 300 records – perhaps the best approach is to maintain a 'key table'. That is a list of the cross-references between the 'key' – the part number or customer code – of each record and the record number at which the associated information is stored.

Key table

The 'key table' can be stored on disc either as a separate file or as part of the main data file to which it refers – see "record types" in the next instalment. If each part number is six characters long and the record number three characters, each key table entry will be nine characters, and 14 pairs can be stored on a 128-byte record. The entire key table for a file of 280 products will thus occupy 20 records. To find any record will require an average of 10 GETs to find the correct key table entry and one more to read the record from the data file. That is almost the maximum number of GETs which can be tolerated, so for larger files another approach has to be found. For small files this approach is simple to use and simple to program and does not require any sorting of the data file or the key table.

Larger files require a more complex method to keep down response times. If sufficient memory is available the key table could be resident (i.e. in memory). It is important, however, that whenever a new record is inserted, the revised key table should be written on to the disc file; otherwise the location of the added record could be lost in the event of any form of program or mains power failure.

If the simple approach cannot cope with the volume, or if very fast file access times are necessary, there are ways of sophisticating the method. For example, the key table could be held sorted. That would allow a form of binary search to be used on the key table records – i.e., read the middle record, if the required key is below then read the middle record of the lower half, and so on.

Alternative

Alternatively an index of the key table records could be maintained in memory, holding the first key on each key table record. With this method only two GETs will be necessary, one to find the key table record and one to find the record on the data file.

To pay for this efficiency it will be necessary to insert new keys into the table in the correct sequence and re-write any key table records affected by the change – figure 1 illustrates this method.

There is clearly more effort required of the programmer to achieve an efficient technique for reading and writing direct files. In fact, the ultimate extension of the key table approach is sometimes available as proprietary software and is called Indexed Sequential file access – this is the method often used on large computers.

One matter to be resolved is how to

n suitable method

delete records no longer required. It would take too long to shuffle all the records following the deleted one to fill the vacant space while the user is sitting waiting at the computer. It is much easier and quicker to allocate a particular field on each record which can contain a deletion marker.

To delete a record, all that is necessary is to enter a defined value into this field. A special program can then be written to go through the whole file sequentially, dispensing with all records flagged for deletion, printing them out for archiving and shuffling subsequent records to fill the spaces left.

This program would also re-create the key table records and would serve the additional purpose of being able to re-constitute the key table should any error in processing or in the disc drive cause corruption of the file.

A different approach which avoids any need for a key table is that of using a Randomising Algorithm. This complicated-sounding title means using some mathematical rule to convert the key into a record number. Let us consider the requirements of such a rule:

- Application of the rule to any particular key must always yield the same record number.
- Even though the distribution of values for the keys may not be even over the range of possible values, the record numbers must be spread evenly throughout the file to minimise space on the disc.
- Ideally, no two keys should yield the same record number; this is virtually impossible to achieve and there are ways to circumvent it but the possibility of such occurrences should at least be minimised.

Fastest method

The procedure to be described may appear somewhat complex but it can be programmed in only a few lines and is often the fastest method of finding the required record.

The first step is to convert the (probably) alphanumeric key into a pure numerical value. There are many ways of doing this and the method described here is not necessarily the best but it works and it is simple.

Each character of the key is taken in turn and its ASCII value found; the total of all these ASCII values is then the numeric value sought.

```
10  T=0
20  L=LEN(KEY£)
30  FOR I=1 TO L
40  T=T+ASC(MID£(KEY£,I,1))
50  NEXT I
```

This routine will, of course, produce the same value of T for two keys which have the same characters but in a different sequence. To improve matters, line 40 could be changed to:

```
40  T=T+I*ASC(MID£(KEY£,I,1))
```

thus giving different weightings to each character of the key.

Having derived a numeric value it must be modified if it is to become a valid record number which is equally likely to be any value between 1 and the number of records in the file. The 'equally likely' part is to ensure that the whole file space is used rather than having the first half full and the last half empty, since it will become clear that the efficiency of this technique depends on there being only a small probability of more than one key giving the same record number.

The best way to achieve this is to ensure that the whole file space is used. The RND function will give a random value which can be modified easily to give a random value between 1 and N and, what is more, it does so in a predictable way.

Repeatable

Different Basic interpreters have different ways of using the RND function, but most require that it be given a starting value from which to generate its stream of pseudo-random numbers. By using the value of T as obtained for the starting value, the number produced by RND will have the required attributes of being repeatable and of being equally likely to be anywhere within the prescribed range. Thus:

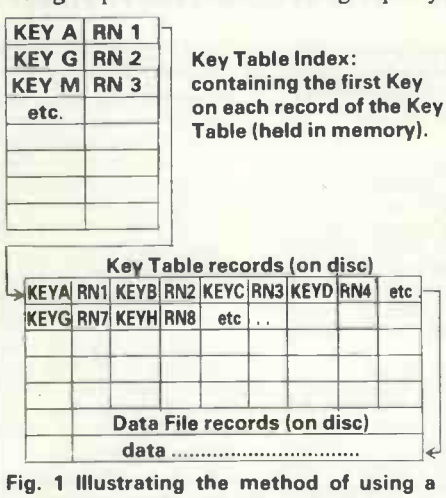


Fig. 1 Illustrating the method of using a Key Table together with Key Table Index to find the data relating to KEYD

```
60  X=RND(-T)
70  X=RND(T)*NREC+1
        (Microsoft BASIC on the SORCERER)
```

NREC is the number of records on the file.

On any other machine the statements may be different but the Sorcerer initialises the random number stream by calling RND with a negative argument.

X is then the record number where we would like to store this particular item of data. It has been found with only six lines of program and without the need to read disc files. There is, however, one further step which must be carried-out before storing the data there. It is possible that some other key has been entered previously which happened to generate the same record number, so it is necessary to check that the record is not already occupied.

That could be a simple test that the key field on the record is equal to all blanks – any other value signifying that the record has been used previously. If it has, there is no problem; try the next record on the file, and so on, until a vacant one is found.

To retrieve a record, exactly the same calculations are performed and when the record number is found the key field is tested to see if it is the one required. If not, the next record is checked, and so on, until the correct key is found or a key of all blanks is found – signifying an unoccupied record.

In the latter case it is clear that the requested key cannot be on file, since if it was it would have been stored in that vacant slot.

To find the record in which to store a new item, the following program can be used:

```
 80  GET N,X,A£
 90  IF LEFT£(A£,6)= "      " THEN 130
100  X=X+1
110  IF X>NREC THEN X=1
120  GOTO 90
130  REM VACANT RECORD FOUND (=X)
```

and to read the file to find the record with the key of KEY£:

```
 80  GET N,X,A£
 90  IF LEFT£(A£,6)=KEY£ THEN 150
100  IF LEFT£(A£,6)= "      " THEN 1000
110  X=X+1
120  IF X>NREC THEN X=1
130  GOTO 90
150  REM FOUND THE RECORD

1000 REM NOT ON FILE
```

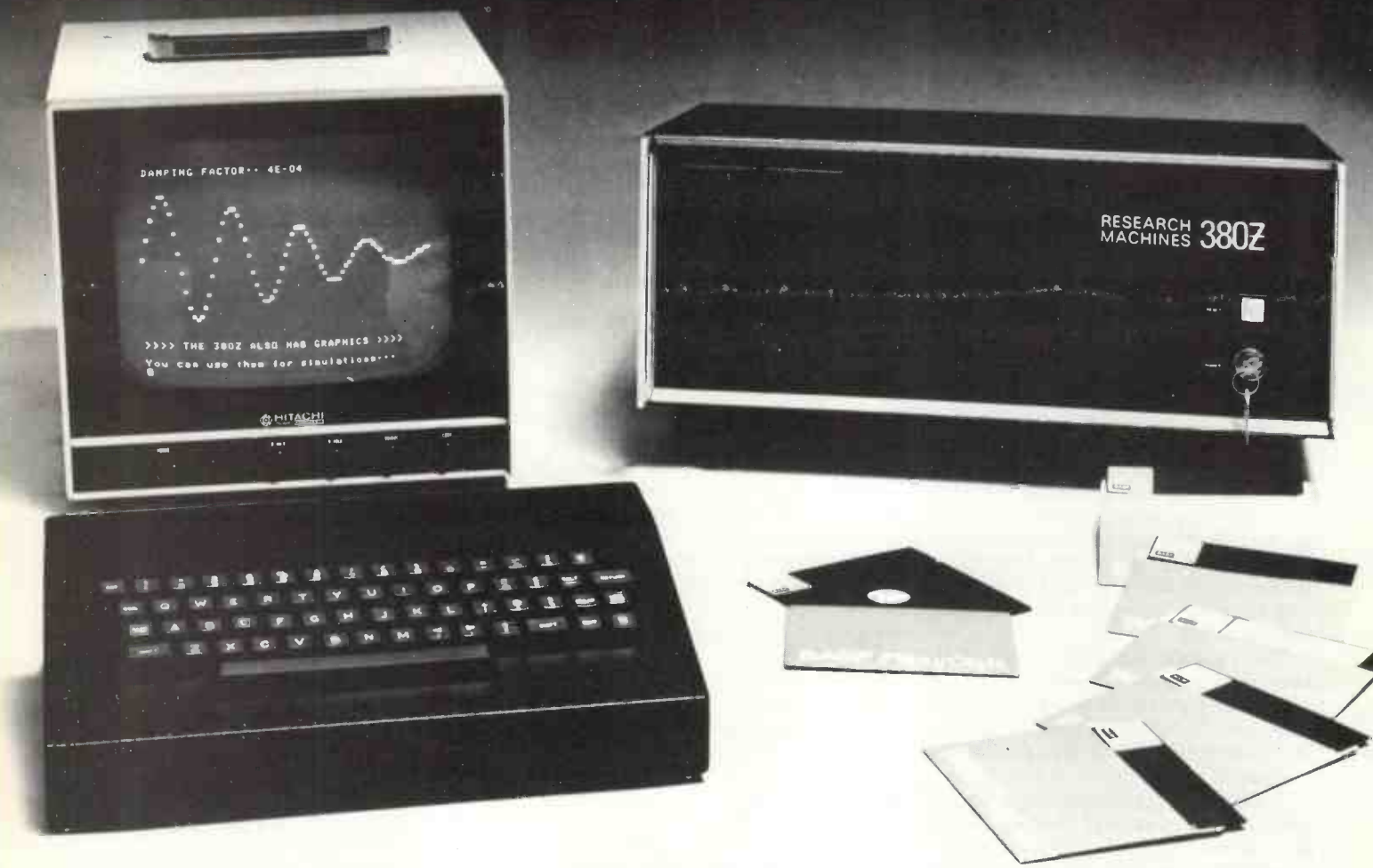
The great advantage of this method is that neither key table nor file look-ups are needed. Most accesses will need only one file read, provided a reasonable amount of slack has been allowed in setting-up the file size.

Twenty percent would be a reasonable figure so that if 1,000 records is estimated as the maximum to be stored, the file should be given 1,200. As the file fills the number of reads will increase, so it may be necessary to write a program to extend the file.

That program will restore every record in a new record number since the algorithm with the new value of NREC will give new record numbers for each key.

I hope this rather technical chapter has not deterred you – it sounds more difficult than it really is. Next time I will be looking at the various items of data which can be held on files and at the relevant items of hardware and software which can affect small business systems. ■

THE EXPANDABLE GENERAL-PURPOSE MICROCOMPUTER



THE RESEARCH MACHINES 380Z

A UNIQUE TOOL FOR RESEARCH AND EDUCATION

Microcomputers are extremely good value. The outright purchase price of a 380Z installation with dual mini floppy disk drives, digital I/O and a real-time clock, is about the same as the annual maintenance cost of a typical laboratory minicomputer. It is worth thinking about!

The RESEARCH MACHINES 380Z is an excellent microcomputer for on-line data logging and control. In university departments in general, it is also a very attractive alternative to a central mainframe. Having your own 380Z means an end to fighting the central operating system, immediate feedback of program bugs, no more queueing and a virtually unlimited computing budget. You can program in interactive BASIC or run very large programs using our unique Text Editor with a 380Z FORTRAN Compiler. If you already have a minicomputer, you can use your 380Z with a floppy disk system for data capture.

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WHAT OTHER FEATURES SET THE 380Z APART?

The 380Z with its professional keyboard is robust, hardwearing equipment that will endure continual handling for years. It has an integral VDU interface—just plug a black and white television into the system in order to provide a display unit—you do not need to buy a separate terminal. The integral VDU interface gives you upper *and* lower case characters and low resolution graphics. Text and graphics can be mixed *anywhere* on the screen. The 380Z also has an integral cassette interface, software and hardware, which uses *named* cassette files for both program and data storage. This means that it is easy to store more than one program per cassette.

Owners of a 380Z microcomputer can upgrade their system to include floppy (standard or mini) disk storage and take full advantage of a unique occurrence in the history of computing—the CP/M™* industry standard disk operating system. The 380Z uses an 8080 family microprocessor—the Z80—and this has enabled us to use CP/M. This means that the 380Z user has access to a growing body of CP/M base-software, supplied from many independent sources.

380Z mini floppy disk systems are available with the drives mounted in the computer case itself, presenting a compact and tidy installation. The FDS-2 standard floppy disk system uses double-sided disk drives, providing 1 Megabyte of on-line storage.

Versions of BASIC are available with the 380Z which automatically provide controlled cassette data files, allow programs to be loaded from paper tape, mark sense card readers or from a mainframe. A disk BASIC is also available with serial and random access to disk files. Most BASICs are available in erasable ROM which will allow for periodic updating.

If you already have a teletype, the 380Z can use this for hard copy or for paper tape input. Alternatively, you can purchase a low cost 380Z compatible printer for under £300, or choose from a range of higher performance printers.

*CP/M™ Registered trademark Digital Research.

380Z/16K System with Keyboard **£965.00**
380Z/56K complete with **DUAL FULL FLOPPY DISK SYSTEM** FDS-2 **£3,266.00**

380Z Computer Systems are distributed by RESEARCH MACHINES, P.O. Box 75, Chapel Street, Oxford. Telephone: OXFORD (0865) 49792. Please send for the 380Z information Leaflet. Prices do not include VAT @ 8% or Carriage

● **Circle No. 159**

Something for everyone

LAST MONTH we surveyed what you can and cannot expect from word processing on a microcomputer. Part two of our review looks at some of the specific products offered for the micro. Some are off-the-shelf applications packages; some are software systems from the hardware vendor. The price range is from £15 for a Pet cassette to more than £300 for a fully-fledged disc word processor. There must be something here for everyone.

Apple II: Word Processor

Cassette systems. Available from Keen Computers. Price: £50.

KEEN COMPUTERS, one of the more active U.K. dealers with the Apple II, is at pains to point out the limitations of this package. For a start, it is intended for writing standard letters – they are typed-in, stored on tape, recalled and amended as required, with new lines and variable information added to personalise them, and then printed.

Commands include insert, delete and change lines; search and replace for specified strings; and line centring. You have to specify approximately how many lines you expect to enter before you start keying, and specific omissions include insert and delete for individual words, left and right justification, and document assembly from standard assembly.

Keen says they will all be featured in a Mark II version which should be available towards the end of the year.

Commodore Pet: MEDIT

Cassette system. Available from Petsoft. Price: £15.

THIS alternative to the CMC word processor in the Petsoft catalogue also has a very good user manual. The introduction makes no bones about the matter: "MEDIT is a very simple and basic editor, designed to run on an 8K Pet with a single cassette". Editing data requires plenty of time and much juggling of cassettes.

MEDIT leaves about 3K in a small Pet and to allow for merging and inserts your cassette files must be less than 1,500 bytes.

You have a total of 18 commands, including those to open and close files. You can read in and store specified members of lines and part of a line, inserting and deleting simply as required. There are no print format facilities and no search and replace functions.

Commodore Pet: CMC Word Processor

Cassette system. Available in the U.K. from Petsoft at £25; also available through Kingston Computers.

CMC in this context is a software house called Connecticut Micro Computer and though this package saw the light of day only this year it already has acquired a good reputation. For a start it has very good documentation considering it is a low-cost cassette.

You can delete and insert lines, edit within a line, replace one line with another, and move text blocks around. There is no automatic search and replace facility, though. Files may be saved and merged; the left margin can be adjusted for indentation but there is no right-justification. Other print directives set the line length and spacing, and centre headings.

CMC wrote the system for an 8K Pet but that leaves space for only 2,000 characters of text – about 100 lines. You will have to print or save one section before starting another. You might find extra memory handy, and a better keyboard is almost essential.

Petsoft has a version for RS232 printers and direct connections to the IEEE port. We are told a floppy disc version is on the way – price about £30.

Commodore Pet: Word Processor

Cassette system. Available from Costed Automation. Price: £125 (plus software support contract at £125).

THIS is not a load-and-go word processor like most Pet software. Costed says it will have to be "installed" by its own staff, who will also modify print output parameters – such as line length – to suit the printer you have. The price includes training for one person.

Training is essential, because there is no manual for the system. Costed declares that it is "very easy to understand and use" but it "becomes cloudy if on-site training is not given".

The command includes text entry; listing, deletion, inserts and amendment; and saving on to and reading from cassette – there is no disc version. Output formatting commands allow you to define new paragraph, new line, tab positions, and standard parameters for characters per line, line spacing, lines per page, and the position of the left-hand margin. Text can be centred, and indented.

There appears to be no search facility and no right-hand margin functions, like justification and coping with widow lines. The only printers acceptable are those which connect to the Pet IEEE interface.

Compucorp 600: TEXT/ ONE

Disc system. Available from Compucorp and its distributors. Price: £1,000.

THE Compucorp 600 is a family of desk-top computers starting at about £4,500. The systems combine screen, keyboard and floppy discs in one unit with a printer separate.

TEXT/ONE promises to be "more comprehensive in operation yet simpler to operate than systems costing much more and accomplishing much less". Functions include addition or deletion of characters, words or lines: block movement of paragraphs, pages and other sections of text; and document assembly from standard paragraphs.

The search-and-replace facility is good and there is a useful mailing list capability which is rare on microcomputers – with it you can insert variable information in standard letters automatically, and the system can select exactly which choice of several options will go in as the variable text.

A significant aspect of this system is the use of single keystrokes for WP functions; there are about 60 of them. The Compucorp 600 has a row of special keys on the keyboard, the functions varying according to what software is running word processing operations. Compucorp provides a strip of key labels to tell you what the keys mean.

CP/M systems: WORD-MASTER

Disc system. Available from several U.K. sources. Price: about £95.

CP/M is a popular operating system now available as standard or an option on many personal computers. Those we know of include Rair Black Box, Exidy Sorcerer, TEI, Cromemco (CDOS is a variant), North Star Horizon, Pertec PCC 2000 and Compelec Series/1, and the Computer Centre disc systems.

Compelec, incidentally, sells WORD-MASTER integrated with the MicroPro mailing list system on both its computers (2000 and Series/1) for £250.

MicroPro is the Californian software house which developed WORD-MASTER. It has a full set of edit commands you can move the cursor left or right by one character, which is normal, or by one word, which is most unusual; you can go to either end of the line or the screen, and you can move the whole file up or down on the screen. Lines, words and characters can be inserted or deleted left or right.

The command mode is equally impressive; it provides for manipulation of stored text. It gives a good variety of search-and-replace options, including a loop facility, so that after a search failure the program can go for some alternative search parameters.

WORD-MASTER has some fairly powerful file management facilities, too; automatic back-up and re-start – the original file is preserved; automatic paging and buffering – to manage the transfer of information between disc and memory; copying and saving any or all of specific text files as required; retrieval

(continued on page 49)

All Systems Are Not Created Equal

Your computer application is unique. It differs from all others. It is because not all applications are equal that MSI has developed a variety of computer systems.

At the heart of every MSI System is the powerful MSI 6800 Computer, one of the fastest and most versatile available. Depending on the System you select, the MSI 6800 has from 16K to 56K of RAM. Mass memory storage in MSI Systems range from 315K bytes in the System 1 to over 10 megabytes in our most powerful System 12.

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● **Circle No. 160**

As with hardware, computer software is not always created equal. Since there are a myriad of programs available, MSI offers a choice of Operating Systems for use with your MSI Computer System. Of course, our favorite is MSIDOS, but we offer the powerful SDOS operating system as well. All MSI Systems will support the other software products associated with each operating system.

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MSI Systems are currently being used in a broad spectrum of personal, scientific, educational, professional and business situations. In addition to our Systems, we can supply you with individual components for personal and OEM use. All MSI System components are available, some in kit form.

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(continued from page 47)
and merging of files or parts of files in any sequence.

The only obvious weaknesses are in the lack of output formatting facilities.

North Star Horizon: AUTOSCRIBE

Disc system. Available from Equinox and its distributors. Price: £395.
AUTOSCRIBE is from a respected Arizona software house, Microsource. It was developed originally by a lawyer and its bias appears to be towards the creation of documents from a library of standard paragraphs; we have not seen a users' manual.

It appears to require a 32K Horizon system, storing up to 40 documents on each diskette with an index, and allowing up to 70 pages per document. Features listed include automatic formatting of upper-, lower-, right-hand and left-hand margins; horizontal and vertical tabbing; underlining and centring: and, of course, a powerful search mode and 'append' facility for document assembly.

Imsai VDP-40: NED

Disc system. Available from Imsai dealers (Corner Computing and Data Precision Equipment responded to our survey). Included in system price.
THE VDP-40 is a 'videocomputer' combining screen, keyboard, two 345KB floppy disc drives and microprocessor (Intel 8080) in one package for a starting price just below our cut-off point of £5,000. Its operating system IMDOS is a derivative of the popular CP/M and includes a 'context editor' called NED.

It is not a 'true' word processor; as it stands it lacks any real output formatting facilities. A context editor works largely by string searching – you specify the word or name or other character string you require – as opposed to a line editor, where you have to specify a line number.

NED works in one of two modes, command or video. This editor uses an imaginary 'character pointer' and in video mode it is at the same screen location as the cursor; in command mode you can move the pointer independently of the cursor. It is not as complicated as it sounds; command mode seems to be best for editing large blocks of text; video mode is more appropriate for small amendments.

Either way, the usual range of insert, delete and erase operations are alternatives for moving through a text file. String searching and replacement is well provided for. Less usual facilities include a 'loop' function which repeats a sequence of edit commands a specified number of times – probably more useful for editing programs than text.

Microstar 4S: Flexitex

Floppy disc system. Available from Microsolve and its distributors. Price: £300.
MICROSTAR 4S only just gets into our survey with a 64K business computer system plus 1.2 million characters of floppy disc storage priced at £4,950. That excludes VDUs and printer.

Flexitex consists of file utilities – to create, delete, re-name, and print text files; a text editor; and a text processor, capable of numbering pages and printing headings and footings automatically. It can accommodate any size of paper and it can retrieve information to be included in the printout from disc files or terminal keyboard.

There is no option in the master menu to create a new text file, because there is no distinction to the user between editing text which exists and which does not exist. The user enters some text; if the name of the text is not on the diskette, the user will become aware of it when the directory of the text is displayed on the screen, and at that time the user may enter a name for a new text file. Flexitex will take care automatically of creating whatever files are necessary to accomplish the task.

NASCOM-1: Letter Writer

PROMS for Nascom-1 developed by ICL Dataskil. Price: £70.
AT a personal computing show last year, Dataskil demonstrated a letter-editing system using the Nascom-1 basic board with no memory expansion. Apparently this was no more than a spin-off from "serious development work". Dataskil reports considerable interest in the concept of a low-cost letter editor.

The program required only some 1.5K in EPROM, retaining ½K of the essential parts of NASBUG monitor. About 700 bytes of RAM was used for the letter text.

Facilities provided include cursor control insert/delete, over-write, scroll line or screen, tabulate, write to standard cassette to store letter and read back, create, amend or edit letter and printout.

Processor Technology Sol: SOL*STAR

Disc system. Available from Comart and its distributors. Price: £85.
SOL*STAR was written by Orange County Computer Centre for a Processor Technology Sol-20 with the North Star mini-floppy drive and the North Star DOS. Comart quotes around £2,750 for a Sol configuration on which it could be used. There are versions of SOL*STAR for the Teletype 43 – a dot matrix printer – and the rather more expensive Diablo daisywheel line.

There are 30 keyboard commands. The principal ones are stored conveniently in two 'menu' pages which can be called up at any time without losing all the text you have just typed.

Most of the commands involve holding down the CONTROL key and typing a letter. Functions include cursor movement, control of scrolling – in both directions – insertion and deletion of lines, characters and blocks, search – but not global search and replace – and tab settings.

You can access a third menu of 'subsystem commands', and through this you can reach disc management functions – save, load, delete, append, list disc contents – and print parameters. For output you may select right-justification, line and character spacing, line and page length, left margin, numbering and titling, and underlining.

RML 380Z: TXED and TEX

Disc system. Available from Research Machines. Price: £77.50 for both.
TXED will run on a 16K 380-Z with a printer and a single minifloppy, but the system really needs 32K, and a second disc would help.

In TXED an editing 'cursor' moves around the text to make changes. You can delete and insert lines and characters, interchange lines, and search through text with replacement if required.

The output formatter TEX is a separate program. As part of the TXED edit process, you must embed formatting commands in the text file you are creating. They include centring, new paragraphs, insertion of blank lines, headings, and automatic page numbering. You can specify margins – left and right – and page and line length. Running the TEX program against your print file then produces the printed version.

TEI Systems: EDIT

Disc system. Available from Abacus. Price: £100.
ABACUS is the U.K. distributor for the £4,000-plus TEI videocomputer. Its 'dynamic screen editor' approaches the specification of a genuine word processing package, and we are told it is shortly to be upgraded.

The edit mode generally uses CONTROL and single character keys for its functions. They include cursor and page movements – the cursor can tab, pages move 24 lines at a time – limited insert and delete facilities and a powerful search and replace capability.

File handling commands allow you to load a specific amount of text, compress blanks – to maximise disc space – and display carriage returns – so that you can see where they will fall. There are no facilities for automatic assembly of a new document from existing text and there are very few print-formatting facilities.

Tandy TRS-80 and CP/M systems: The Electric Pencil

Cassette or disc. Several suppliers.
THE ELECTRIC PENCIL is another of the 1978 success stories in personal computing. Californian Michael Shrayer wrote it originally for micros with the CP/M operating system. CPOM runs on most 8080 and Z-80 systems and it has also served as the basis for the operating systems on many other microcomputers – Imsai, ADDS, Cromemco and others. Electric Pencil can be used in one form or another on a number of personal computers.

To this list the Tandy TRS-80 was added recently, the first non-CP/M implementation Shrayer has done. You could try Rostronics (01-870 4805), T V Johnson (0276 62506) or Optronics (01-892 8455).

For the CP/M version, U.K. sources of which we know include Digitus (01-636 0105), Byte Shop (01-554 2177) and

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Computer Workshop in Manchester (061-832 2269). The price for this diskette system seems to be £250-£300.

Even in the minimal TRS-80 version, Electric Pencil has 34 commands; most of them are implemented by holding down CONTROL and typing one other key. The cursor can be moved around on the screen and to the beginning or end of the file; you can scroll backwards or forwards through the file. The usual insert and delete commands operate on characters, lines and text blocks – you have to set 'markers' to indicate the start and end of a block.

String searching allows you to look for strings of up to 40 characters and, if required, replace them. You can also set-up a coded string search, which could be very useful; for example, if you have a coded name and address file you might search for a string "DD# # # 8X" – the characters are ignored and the program picks up any occurrence of the string with the other characters in the position indicated.

Print formatting includes justification, left margin, page and line length, page and line spacing, underlining, titling and numbering.

Adapted to the TRS-80, Electric Pencil loses one or two bells and whistles and you are recommended to buy a lower-case hardware modification – who wants word processing in capital letters only? It will run on a 16K Level I or II. Output is to an RS232 printer.

Tandy TRS-80: Text Editor

Cassette system. Available from A J Harding. Price: £14·95.

NO GREAT claims would be made for this general-purpose text editor, but it has many features found normally only in more expensive programs and it incorporates a 'fix' for the annoying keyboard bounce problem on the TRS-80.

It is fully-compatible with the RS232 printer interface supplied by Small Systems Software, which means it will run on most printer adapters of this type.

There is a simple set of nine commands including clear, delete and insert (characters), print, save and load. No formatting operations are provided.

Tandy TRS-80: WORD I

Cassette system. Available from Micro Architect, 96 Dothan Street, Arlington, MA 02174, U.S.A. Price: $32 (includes postage. Order with Barclaycard/VISA and quote your number).

THIS is a 16K Level II system which we intend to review. It is cheaper than Electric Pencil, the only real alternative.

WORD I accepts lines of text interspersed with lines of format control information and formats the text into a displayable document. Commands permits you to set page length and width, skip lines or pages, centre text, multi-column output, title headings. Line spacing and adjusting, right-justification and page numbering are all controlled automically.

Tandy TRS-80: WORD III

Disc system. Available from Micro Architect. Price: $39 (Barclaycard/VISA)

THIS diskette version of WORD-I offers all the facilities of that package, plus the attractions of floppy disc storage for text (fast access filing). The WORD packages have 20 user commands, most of which concern text formatting on output. You use the normal TRS-80 screen edit functions – like the cursor controls – to alter text.

This system apparently offers no document assembly or search-and-replace facilities. There is no limit, however, to text size. We understand there is an all-singing, all-dancing WORD IV on the stocks.

Zilog microcomputers: ZFORM

Disc system. Available from franchised Zilog dealers. Price: £100.

ZFORM is a powerful-looking output formatter which operates on files produced by any of several available text editor programs for the Z-80.

This is a good example of a text formatter. You can specify length and width of pages, margins and headers and footings – including page numbers; tabs, indents and centring are all available; you can set the spacing and specify justified or unjustified text. Among selectable options are ribbon colour change, bolt print, underlining and sub- and superscripts. ■

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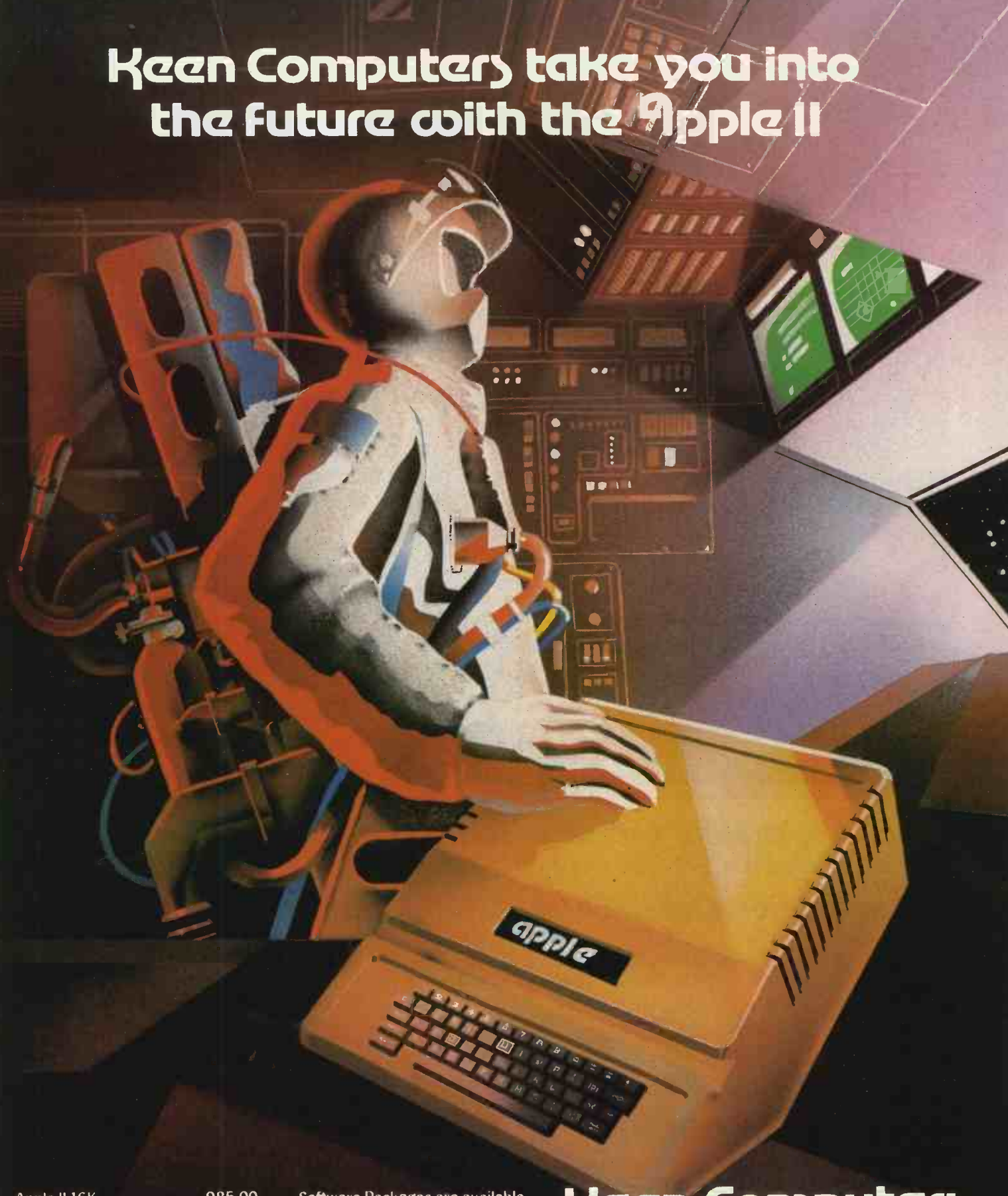

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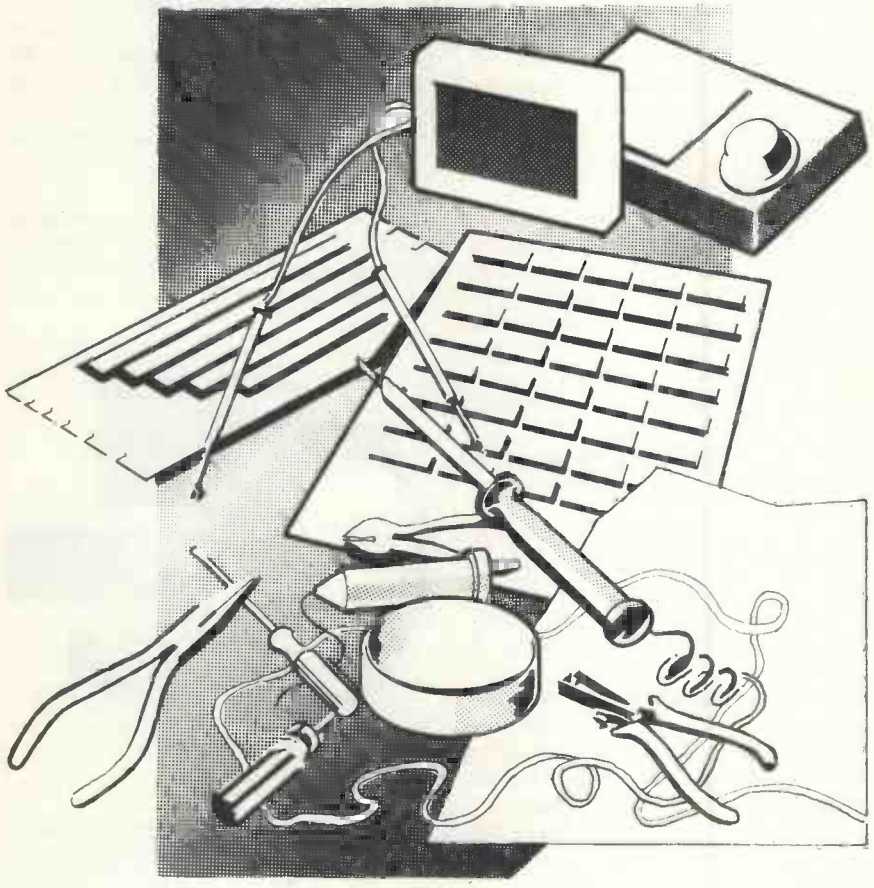
A practical introduction

THERE ARE too many myths about computers. Too many people hold too many rigid and unsubstantiated beliefs about what computers are, what they can and cannot do, how and why they work. This introduction will change all that. For a start, let us summarise the myths:

- **computers can think.**
- **computers are large.**
- **computers are bureaucratic.**
- **computers are expensive.**
- **most computers are run by government organisations.**
- **most of the rest are run by large companies.**
- **computers are electronic brains.**
- **computers are incomprehensible unless you are some kind of genius.**
- **computers are best left to someone else.**
- **computers fail all the time.**

They are all fundamentally incorrect. Computers are not necessarily like that, though some people would like you to think so. It's worth looking briefly at how the myths evolved before deciding what is wrong with them.



The whole computer business, like most others, is driven by technological and economic forces. When the components were expensive, not many people could afford computers but for the people who could bear such an outlay, there were considerable benefits of scale, so computers tended to be complicated, expensive and big.

Two reasons

The other main prop of the myth is the need for dedicated acolytes. While computers were complicated, it's true that to understand, organise and manipulate their complexity a bunch of specialised jobs had to be created. The need for computer training and the arrival of computer jargon both served to separate computer people from the rest of us.

Some computers are still big and complicated; they still require specialised staff; they still cost a good deal of money to buy and to run; they still operate at unimaginably fast speeds.

That kind of computer is now in the minority. They are bought for only two reasons – to solve gigantically complex problems or to allow a large number of people to use a little bit of the computer, all at the same time.

Weather forecasting or space exploration are obvious candidates for the first category. The second is called time-sharing and it is an alternative to giving the same number of people a small computer of their own.

A small computer of your own is what *Practical Computing* is about. That mixture of technology and economics has worked to produce a breed of computer which does not differ in kind from the multi-million-dollar megaliths with their over-qualified minions, their impenetrable forests of new and mis-spelt words, their general inaccessibility.

What is a computer?

Technology has provided a cheaper and more compact type of computer. The economic factors dictate that more people can afford them, more individuals want them, more businesses need them; so they can be produced and sold fairly cheaply. Computers are becoming accessible.

A computer is a fast, rule-following idiot machine. It is fast because it is electronic and electrons are speedy. It follows rules because that is all a computer does; you can alter its set of rules more or less at will, you can add rules, you can complicate rules. It's an idiot because it simply can't think for itself – not in terms of original, creative thought, anyway. It follows those rules.

That applies to all computers irrespective of their size, shape, colour, capacity, nationality or the uses to which they might be put.

The essential element is that you provide rules for it to follow and that you can change them. All talk of 'rules' is a little abstract, so let's give the business a name – *programming*.

A program is a set of instructions for the computer to follow. It will try to follow them blindly, typing errors and all. If you change the program, or substitute another, the fast idiot will go through the new instructions as coldly and as logically as before.

Remember this; the freshly-arrived computer is blank, it has no intrinsic purpose until you give it one, and the

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word computer is incorrect, a historical accident; it doesn't necessarily do computations at all. It's just that the first computers spent all their time doing calculations – for shell trajectories and census returns, initially.

System mix

It's helpful to start calling the computer a 'system'. Most computer people do and for a change this is a meaningful use of a jargon word. A system is a set of components which can be combined to produce effects none of the individual pieces could manage alone.

The components of the computer system are a mix of *software* – which is a group name for all your programs – and *hardware* – all the pieces you could stub your toes on; literally, everything that is hard, tangible and visible.

You have to relate that to what a computer does when it is computing. Four things happen:

- information (or words, or data, or instructions, or whatever) goes in; and that is *input*.
- the input is decoded, acted upon, massaged, manipulated; that is *processing*
- it may be stored for future use; so may whole programs and any results of processing
- alternatively, or subsequently, the results of that processing may be displayed, printed, or in some other way proclaimed to the outside world, usually you; that is called *output*.

A conventional computer, then, has facilities for:

- input
- processing
- storage
- output.

What happens is that you, or someone else, *inputs* a program which is stored until it is needed. Subsequently some data is input, the program is activated and processes it, and the results are output.

The idiot in the middle

Obviously the piece in the middle of all this computing will be the processing component. It will be no shock to discover that this is called a processor – or central processing unit, or CPU.

Time for technology. What happens inside a processor is that electricity moves down one circuit or the other. The complexity of the alternatives – how fast the choice can be made, how quickly the electrons can follow the chosen route, how small the whole thing can become, is what distinguishes one processor from another.

There are dozens of processors, incidentally, and there are many more products for the end-user which have found ways of incorporating the same processor into identifiably different computer systems.

Computers are really a whole series of electronic switches. Like any switches, they can be ON or OFF. There isn't any other possibility. As it happens, there's a neat way of expressing this ON/OFF business – binary numbering.

Don't be worried by this but there are many numbering systems other than the one we use, which is called decimal, because it uses 10 digits. The binary system uses only two digits, which for the sake of argument are '0' and '1'. If '0' corresponds to 'off' and '1' to 'on', obviously you have a neat way of representing the internal operations of the computer.

The electronics can decode a string of 0s and 1s as a series of off/on combinations and you have a way of communicating with the electronics. You can tell it

that certain types of 0/1 patterns will be program instructions; other binary structures will be information to be processed by programs.

Suspicious characters

It is possible to write programs which give instructions for any computer encoded as 0s and 1s. Provided you and the computer both know what the binary sequence means, it is possible to hold any information in this form, even alphabetic characters.

It is extremely tedious to communicate with the computer in this way, though, not least because any normal person would have to keep checking on the binary codes for alphanumeric characters. You would go out of your mind.

So you give the computer a special manufacturer-supplied program which will convert a more intelligible way of expressing information into the binary digits a computer can use. That way you can give the computer a number or a letter and with a quick piece of internal transformation it can understand what you mean.

Most computers translate characters according to an eight-bit code, a 'bit' being a binary digit. An eight-bit code comprises a string of eight digits, each of which can be 0 or 1. That gives a total of 128 possible combinations, enough to give patterns for each letter of the alphabet, each number, and a few punctuation marks and arithmetic symbols, too.

So if you key-in a particular sequence of characters at your computer keyboard, it will decode them into a group of eight-bit codes, and they are the binary sequences it can understand.

It can hold them in its memory, too. The storage capacity of a computer, the amount of information it can keep in memory, is expressed usually in characters – or bytes. A 'byte' is eight bits, so generally one byte is the equivalent of one character.

You will also encounter the cryptic symbol 'K'. That is shorthand for 1,024 – don't worry about why K means 1,024, it's just one of those things. So '8K' means 8 x 1,024 = 8,192 characters.

Chips that pass in the night

Electronics these days is about switching streams of electrons (or electricity) and it is only 60 or 70 years old. In early days a kind of switch called a *relay* was used; they were comparatively slow to operate, though.

'Slowness' here means a few thousandths of a second, which sounds fast until you realise that even a simple internal operation looks complicated when you reduce it to a number of switches opening and closing – and for one operation that typically means several thousand, several million switchings. They all mount up.

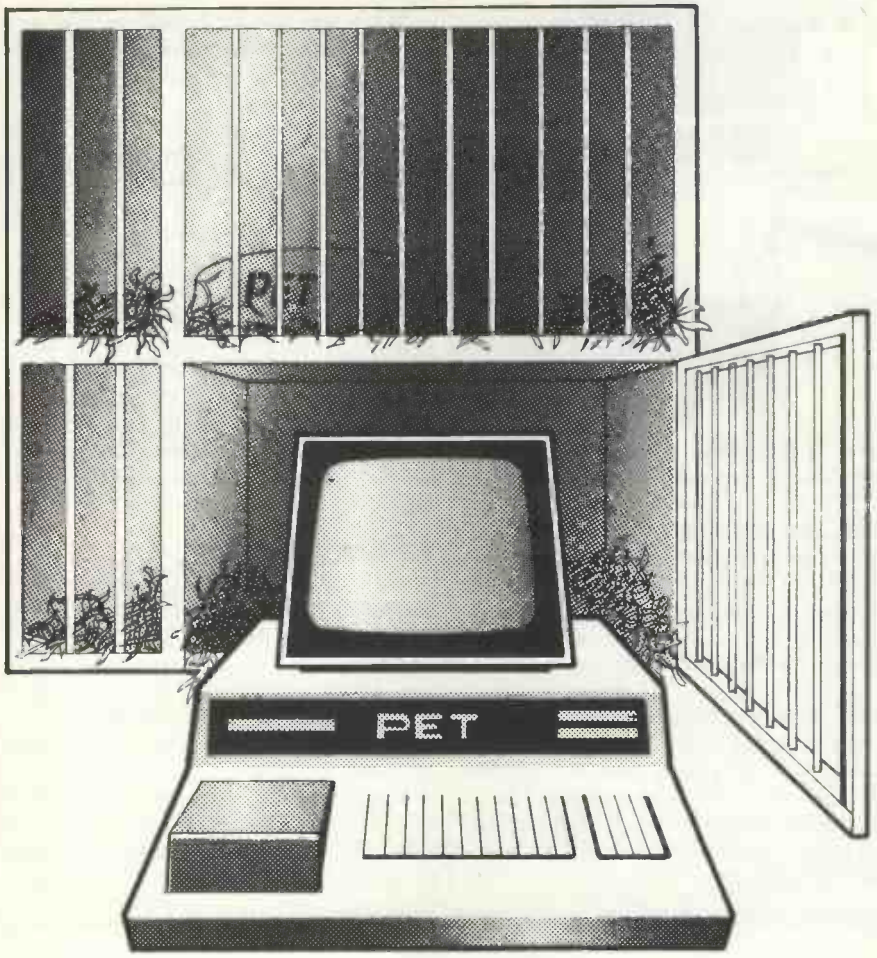
So the advent of *vacuum tubes* in the 1950s pleased everyone. They operated rather faster. *Transistors* followed, a few years later, faster still and more reliable. The major breakthrough of the early 1960s was the *integrated circuit*, and that's where we are now.

Even faster and even more reliable, integrated circuits were also considerably cheaper and much more compact. They used the relatively new technology of semiconductor materials to cram an increasingly large number of electronic switches on to a decreasingly small silicon chip.

So you've heard of silicon chips? Silicon materials happen to be the best way at present of putting the maximum number of circuits – at least 100, more usually several thousand – on to a really small area of crystalline material.

That, in turn, is encased in a block of plastic with legs; each leg corresponds to and is connected to one of the circuit ends on the chip. The little lot plugs into, or is soldered into, a socket on a printed circuit card, which is sometimes called a printed circuit board and abbreviated to the PCB.

Those boards are fibre-glass or plastic rectangles with circuit lines printed on to them. The lines are gold or silver or some



other electrically-conductive metal and they run between the socket holes; put the correct semiconductor packages into the correct holes and the chips can pass electronic signals which mean actual data to each other.

You can't put all the chips you need on to a single PCB – yet. So the chips on one board have to have some way of communicating with the chips on another. They also have to have some way of getting information to and from the rest of the system, and they need some electrical power to work in the first place. So a PCB has a line of circuit connectors along one or more edges; they are the other end of the circuit lines which connect the socket holes.

Processor power

You plug the circuit boards into slots in a kind of metal skeleton frame. This has built-in wires connecting one slot with another, and all slots with the electricity supply and the other parts of the system. The connectors along the edge of the PCB mate with connectors in the frame, so there's a way of passing signals to and from the PCB via the frame.

A processor isn't a computer, obviously; it is just one component but it is an important component because it decides exactly what the computer can and cannot do.

A *microprocessor* is a small processor. That doesn't do it justice – a microprocessor represents a major technological advance, because on one or two chips the designers have managed to cram all the circuits for which conventional computers have several chips.

There are three important implications of this. Microprocessors are cheap to mass-produce, they are fairly small and, for various technical reasons, they can't be as powerful or as fast as their upmarket brethren.

You might meet four names among microprocessors. None is a computer, but they are the most widely-used microprocessors which feature in small computers.

● **Intel 8080** – and some family relations like the 8048. Intel made the world's first microprocessor in 1971, and this is now the most popular micro. It is used, among others, by Processor Technology, the Compelec Altair system, the Heathkit H8 kit computer, the Imsai line, and the Compucolor II.

● **Motorola 6800**: Motorola is probably No 2 in the microprocessor business; like Intel and most of the micro manufacturers, it sells the bulk of its production to industry and other users outside the kind of computing of which we are talking. The best-known 6800-based system in our field is the SWTP computer sold by Computer Workshop.

● **MOS Technology 6502:** This micro bears a passing resemblance to the 6800 and it is used widely in so-called personal computers. Among those are the manufacturer's own Kim-1, the similar Superboard II from Ohio Scientific – other Ohio computers also incorporate it; and above all the Pet, whose maker, Commodore, owns MOS Technology; and the Apple II.

● **Zilog Z-80:** Zilog was set up by some people who left Intel with the aim of building a similar microprocessor – only better. To some extent they succeeded. The Z-80 is well-liked by those who know about such things and is used by the North Star Horizon, Tandy TRS-80, and the Nascom-1, among others.

Thanks for the memory

A particular arrangement of particular chips will provide the functions of a processor. The same kind of technology is applied differently to provide other parts of the computer system, including the memory.

There are various ways of storing information – especially programs – for future use. They differ primarily in speed of access. You read information fastest from read-only memory or ROM. It is so-called because you can't 'write' new information on to it.

ROM is physically one or more of those plug-in semiconductor packages. Its contents are usually fixed by the manufacturers and consist generally of frequently-used programs without which your system couldn't really operate.

Then there is read/write memory, whose contents you can alter. Sometimes it's called random-access memory, or RAM. This is the main 'user' memory of the system, sitting there waiting for you to fill with your own programs or the data on which your programs will operate.

Finally there are various external storage devices, the slowest for the computer to get at but also the cheapest. These are connected usually by cable to the box which houses PCBs of the processor.

The two external storage media you will encounter are tape and disc and the slowest and cheapest versions of each are cassette and floppy disc.

Cassettes as used with computers are much the same as ordinary audio cassettes; on the cheaper computers they are audio cassettes sometimes. Certainly the cassette units are sometimes off-the-shelf portable tape recorders.

Cassettes are obviously a cheap form of storage; you can buy one of those recorders for well below £30, after all, and the cassettes aren't expensive. They are, however, limited. You can't read from or write to cassette at the speeds

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possible with disc. More important, cassettes store data serially. That means one piece of data is stored after another and if you want to reach a particular item you have to pass over everything which precedes it on the tape.

You don't have that disadvantage with floppy discs. They are in two sizes, one about the diameter of a 45 rpm record and other around two-thirds of it. They really are discs, and they really are floppy, though to give them at least some rigidity and some protection they arrive in cardboard envelopes. They have slots cut in them to expose the disc surface so that the read/write head can make contact with it.

Faster

Discs are much faster at getting data to and from the processor. They also allow what is called 'random' access to data stored. It isn't really random – it just recognises the fact that you can tell the read/write head to move over the disc before it does any reading or writing.

With audio tape, there is no simple way of getting to the start of a particular taped song on cassette. The same applies to data on a cassette but just as you can move a record arm over an LP to the correct point, so the computer can move the read/write head to the proper point

on a floppy disc. That can be very important, as we shall see later.

There is one other form of storage which you might come across – paper tape. It stores data in a form you can see. A reel of paper tape contains holes punched across the tape, there can usually be up to eight of them corresponding to the eight-bit binary code and each hole denotes a '1' position in that code. No hole means a '0'.

Paper tape is very slow to read and slower still to punch and the special reader/punch unit which does that is expensive; it is also noisy. Still, it's a clear and simple method of storing data and if you already have the reader/punch mechanism, it might be worth considering.

I/O is input/output and the two are usually bracketed because the one device often provides both functions; it's easier to build it that way.

The visual display unit or VDU is the classic example. It comprises an input device (the typewriter-like keyboard) and an output device (the television-like screen), but a VDU manufacturer finds it convenient to provide one cable for connection to the processor.

In fact, that cable contains some wires specific to the imput function and some for output; since the computer knows which is which, the VDU isn't really a single device at all. In any case, many of today's smaller computers make a physical distinction between a display and the keyboard.

Alternative

Another I/O device encountered frequently is the keyboard/printer terminal, an alternative to the VDU but with a printer instead of a screen. You might also have a totally separate printer with no keyboard; you will certainly need one if you intend to use your computer system for your business.

The are other more esoteric forms of I/O. One which appeals particularly to technology buffs is speech; the computer recognises what you're saying, and it

replies vocally, too. The voice output part is more or less possible now, though it's not exactly broadcasting quality; voice input is proving more of a problem.

What is a personal computer?

You can forget most of what has gone before because today you can buy off-the-shelf a fully-fledged plug-in-and-go computer system which requires you to understand as much about electronics as the buyer of a music centre knows about hi-fi. Frankly, though, in both cases you will have more pleasure from your purchase if you know what's going on inside.

That off-the-shelf buy is what is usually called a personal computer – the emphasis being on the individual user. Though you might buy one for your business, you will also be the principal user. By comparison, larger computers sometimes occupy full-time staff who do nothing but work with the computer but who didn't select it and who didn't sign the cheque.

Let's start at the bottom. The most basic personal computer looks like this:

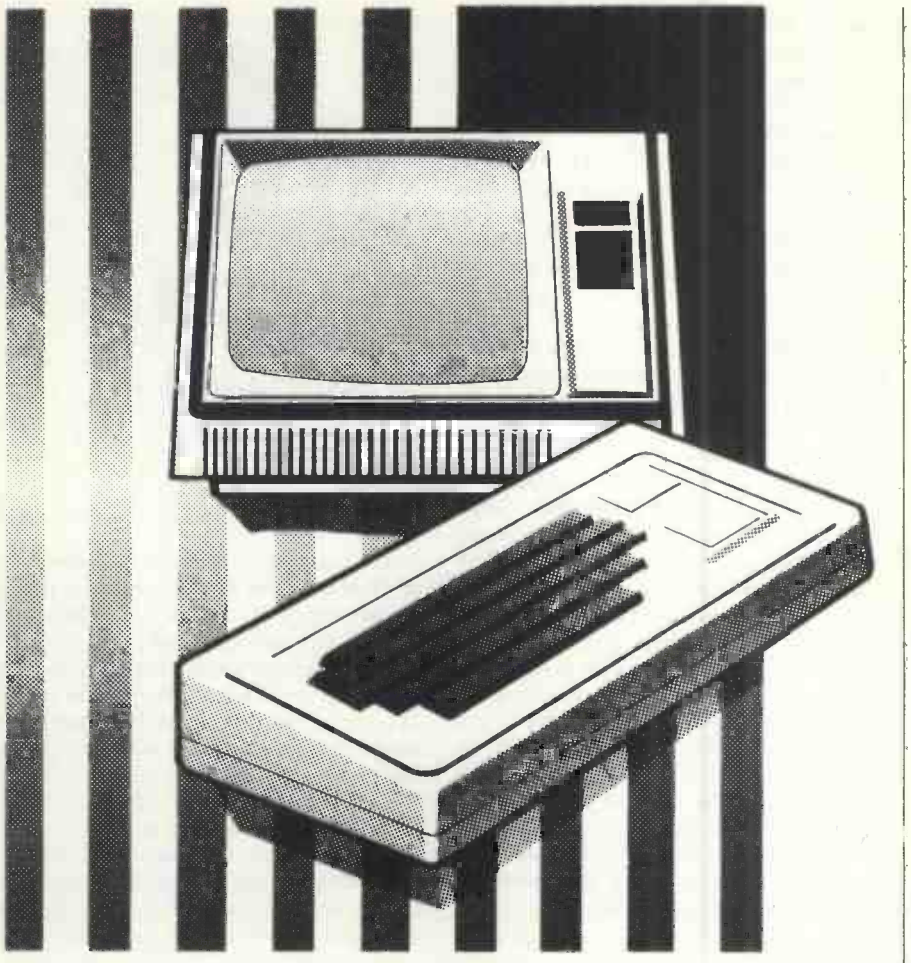
- **Input:** typewriter-style keyboard.
- **Processor:** totally invisible, probably buried somewhere inside the keyboard on a couple of circuit boards.
- **Storage:** internal memory is probably there, too, on one or two more PCBs. External storage will be a cheap cable-connected keyboard.
- **Output:** a screen, possibly an ordinary portable TV set slightly amended.

The three best-sellers at the bottom end of the personal computer market exemplify different approaches.

- **Commodore Pet:** less than £500. One unit containing keyboard, built-in cassette unit, and screen.
- **Tandy TRS-80:** less than £500. Four separate units – screen, keyboard (incorporates the processor and memory), cassette player, power supply.All computers need a black box to convert mains voltage to the current they use; in most computers this transformer is invisibly inside another unit.
- **Apple II:** less than £1,000. Three separate units – colour TV, keyboard (incorporates processor, memory and power supply), and cassette unit.

As for software, all have an *operating system* of some kind – typically a ROM chip or two which contain all the low-level binary decoding functions which make things work; you won't need to know anything about it, though. You will also have a *programming language* called Basic.

Remember all that decoding the computer is doing to save you having to communicate with it in binary? Well, that conversion process can be extended and most of today's computers allow you to use a near-English 'language' called Basic.



It is fairly easy to learn and it's easy to understand. In general, the syntax and vocabulary of a programming language like Basic are simpler to grasp than the rules of a foreign human tongue.

Basic has become popular partly because it was devised from the start as a beginners' language. It had little competition; and the business of translating it into binary digits for the computer – the so-called 'machine code' – didn't require as much space or effort from the computer as other programming languages.

Today you might also hear about PASCAL, a language with similar aspirations but it is only just starting to appear on small computers. The only other serious contender is Cobol, a long-winded language for business use which really scores only when you are already familiar with it, perhaps by using it previously on a big computer.

What can it do?

Peter Ustinov's biography compares TV to telephones. If someone asked you whether you like telephones, you would have to say it depends who is on the line and what they are saying. The same applies to TV and it's also true of computers.

A small computer can do something for everyone. That is an over-simplification, of course, but in practice it can probably do something for you, provided you tell it what to do. If the job you have in mind can somehow be expressed as a series of rules or instructions in the form of a computer program, the computer can do it.

There are two ways of putting in a program. You can key it in yourself, or you can 'load' it from cassette, disc or paper tape, in which case someone else will probably have written the program and sold it to you ready for loading in that form.

So you can put in a program you've written yourself or you can load someone else's. What those programs do is limited only by your imagination – within reason.

Here are some examples we've heard of:

- **Games.** It's easy to regard computerised games as trivial and irrelevant. In fact, game-playing obviously can be intellectually and emotionally stimulating as well as merely diverting.
- **Simulations.** There's a cross-over point which illustrates the value of games. Simulating the economy of Sumaria or the starship *Enterprise* might be games but there's little which is different about planning the future of your company or looking at alternative ways of getting you and the family to Dubrovnik this summer.

A good example is in education, where a history teacher might use the classroom computer to decide 'what if' questions and thus bring historical situations to

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life. A recent prizewinner in a *Practical Computing* competition is doing that with a variety of situations, including the Norman Conquest – the pupils take parts, make decisions based on the historical situation, and watch the computer decide what the outcome would be.

● **Education.** This could be applied equally to geography and science subjects. The computer can also be used with obvious benefit in complicated calculations at school; but most teaching and much school administration could also gain from some automation of the more routine functions.

● **Business.** The same applies to the administration of business, though the returns are visible and financial. Stock control is an obvious example. A small computer could tell the shopkeeper or a retailer the current stock position at any time on all items, which were selling fast or slowly, which were approaching reorder levels, and how quickly the supplier could deliver. With that amount of information you ought to be able to cut back inventory levels and save money.

You could well do the same for debtors if you have a big sales ledger, and you should certainly look to save time by having the computer produce invoices with VAT analyses as an automatic by-product. It might also produce 'personalised' form letters or quickly-updated price

lists if your business involves those.

● **Home.** There is more rubbish talked about computers in the home than any other area of this subject. True, a computer can run your bath, feed the cat, switch on the TV and change the record but the extra items of hardware you would need could become complicated and expensive. In any case, who needs it?

There are, however, some sensible home applications. Playing games and doing household accounts are obvious candidates. If you're writing a novel, the computer might help, too. You'll need some skill to put a microprocessor into a vacuum cleaner but that's a chore worthy of automation. There is also some scope for having the computer control your home while you're away – feeding and watering your houseplants, perhaps, or turning a video recorder on and off at longer intervals than the VCR manufacturer allows.

● **Art.** Computer-generated art is not to everyone's taste, but at the very least you can have plenty of innocent fun persuading your computer to produce patterns, poems, animated cartoon-like sequences and even music, though you might need special hardware. Some highly serious work has been produced with the computer, so don't take it too lightly.

What to look for

As with motor cars or hi-fi systems or sorbets, there are no hard and fast rules which do not rely ultimately on personal preference, but here are some points to consider:

● **Processor:** It doesn't matter whose processor is inside your computer unless you want to get into it with your soldering iron, in which case you shouldn't be reading this.

● **Standardisation:** Much more important is to consider what you might want to add in the future. Some personal computers follow a standard arrangement of connectors for the slots in their metal frames; so into those slots you can put

any PCB which obeys the same standard arrangement.

The best-known standard is called S-100. If you think you'll want to add goodies, you might well opt for a computer with the S-100 standard. Don't be too dismayed if your favourite computer doesn't have it; it reduces choice but it's not a disaster.

The other important standard to ask about is called RS-232, also known as CCITT V24. This refers to external connectors, the means whereby you can attach printers and other peripherals to your computer. Again, RS-232 increases the options and it's probably more important to have it than S-100.

● **Read-only memory:** ROM is generally a good thing. If you have to load the basic system software into the computer each time you want to use it, you don't have ROM in your computer. Having these functions pre-programmed and ready to go in ROM modules saves time and you won't have any load problems – they happen occasionally. Still, this isn't something for which there is much choice about; either you have it, or you don't have it.

● **RAM:** Read-write memory is much more important. The pressing question is how much do you need? And there's no easy answer.

Determine how much memory you can have for your programs and data, because most personal computers put some of their basic system software in RAM, whether you like it or not.

Then you might look at what your input takes up. For instance, if you wanted to put in a full A4 page of text you would need almost 4K of memory to store it. A relatively complicated game with many twists and turns, like most of the versions of *Star Trek*, will need 7K or 8K.

There's a variant on Parkinson's Law here – you almost always use all the memory you have, whatever size it is. Aim for at least 8K and try for 16K if you can afford it; you'll want to run fairly sophisticated programs sooner or later.

● **Programs:** Go for Basic. All personal computers have a Basic and it has become the *lingua franca* in which programs are exchanged. Beware, though, variants of the language are not interchangeable, and you can't load a Basic program written for a Pet into a TRS-80 and expect it to work.

If you buy one of the more popular personal computers – Pet, TRS-80, Apple II – you will find there is a good deal of ready-made software on sale in the form of cassettes (£3 to £25) and diskettes (usually £10 to £50).

Check whether your computer uses an operating system called CP/M or a floppy disc drive made by North Star; again, there is plenty of off-the-shelf software available (on floppy disc) for these.

● **Keyboards:** Unless you have a computer with a decent keyboard, you can have all kinds of problems trying to type-in a program. A good all-purpose keyboard follows the QWERTY typewriter layout. It has a solid, chunky feel when you depress keys and it has a big, unmissable RETURN key – this you use to tell the computer you have concluded one line of input and want to start the next, so it is used frequently.

Extras on it might include a separate numeric keypad on the right (speeds the entry of numbers) and a CAPS LOCK key in addition to SHIFT LOCK – locking into capitals means only that you can press all the non-alphabetic keys and still get whatever is in the lower-case position.

● **Display:** Go for a big display if you can. A good-sized display produces more information more quickly and in more alternative shapes and sizes than a printer or a small display. 'Big' in this context means it should be able to show at least 16 lines of 64 characters.

Displays are in three varieties. You ought to obtain the best possible results from a purpose-built visual display unit (VDU). They normally display 24 lines of 80 characters, but they will generally add at least £500 to the cost of the system.

A built-in screen like that on the Pet or Compucolor II might not display so many characters but you will get special graphics symbols and no need for cabling.

The third type is simply a converted TV, the simplest and the cheapest kind of display, though it might not produce the sharpest image.

● **Power supply:** Translating the mains power into the electricity your computer needs is the job of a chunky component usually called the power supply. In fact, it's a voltage transformer like the one used by a model train or racing car layout.

It is possible to overload the power supply, in which case things get hot and/or frail. So look for really beefy transformers and hefty wiring. Also get some advice about how much you can plug into the system's existing power supply before it needs a hand.

Computers dislike variations in the electric current. This may result in the appearance of wobbly characters on the screen, or data being lost between the processor and cassette or disc, or at worst, some component failing.

Voltage variations are inevitable in mains electricity and if your computer is plugged into the ring main you may compound the problem by having other electrical appliances switching on and off – refrigerators, stereo set-ups, irons, heaters.

Ask someone's advice about *voltage regulators*. For an average personal com-

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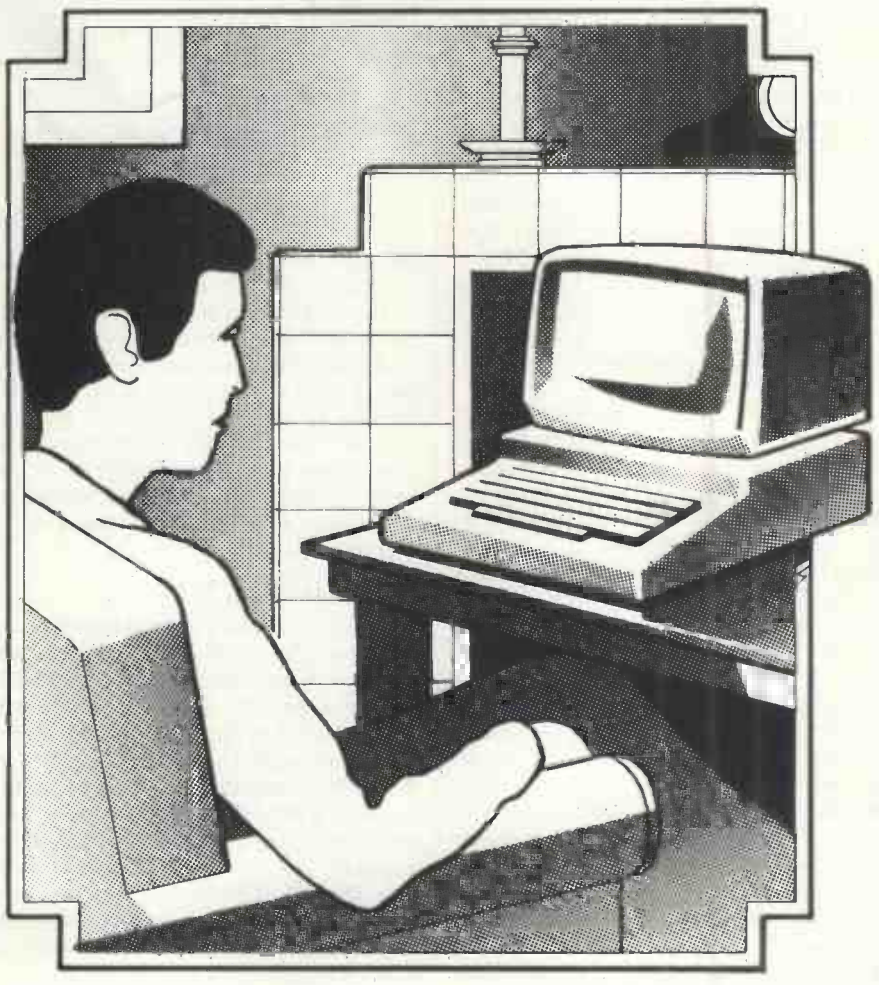

(continued from previous page)
puter you could buy one for £25-£50; it plugs into your mains socket, and you plug the computer into it. The regulator evens out the dips and peaks in the power supply cleverly, delivering a smooth flow of electricity to your computer.

● **Printers:** Sooner or later you'll want a printer to keep a record of your programs – you might lose or damage a cassette, after all. For some applications, like business uses or word processing, a printer clearly is vital.

The immediate problem is connecting a printer to your computer. Having specified an RS-232 interface means you can attach almost any printer; otherwise your options are more limited.

There are two types of printer. There is high-quality, typewriter-like printing from daisywheel printers (£2,000 or more) or from converted IBM golf-ball typewriters (£1,000 or more but rather slower). Dot-matrix printing is a technique whereby characters are built up from dots, and because those printers are mechanically simpler, the prices are lower – down to around £300 for a very small and slow printer which can manage only 40 characters to a line. In the range £700 to £1,000 you will get a faster printer (60 to 120 characters per second) which is good enough for anything but top-quality printing.

● **Storage:** Using cassette tape or floppy disc for storage gives you a cheap and easily-expanded alternative to keeping data and programs in RAM.

The cheapest kind of cassette system loads at something around 50 bytes per second, and the fastest rarely exceed 300 bytes per second; it could take several minutes to transfer a complex program.

If you can afford it, choose floppy discs – their chief virtue is that they operate at much higher speeds, taking far less time to transfer information. This saves on boredom but it also allows you to make better and more imaginative use of your system.

In any case, your computer may well be doing jobs all the time which involve looking-up records; you need the speed of disc storage for this.

● **Documentation:** Personal computers generally have inadequate user instructions and reference manuals. These days the accompanying documentation tends to be better-produced and some of the learner-level starter manuals are really good. Even if you are sure that all the information is there somewhere, it can still be very difficult to read via an index or the contents page. Quantity is no substitute for quality.

● **Users:** You should also look for an active users' newsletter, perhaps even a specialised user group. Both are media for exchanging opinions, advice, notifications of errors, and potentially useful programs.

● **Supplier:** You'll come across three kinds of supplier – single-system specialists, single-system generalists, and computer stores.

The last category is probably the most important. The computer store sells several types of computer, several types of printers and disc drives, and almost everything you need for your computing – paper, discs, tapes, books, magazines, the lot. Those places should serve as local social centres for the personal computer community, repositories of knowledge and advice and notice-boards for exchanges, advice and information – or that is how it should be. If your local computer store doesn't seem like that, tread warily.

The second group comprises mainly Pet and Tandy dealers, retailers who handle other products – typically audio systems or hobbyist electronics, sometimes other consumer electrical goods –

but who sell only one brand of computer, normally at rock-bottom prices.

The single-system specialists typically make their money from knowing a great deal about the one brand they sell and by selling you many extras for it, including perhaps some programs written by them to your specifications. Some computers you cannot obtain anywhere else. If you need a relatively complicated system to do certain specific tasks, that kind of supplier is your best bet.

What to buy?

Ensure you know what computers can and cannot do; then decide more or less what you want from a computer. The first decision should be what type of computer to consider, and there are four categories to look through:

● **Hobby computers:** Typically costing less than £300, they require some technical knowledge. They are either build-it-yourself kits – not too difficult to assemble – or ready-built computers on a single printed circuit board – with some memory but not much, and with no protective casing around it.

They may have a built-in keyboard for input; they may have a small display for output. Some have neither, some have both, one has a keyboard and a tiny printer on the PCB.

All have connectors to attach cassettes, printers, or other external devices. Most have Basic; some have only their own cryptic programming languages. Examples of this breed are the Kim-1, Aim-65, Nascom-1, and Ohio Superboard II.

● **Games growing up:** Again less than £300, they are a spin-off from the TV games you see for a few pounds. The more complicated allow you to plug in new cassettes for more games. Since these so-called games centres are essentially microcomputers with the games cassettes being programs, you could add a keyboard and program them yourself. Some of the games manufacturers now allow you to do that. It's already happening in the States, and there will be similar products this year in Europe, from Philips and others.

● **Appliance computers:** Denotes computers designed to be sold, taken home, plugged in, and used just like any other domestic applicance, TV or washing machine. The Commodore Pet was the first and the best example. It's compact, simple to use, and is in one piece. Against that, it's not particularly expandable. The newer model is more expandable but you have to add extra external items, like a printer and floppy disc drives.

A more recent arrival in this genre is the Compucolor II – more expensive but it incorporates floppy disc rather than cassette and it gives you a full colour display rather than black and white only. Further up-market there are several plug-in-and-go computers, so the price spread is from £500 to more than £5,000. The more expensive ones are designed for business use, of course, and they assume generally that you will be attaching at least one external device – a printer.

● **Building-block computers:** They separate the I/O, external storage and processor functions into different boxes and connect them by cable. The processor box contains the memory and may contain floppy disc drives, too, as in North Star Horizon. The Apple II, Tandy TRS-80 and Processor Technology Sol exemplify an alternative design trend by putting the processor and memory into the keyboard.

The attraction is simple. To uprate one area of the system you can disconnect the existing unit and plug in a better one, and/or you can attach more of the same, and/or you can add extras.

So you could swop a slow but cheap cassette for a fast but expensive floppy disc when you can afford the difference. You can attach more memory or a second disc if you want more storage. You could plug in a special typewriter-quality printer or one of those voice output devices if you want some extra facilities.■

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Percom FD200 Mini-floppy Disk Drive (including PSU)	£350.00
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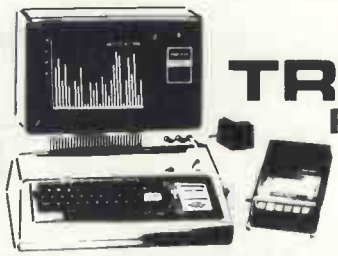
If you don't see it – ask if we have it.



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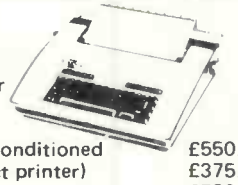
'Electric Pencil' keyboard mod. to give lower case with text/word processing package.	£28.00
S100 Interface for TRS 80	P. O. A.
'Library 100' – 100 progs for TRS 80 on cassette (Level II)	£39.00

Printers



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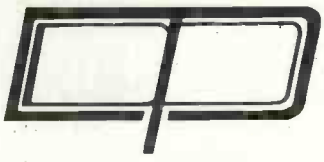

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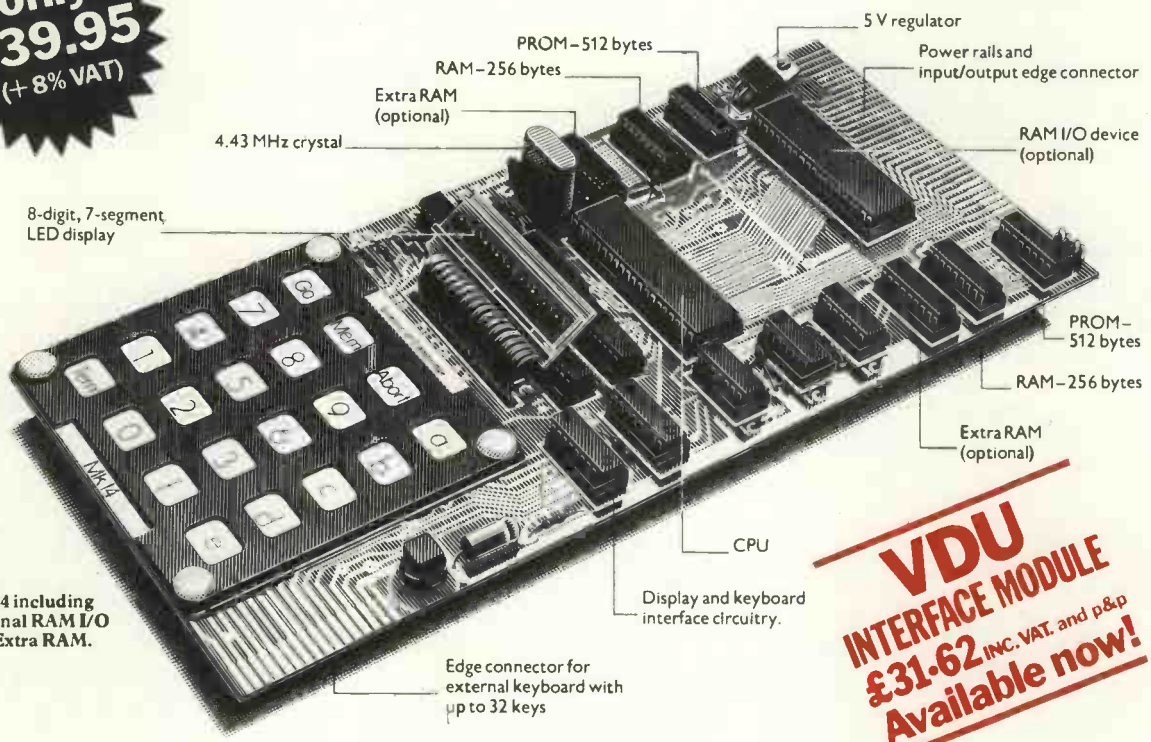

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●Hexadecimal keyboard ● 8-digit, 7-segment LED display ● 8 x 512 PROM, containing monitor program and interface instructions ●256 bytes of RAM ● 4 MHz crystal ● 5 V regulator ● Single 8 V power supply ● Space available for extra 256-byte RAM and 16 port I/O ● Edge connector access to all data lines and I/O ports

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CONFERENCE PROGRAMME

INTRODUCTION TO THE USE OF MICROPROCESSORS IN LIGHT INDUSTRY.
Thursday, July 5. Chairman: John Coll, Head of Electronics, Oundle School.

KEITH BAKER, UNIVERSITY OF SUSSEX: Microprocessors and the Product.

HOWARD KORNSTEIN, INTEL CORPORATION: Future trends in microcomputer technology.

MIKE GURR, BOC: Getting into Micros.

JOHN COLL, OUNDLE SCHOOL: Software simplified.

BARRY STANDRING, INTEXT: Business Information Services.

ALL SPEAKERS: Panel discussion.

PERSONAL COMPUTERS IN BUSINESS
Friday, July 6. Chairman: Keith Baker, Lecturer in Computer Science, University of Sussex.

PORTIA ISAACSON, ELECTRONIC DATA SYSTEMS CORP., U.S.A.: The personal computer, trends and developments.

ADAM OSBORNE, OSBORNE AND ASSOCIATES, U.S.A.: A view from the States.

JOHN COLL, OUNDLE SCHOOL: Teach yourself computers.

CHAIRED BY KEITH BAKER: Personal computer parade – description and demonstration of four machines.

ALL SPEAKERS: Personal computer probe – questions on demonstration.

MIKE GURR, BOC: Running your business at home – with micros.

CLIVE LOVELUCK, ULSTER MANAGEMENT CENTRE: Personal computers, a new dimension in management training.

DO-IT-YOURSELF COMPUTERS
Saturday, July 7. Chairman: Mike Gurr, Database Consultant, BOC.

ADAM OSBORNE, PRESIDENT, OSBORNE & ASSOCIATES: DIY in the U.S.A.

GUY KEWNEY, *Computing*: U.K. products evolution.

PORTIA ISAACSON, ELECTRONIC DATA SYSTEMS CORP., U.S.A.: The 'byte' shop explosion.

MIKE GURR, BOC: New techniques in software.

JOHN COLL, OUNDLE SCHOOL: Case study – a personal computer built from scratch.

PORTIA ISAACSON: The games people play.

CHAIRED BY ADAM OSBORNE, ALL SPEAKERS TAKING PART: Discussion panel.

CONFERENCE INFORMATION

SEMINAR REGISTRATION

You can apply for a registration form by writing to Online Conferences Ltd., Cleveland Road, Uxbridge, Middlesex.

REGISTRATION FEES

Thursday, July 5 – Introduction to the use of Microprocessors in Light Industry. £45 plus £3.60 VAT.
Friday, July 6 – Personal Computers in Business. £45 plus £3.60 VAT.
Both days – £75 plus £6.00 VAT.
The fees include daytime refreshments and a light buffet lunch.
Saturday, July 7 – The Do-it-Yourself Computer Day. £10. The fee includes coffee and tea, but not lunch.

GENERAL SHOW INFORMATION

HOURS OF EXHIBITION
Thursday, July 5-10am to 6pm
Friday, July 6-10am to 6pm
Saturday, July 7-10am to 6pm

ADMISSION
Entrance to the exhibition is by ticket only. Price £1. On Saturday, the DIY Computer Fair day, children under 14 will be admitted for 50p. A special offer of three tickets for £2 is available on tickets bought in advance. They can be used on any day. Seminar participants will be given a complimentary exhibition ticket which can be used on all three days of the show. Advance tickets available from Online.

CATERING FACILITIES
The exhibition foyer has a bar and there are tea and coffee points in the exhibition where snacks will be available. The Bloomsbury Centre Hotel has full restaurant facilities.

ACCESSIBILITY
The hotel is easy to reach by Underground – Russell Square, Kings Cross/St. Pancras, Euston and Euston Square are within easy walking distance. Bus routes are two minutes' walk away, and the 68, 77, 170, 188, 196 and 239 service the area. The hotel has a basement car park and there is an adjacent National Car Park.

ACCOMMODATION
Online recommends that overnight accommodation be booked through Exp-O-Tel, Strand House, Great West Road, Brentford, Middx. Tel: 01-568 8765.

TELEPHONE FACILITIES
Coin boxes are situated around the hotel.

1979 Microcomputer Show, incorporating the Do-it-Yourself Computer Show, is organised by Online Conferences Ltd., Cleveland Road, Uxbridge, Middlesex. Tel: (0895) 39262. Contact: Christine Clarke.

LIST OF EXHIBITORS

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7 Peartree Dell,
Letchworth, Herts.
Tel: (046 26) 73301
Stand 15

Comart,
PO Box 2,
St. Neots, Huntingdon.
Tel: (0480) 215005
Stand 34

Commodore Business Systems,
360 Euston Road,
London, NW1.
Tel: 01-388 5702
Stand 21

Computabits,
41 Vincent Street,
Yeovil, Somerset.
Tel: (0935) 26522
Stand 6

Computer Bookshop,
Temple House,
43-48 New Street,
Birmingham, B2 4LH.
Tel: 021-643 4577
Stand 47

Comp Computer Components,
14 Station Road,
Barnet, Herts.
Tel: 01-449 6596
Stands 28 and 29

Datalogic Ltd,
29 Marylebone Road,
London, NW1.
Tel: 01-486 7288
Stand 45

Dillon's University Bookshop,
1 Malet Street,
London, WC1.
Tel: 01-636 1577
Stand 4

Distributed Data Processing,
Essex House,
Cherrydown,
Basildon,
Essex.
Tel: (0268) 727474/282155
Stand 5

Electrical Research Association,
Cleeve Road,
Leatherhead,
Surrey.
Tel: (037 23) 74151
Stand 24

Equinox Computer Systems,
Kleeman House,
16 Anning Street,
New Inn Yard,
London, EC2.
Tel: 01-739 2387
Stand 32

Euro-Calc Ltd,
55 High Holborn, London, W1.
Tel: 01-636 8161
Stands 1 and 2

Gemsoft Ltd,
Alverstone Lodge,
Wych Hill Lane,
Woking, Surrey.
Tel: (04862) 60268.
Stand 33

Grama (Winter) Ltd,
21b Dryden Chambers,
119, Oxford Street, London, W1.
Tel: 01-636 8210
Stand 46

H B Computers,
22 Newland Street,
Kettering,
Northamptonshire.
Tel: (0536) 839922
Stands 51 and 53

H L Audio Newtronics,
138 Kingsland Road,
London, E2.
Tel: 01-739 1582
Stand 8

A J Harding,
28 Collington Avenue,
Bexhill-on-Sea,
East Sussex.
Tel: (0424) 220391
Stand 55

Keen Computers Ltd,
5 The Poultry,
Nottingham, NG1 2HW.
Tel: (0602) 583254
Stand 44

KES Computers,
4 Summerfields,
Yarnfield,
Stone, Staffs.
Tel: (0785 77) 297
Stand 54

LP Enterprises,
313, Kingston Road,
Ilford, Essex.
Tel: 01553 1001
Stands 12 and 13

Lyme Peripherals,
2 Avenue Court,
Farm Avenue,
London, NW2.
Tel: 01-425 0490
Stand 7

Midwich Computer Co. Ltd.,
Hillsborough House,
Churchgate Street,
Old Harlow, Essex.
Tel: (0279) 25756
Stand 16

MicroFocus Ltd.,
58 Acacia Road,
London, NW8.
Tel: 01-722 8843
Stand 22

Microsolve Computer Services Ltd,
252 Hale Lane,
Edgware, Middx.
Tel: 01-958 4347
Stand 10

Nascom Microcomputers,
92 Broad Street,
Chesham, Bucks.
Tel: (02405) 75151
Stand 48

Newtons Laboratories,
123 Wandsworth High Street,
London, SW18.
Tel: 01-870 4248
Stands 38, 39, 40 and 41

Online Publications,
Cleveland Road,
Uxbridge, Middx.
Tel: (0895) 39262
Stand 35

Osborne & Associates,
PO Box 2036,
Berkeley, CA 84702, USA.
Stand 50

Personal Computers Ltd,
194-200, Bishopsgate,
London, EC2.
Tel: 01-283 3391
Stand 49

Petsoft,
MicroAct Ltd.,
5-6 Vicarage Road,
Edgbaston, Birmingham,
Tel: (0635) 201131/200854
Stand 14

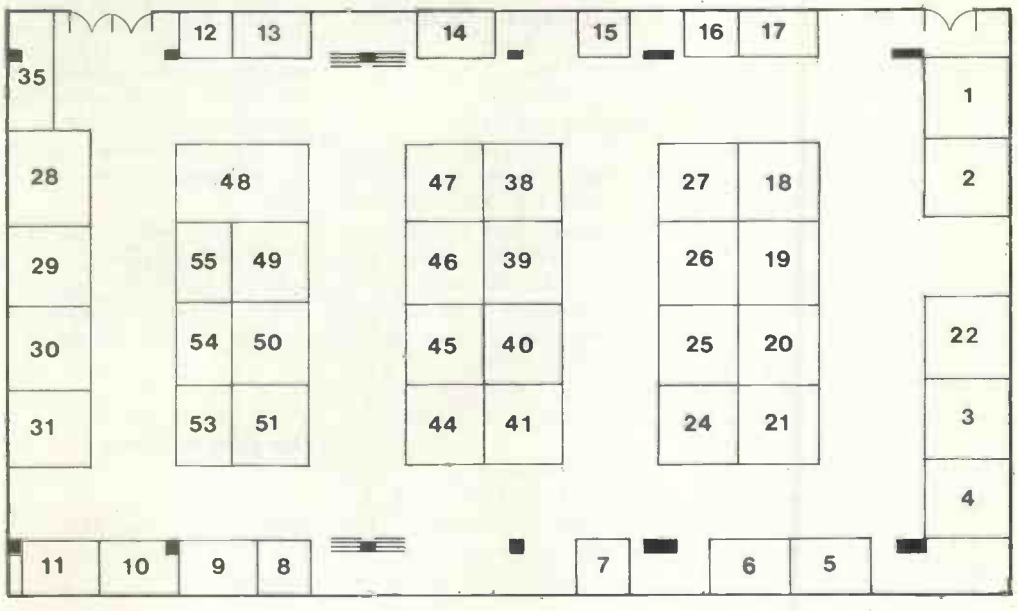
Practical Computing,
30-31 Islington Green,
London, N1.
Tel: 01-359 8451
Stand 17

Research Machines,
209 Cowley Road, Oxford.
Tel: (0865) 49791
Stand 30

Rostronics,
118 Wandsworth High Street,
London, SW18.
Tel: 01-660 4805
Stand 31

Sirton Products Ltd,
13 Warwick Road,
Coulsdon, Surrey.
Tel: 01-660 5617
Stand 9

Technalogics,
8 Egerton Street,
Liverpool, L8 7LY,
Merseyside.
Tel: 051-724 2695
Stand 11



What you can see at the Show

Abacus Computers Ltd
62, New Cavendish Street,
London, W1.
Tel: 01-580 8841
Stand 3
ABACUS will be exhibiting two machines, the TEI and Compucolor. They will run on standard Cobol packages and the Compucolor will be hooked to a graphics terminal controlled by the TEI.

You will be able to get your hands on the machines and there will be sales and technical staff to take orders and give free advice.

Byte Shop
426-428, Cranbrook Road,
Gants Hill, Ilford, Essex.
Tel: 01-554 2177
Stands 18, 19, 20, 25, 26, 27
THE Byte Shop, with more space than anyone else at the show, will be giving most of its range an airing. The equipment on show will include the Cromemco System 3, Processor Technology Sol-20, North Star Horizon, the new Pet and the ITT 2020. There will be continuous demonstrations of the machines by experienced staff.

Two new surprise ranges will be launched – a complete range of Ohio Scientific Superboards with 74MB disc drives, plus a range of equipment based on the Digital Equipment LSI processor.

CCS Microhire
7, Peartree Dell,
Letchworth, Herts.
Tel: (046 26) 73301
Stand 15
THE COMPANY will be concentrating on two aspects – sales and hire. It will be exhibiting Pet, Apple II, Exidy Sorcerer and Compucolor. You will also have an opportunity to see the machines running on CCS software.

The Japanese microcomputer SORD is expected to make an appearance. Two versions, the 48K and the 128K, will be demonstrating colour graphics, among other things.

Sales and hire transactions will take place, as well as an exchange service, so if you want to take your old computer and swap it for another, this is the stand to visit.

Comart
PO Box 2,
St. Neots, Huntingdon.
Tel: (0480) 215005
Stand 34
COMART will be exhibiting its complete range of Cromemco equipment, along with the Processor Technology Sol and the North Star Horizon. All will be running on standard packages. It also hopes to be showing its Microbox.

The stand will be fully-staffed with sales and technical people who will be taking enquiries on sales and passing them to dealers. An abundance of literature on all systems will be available.

Commodore Business Systems
360, Euston Road,
London, NW1 3BL.
Tel: 01-388 5702
Stand 21
COMMODORE will be showing the whole range of Pet microcomputers and peripherals, including all the new equipment. A range of its own software will be running on the equipment and sales and technical staff will be on hand to give demonstrations and answer questions. The Kim 1 will also be exhibited.

Comp Computer Components
14, Station Road,
Barnet, Herts.
Tel: 01-449 6569
Stands 28 and 29
COMP will launch its new machine at the show, the Compukit UK 101, which will compete directly with the recently announced Nascom-2. It is a turnkey kit based on the 6502 processor. It has 19K of memory, 4K of user RAM expandable to 8K, and a 2K powerful monitor, 256-character set and 8K Microsoft Basic.

It is complete with power supply, keyboard and RS modulator, which means that you can interface it to an ordinary TV set, giving 48 characters per line. You can walk away from the show with one under your arm for £219.

There will be a one-hour seminar on Saturday afternoon, given by designer Tony Burke, to introduce the machine. Vouchers worth £5 and £10 will be given away and they can be used towards the purchase of the U.K. Compukit.

Other hardware on display will include the new 16K Pet, Exidy Sorcerer, Apple, TRS-80, Nascom and Hitachi monitors. Five to 10 percent discounts will be given on all the above.

The stand will be staffed by the well-informed engineers who are employed by Comp for such occasions.

Computabits
41, Vincent Street,
Yeovil, Somerset.
Tel: (0935) 26522
Stand 6
THIS stand will display a range of standard Pets and Kim-1s, but instead of the normal peripherals it will be running with a set of related products designed by Computabits. Hopefully, they will include voice input and output and a music synthesiser for the Pet. The Kim-1 will be working with many of the special projects featured in *Practical Computing* over the last few months.

Nick Hampshire, Computabits editor of *Practical Computing* and manager of the business, hopes to have his new book published in time for sale at the show. It is, he says, packed with "all the things Commodore doesn't tell you".

The stand will be staffed by technical people and part of it will be sublet to *Infoguide*, which markets Compusettes cassette software for the Pet.

Computer Bookshop
Temple House,
43/48, New Street,
Birmingham, B2 4LH.
Tel: (021) 643 4577
Stand 47
COMPUTER BOOKSHOP is a trade distributor of books, literature and training courses, supporting the development of the microelectronics and personal computer industry.

Books on display will concentrate on the four major processors – the 6800, 8080, Z-80 and 6502 and "will fulfill the needs of all sections of hardware users."

Two new books which will be on display are *Programming the 6502* by Rodnay Zaks – recommended by Mike Lake of the Independent Pet Users' Group – and *Programming a Microcomputer 6502* by Caxton Foster. Both titles are applicable to Pet and Apple.

Also on display will be a range of Camelot education books written specifically for use in schools and colleges. A detailed catalogue of all Computer Bookshop titles will be available.

Datalogic Ltd
29, Marylebone Road,
London, NW1.
Tel: 01-486 7288
Stand 45
THERE is an air of mystery surrounding the Datalogic stand, where a new microcomputer will be unveiled. All we could discover about it is that it is a product of the Datalogic micrologic division and it has been described as a "computer in a briefcase".

It has been designed for a specific application for a customer who has already ordered 50 of the machines.

Dillon's University Bookshop
1, Malet Street,
London, WC1E 7JB.
Tel: 01-636 1577
Stand 4
ONE of London's leading bookshops, Dillon's will be exhibiting more than 50 titles relating to microcomputers and microprocessors. The stand will be staffed by "people who know about the books".

Only one copy of each book will be on display, so Dillon's will be taking orders only.

Distributed Data Processing
Essex House,
Cherrydown, Basildon, Essex.
Tel: (0268) 727474/282155
Stand 5
DDP will be promoting its new improved large disc drive. It increases the storage capacity for the ITT 2020 over its market competitor, the Apple II.

The black and white monitor for the 2020 will be on sale at a reduced price, as will the 16K upgrade kit. DDP also hopes to have a colour monitor available.

Electrical Research Association
Cleeve Road,
Leatherhead, Surrey.
Tel: (03723) 74151
Stand 24
ERA is not exhibiting the usual equipment models but is concentrating on the education and training side. On display will be the microprocessor teaching system, the MP Experimentor. It was designed originally as a course for ITT in West Germany but ERA has now devised a machine which it will market.

Full and detailed coverage will be given to several experimental and highly-researched projects. Perhaps the most interesting and exciting is that which looks at the problems of Microprocessor versus Man and The Elements.

This fascinating document looks at the effects of weather on microprocessors, its reaction to altitude and, arguably the most exciting of all, the Physical Destruction Analysis.

Various experiments have been made in an abundance of agonising ways, including setting a chip in a plastic encapsulation, boiling it in sulphuric acid to remove the plastic covering, then studying the chip under an electromicroscope for faults in all individual sections.

The project also examines the effects of nuclear weapons on microprocessors. For example, it shows what would happen to a microprocessor contained in one of the more sophisticated armoured vehicles during and after attack.

Equinox Computer Systems
Kleeman House,
16, Anning Street, New Inn Yard, London, EC2.
Tel: 01-739 2387
Stand 32
EQUINOX will be showing the Equinox 300 multi-user, multi-tasking, time-sharing microcomputer. It serves a mixture of VDUs and printers, as well as floppy discs, hard discs and industry-standard tape drives.

Systems similar have been installed in several businesses, educational establishments and laboratories. The system has a powerful operating system, including Basic, Lisp, Pascal and Snobol 4, together with a multiple-pass macro-assembler with linking loader and screen-orientated text processor and editor.

Equinox will also be showing the Horizon Z-80A-based system.

Eurocalc Ltd
55, High Holborn,
London, W1.
Tel: 01-405 3113/3223
Stands 1 and 2
EURO-CALC, the shop which sells anything with a chip in it, will be exhibiting a new microcomputer which it feels will cause one of the biggest stirs of the show.

The machine is Plessey-made, built exclusively for Euro-Calc and entirely in England. It can be used as a stand-alone unit or as a program development system.

Euro-Calc will also be displaying its usual brands, including Pet, Apple, ITT 2020 and some printers.

Gemsoft Ltd
Alverstone Lodge,
Wych Hill Lane, Woking, Surrey.
Tel: (04862) 60268
Stand 33
GEMSOFT will be displaying some 70 games for computer and television and you can see some of them running on the Pet. It also hopes to have two business packages available which it is now hurriedly writing.

It has also developed a sound effects board for games.

Grama (Winter) Ltd
21B, Dryden Chambers,
119, Oxford Street, London, W1.
Tel: 01-636 8210
Stand 46
GRAMA will have a full range of Pet and SWTPC hardware on view. It will be demonstrating its own software package, BUs(iness) 1, which is a complete package comprising 23 options and 30 programs stored on 10 files.

Tony Winter, owner of the firm and author of the package, reckons it to be in advance of anything he has so far seen and values it at more than £1,000. He is offering it at £275 plus VAT.

For the duration of the show any firm order for a system worth more than £3,200, including disc and printer, placed at the exhibition will include BUs(iness) 1 free.

A.J. Harding
28 Collington Avenue,
Bexhill-on-Sea, East Sussex.
Tel: (0424) 220391
Stand 55
THE TRS-80 is the main attraction, particularly as the new Level Three will be introduced for the first time.

The new Monitor Three program will make its debut. The Library 100 model will be on show on a demonstration machine.

H B Computers
22 Newland Street,
Kettering, Northamptonshire.
Tel: (0536) 83922
Stands 51 and 53
PETs, Exidy Sorcerers and Apple IIs are the attractions with some possible but so far unspecified releases. Filling the shelves will be TV interfaces, sound boxes, Pertec floppy discs, and a series of new interfaces.

H L Audio Newtronics
138, Kingsland Road,
London, E2
Tel: 01-739 1582
Stand 8
THE MAIN feature will be the Elf II kit. Associated hardware includes the giant board kit, 4K static RAM board, ASCII keyboard, power supplies, modulators, light pen and steel cabinets. Software available includes Tiny Basic on cassette, and Elf-Bug monitor on cassette. Manuals will also be on sale.

Keen Computers Ltd
5, The Poultry
Nottingham.
Tel: (0602) 583254
Stand 44
THIS dealer will be displaying various pieces of software which turn the Apple II into a business, educational or home enthusiasts' machine. The Keen range of software is wide and covers all major commercial uses. Titles include Incomplete Record Accounting, Word Processing and Information Retrieval.

A variety of statistical and mathematical software will also be available, as will the range of memory upgrade kits for the Apple II, ITT 2020 and Tandy TRS-80.

A selection of printer and display terminals suitable for use with the Apple and other micros will be on view, such as the Eledex DP 8000, Centronics 779 and Diablo 1610.

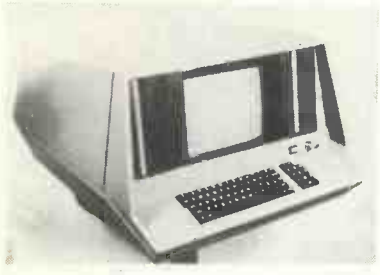
Keen is one of six dealers for the Attaché microcomputer which will be filling the rest of the shelves on the stand.

Kes Computers
4 Summerfields,
Yarnfield, Staffs. ST15 0RH
Tel: (0785) 77297
Stand 54
KES COMPUTERS will be showing an Ohio Superboard with

(Continued on page 71)

Buy a System. . .Not just a "Pretty Box"

The SD System* — From about 97p per hour (40-hour week)



***The SD System Includes:-**
SDS-200 Microcomputer
T.I. 810 Printer (or Equivalent)

A Total System

SD Systems knows that small businesses do not keep full-time programmers on staff. We also know that individually designed business programs can be expensive on a one-time basis. That is why we offer the SDS-200 and compatible business software.

Complete Software

SD Systems Business Software is a complete system package that includes everything from general ledger, payroll and inventory control to Cash Receipts and Mailing List. Special modifications can be made to fit your specific needs.

Leasing Available

The SDS-200 is available by leasing. This gives the small business the opportunity to select the method of acquisition that best fits their needs.

The SDS-200 TOTAL System features:

System Hardware

The SDS-200 give you features that are not found in systems costing thousands more. State-of-the-Art Engineering. Quality Production and Full Reliability testing make the SDS-200 a dependable, compact and easy to operate data processing system.

- Up to 256K Bytes RAM
- Full Keyboard with Special Accounting Key Pad
- Large 12 in. Video Display Screen
- Full Cursor Control including Addressable Cursor
- Blinking, Underlining, Reverse and Protected Fields
- Uses 8 in. Flexible Diskettes for Permanent Storage 2 Mbyte on-line
- Forward and Reverse Scrolling
- Capable of up to 160 Special Characters
- Expandable with Memory and Peripheral Equipment
- Will Operate as a Remote Batch Processor for Large Systems

System Software

A full range of Business Programs are available from CAP-CPP written in Microcobol.
The system will support all normal high level languages including:-
Fortran
Cobol
Basic
CP/M

SD SYSTEMS

SDS-200 Expandable

The SDS-200 is designed in a manner to give you expansion capabilities. As your needs change the computer system that you select today should be able to change with you. By the addition of memory and peripheral equipment, the SDS-200 can expand to fit your needs.

U.K. DISTRIBUTOR:

AIRAMCO LTD

Unit A2, 9 Longford Avenue, Kilwinning Ind. Est., Kilwinning, Ayrshire KA13 6EX
(0294) 57755 Telex 779808

Dealer enquiries invited

● Circle No. 172

What you can see at the Show

(Continued from Page 69)
C24P mini-disk and a new packaged single-board computer based on the Ohio 500 board. This is 8K Basic using an RS 232C interface or 20 milliamp loop serial interface – other standards can be met for various terminals.

The Pet User Board Serial Interface will also be on display.

Kes also offers computer systems consultancy to tailor systems for customers.

LP Enterprises
313, Kingston Road,
Ilford, Essex. IG1 1PJ
Tel: 01-553 1001
Stands 12, 13

LP ENTERPRISES will show its range of books and magazines. The company handles subscriptions for American personal computing magazines, as well as holding a large selection of books on nearly all the professional, business and hobbyist computing topics.

Examples include books on introduction to micros, business programs in Basic, the artist and the computer, and pocket guides for programmers. New publications will be available from Scelby, Byte Publications, Sybex, Sams and Creative Computing Press.

LP Enterprises specialises in distributing microcomputer software on diskette and cassette, including CP/M operating system, Basic, Fortran compilers and business software such as stock control, sales ledger/purchase ledger (accounts payable/receivable) and general ledger. They are available for popular makes of 8080, Z-80 and 8085 processors.

Lyme Peripherals Ltd
2, Avenue Court,
Farm Avenue, London NW2.
Tel: 01-452 0490
Stand 7

LYME PERIPHERALS will have its full range of VDUs on display. For the first time, it will be featuring the Lyme 4003 VDU. It incorporates all the features available on the 4002, with the added advantage that it is compatible with the Digital Equipment VT52.

Lyme was due to merge with James Scott of Glasgow, a firm specialising in keyboards for the IBM 3270, which may also be on view.

Microfocus Ltd
58, Acacia Road,
London, NW8.
Tel: 01-722 8843
Stand 22

THIS software and systems house will be demonstrating its CIS Cobol Compilation System which runs on 8080 and Z-80 processors. The software will be running on the Intel MDS-800 and the Tandberg TDV range of intelligent desk-top terminals.

A new variant of CIS Cobol will be launched at the show.

Microsolve Computer Services Ltd
125-129, High Street,
Edgware, Middlesex. HA8 7HF
Tel: 01-951 0218
Stand 10

MICROSOLVE will be showing Apple II with a new printer, the Printerm Model 879, which is one of the new generation of low-cost printers with a speed of 120 cps. Software consists of debtors' ledger, invoicing, medical billing and case history, financial modelling and payroll. There is also a school physics and commerce teaching package.

Also being exhibited will be a new computer, the Micro Star 45 with 64K RAM. It is a multi-user, multi-task computer starting at £5,000 and can be used by up to three simultaneous users. It will support a double-sided floppy disc drive with an option for double density.

Among the software it contains is a full word processing package, a purchase and debtors' ledger and stock control. The printer will be the new Qume Sprint 5, a daisy-wheel printer terminal with typewriter quality for word processing.

Midwich Computer Co Ltd
Hillsborough House,
Churchgate Street,
Old Harlow, Essex.
Tel: (0279) 25756
Stand 16

THE Hardware Co changed its name recently to the Midwich Computer Co. The new name is being accompanied by a new range of microcomputers which will be given their first public airing.

The computers are of Italian, design, from SGS-ATES. The modular microcomputers are based on the Z-80 CPU and are aimed at the education market.

The lowest-level machine is the Nenocomputer System. It uses a "calculator-style", hand-held hexadecimal data input display station and a solderless experimental breadboard station with binary data input display for digital experiments.

They are combined to enable the student to design and study complete microcomputer systems using Z-80, PIO, CTC and MOS memory. The computers are provided with training books which take the student through fundamental computer basics to the most complex Z-80 programming.

Nascom Microcomputers
92, Broad Street,
Chesham, Bucks.
Tel: (02405) 75151
Stand 48

ACCORDING to Nascom, "one of the most interesting new products of the show will be seen," the Nascom-2, featuring 20K of memory, 8K Microsoft Basic and an "incomparable" 2K monitor.

On show with the Nascom-2 will be the Nascom-1 and all its add-ons, including a memory board and Vero frame. The latter will accept the Nascom-2 as well. Other new products are expected to be available.

Newtons Laboratories
PO Box 789,
127, Wandsworth High Street,
London, SW18.
Tel: 01-870 4248
Stands 38, 39, 40, 41

THIS FIRM is one of several distributors of the Alpha Micro System, claimed to be the most powerful and versatile micro system available. It supports eight floppy discs, four hard discs or any combination of both. Memory ranges from 64KB to about 1.02 MB.

The system is based on AMOS (Alpha Micro Operating System) which is a multi-user, multi-tasking, time-sharing operating system which includes job priorities and a command language interpreter.

Printers and other peripherals will be available from stock.

Online Conferences Ltd
Cleveland Road,
Uxbridge, Middlesex.
Tel: (08995) 39262
Stand 35

ONLINE specialises in the co-ordination of conferences and exhibitions in the fields of information processing and communications technologies. All the events are related directly to practical commercial considerations and many highlight trends in technology which have important social implications.

The Microcomputer Show is an obvious example, as is Viewdata '80. This event is scheduled for next Spring at Wembley Conference Centre and will investigate the use of the television screen as an information access device.

The proceedings of most of the conferences have been published and form the most comprehensive range of books on computer communications and technologies available. Online publications has trebled its sales over the last year and is adding continually to its publications titles.

(Continued on page 75)

DYNABYTE COMPUTERS ARE ALL BUSINESS INSIDE AND OUT.

When we designed our new small business computers, we meant business.

As basic as that seems, it is unique. Just about every other microcomputer being sold as a small business system today was originally designed as a kit for hobbyists.

Every design decision was made with quality and reliability in mind. The result is dependable performance and a solid appearance for business, professional and scientific applications.

FIRST SMALL SYSTEM WITH BIG SYSTEM STORAGE

Many applications handle large quantities of information, so the DB8/2 uses two quad density 5-inch disk drives with our exclusive Dual Density Disk Controller for up to 1.2 megabytes of formatted storage. That's more capacity than two single density 8-inch drives.

If you need more storage, our DB8/4 has two 8-inch drives with up to 2 megabytes capacity, more than any other dual floppy disk system on the market.

OUR SOFTWARE IS BIG ON BUSINESS

Dynabyte helps you get down to business immediately. The DB8/2 is the first microcomputer to offer enough storage capacity on 5-inch drives to fully utilize CP/M,* the most widely accepted disk operating system. We also supply and support BASIC, FOR-

* CP/M is a trademark of Digital Research.

TRAN and COBOL programming languages. Our applications packages include general ledger, accounts receivable, word processing and many other CP/M compatible programs.

Reliability is a big consideration in buying a business computer, so we built it in. Our edge connectors meet military specifications, the toughest electronics manufacturing standard. Our regulated power supply is designed to meet U.L. standards, which means the entire system runs cool and dependable. And our cast aluminum enclosures are rugged as well as attractive.

AND THE BIGGEST THING OF ALL

Customer support. Our support starts at the factory with testing and burn-in programs that assure the *entire* integrated system is reliable prior to shipment. Our completely modular design allows continuing support in the field. We maintain a bonded inventory of all sub-system modules which means we can deliver replacement subassemblies overnight nearly anywhere in the U.K.

Dynabyte built in little things, too. Like a fully-populated 12-slot backplane, switched AC outlets for accessories, an option for European power, quiet whisper fans with long-life metal construction, lighted indicator switches for Power On and Halt, a shielded enclosure to protect disk drives from electro-mechanical interference, and a fully enclosed power supply for operator safety.

Since we didn't cut corners in design, the price/performance ratios of our systems make good business sense.

THE INSIDE FACTS

The DB8/2 Computer System includes two 5-inch disk drives either single or double sided for up to 1.2 megabytes of mass storage; a 4MHz Z-80 processing module with one parallel and two serial ports, 32k of RAM, a 12-slot fully-populated backplane; our exclusive Dual Density Disk Controller, and CP/M.

The DB8/1 Computer includes a 4MHz Z-80 processor with one parallel and two serial I/O ports, 32k RAM, and a 12-slot fully-populated backplane.

The DB8/4 Disk System, designed to be the mass storage companion to the DB8/1, includes two 8-inch floppy disk drives in either single or double sided configuration for up to 2 megabytes of mass storage, our Dual Density Disk Controller, and CP/M.

All three units will be available in rack mount models.

For a descriptive brochure and price list, call or write Dynabyte UK/Europe, 25 Park Rd, Scarborough, Yorks, England. Phone: 0723-65559.

Or better yet, see your local dealer.

DYNABYTE

Associates to Dynabyte, Inc. U.S.A.

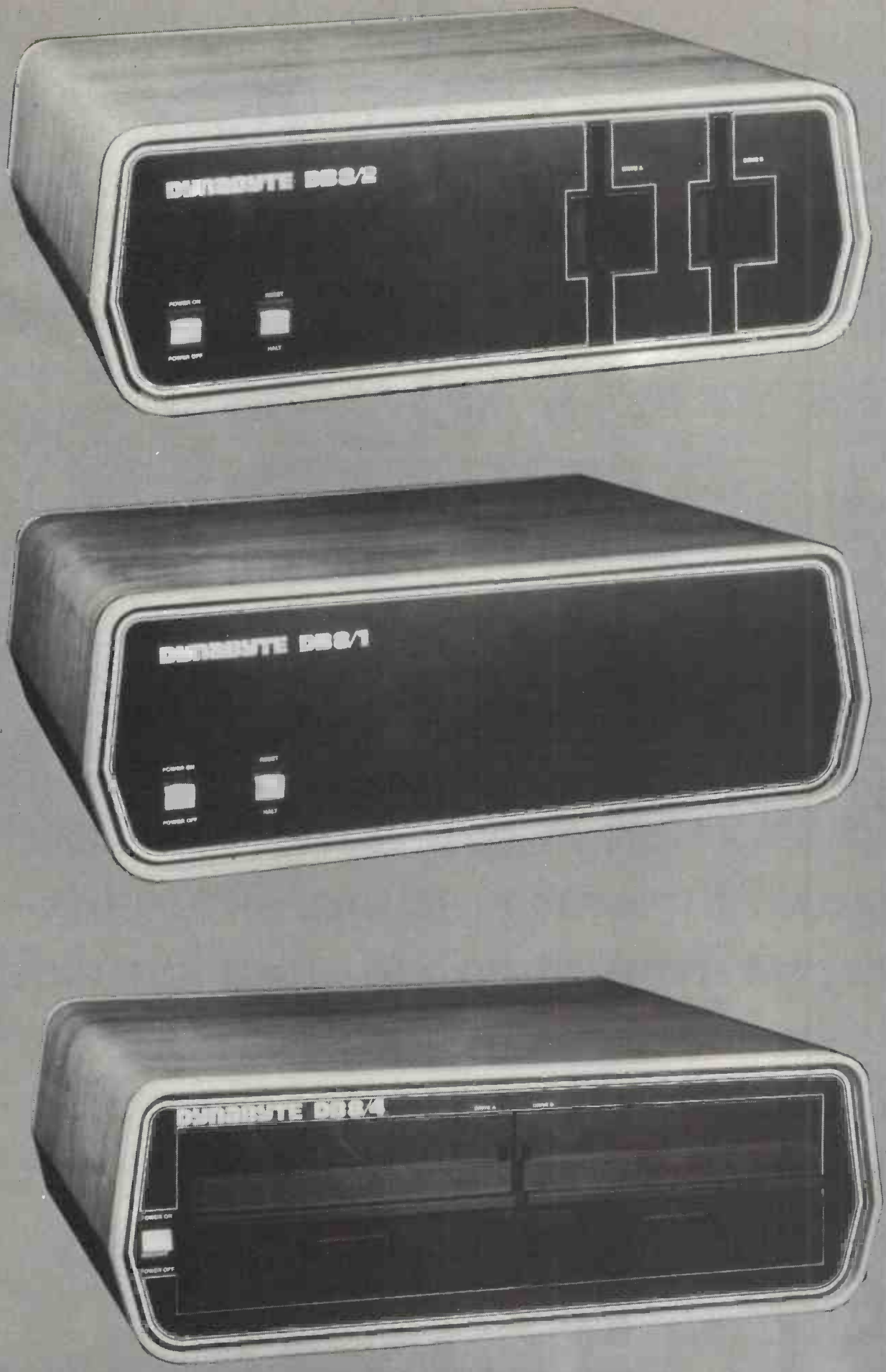
YOU CAN DEPEND ON IT.

Regional Distributors:

Merseyside: Zytel 2 Alexander Drive, Heswall. 051-342 4443
Brookfield Drive, Aintree. 051-523 4011.

Other regions available. Contact Mark Proudfoot.

● Circle No. 173


DYNABYTE DB8/2
POWER ON
POWER OFF
RESET
HALT
DYNABYTE DB8/1
POWER ON
POWER OFF
RESET
HALT
DYNABYTE DB8/4
POWER ON
POWER OFF

DYNABYTE

What you can see at the Show

(Continued from page 71)

On display will be more than 60 titles, as well as a range of forward conference literature. One of the world-wide best sellers is *Personal Computers in Business* and a new title *Introduction to Microcomputers* is expected to have record sales.

Osborne & Assoc.
PO Box 2036,
Berkeley CA 84702
U.S.A.
Tel: 0101-415 548 2805
Stand 50
THIS publishing house and consultancy will have all its titles on show, including *An Introduction to Microcomputing, A Program for Logic Design, Assembly Language Programming,* and *Business Book.*

Adam Osborne, who is also playing a major role as a speaker at the seminar, and Georgette Psarias will be present.

Personal Computers Ltd
194/200, Bishopsgate,
London, EC2.
Tel: 01-283 3391
Stand 49
PERSONAL COMPUTERS is one of the leading Apple II distributors, with 20 dealers throughout the country. The show is the ideal opportunity for it to exhibit its range of Apple hardware and as it runs the Apple software bank, you should have the opportunity to see some interesting programs at work.

Petsoft
5/6, Vicarage Road,
Edgbaston, Birmingham.
Tel: (0635) 201131/200854
Stand 14
PETSOFT will have a complete program supermarket at the show, comprising the "widest range of software available for microcomputers in the world". Two hundred titles will be there, ranging from accounting at £350 on disc to chicken recipes at £3 on cassette.

Petsoft will be launching a new range of business software, collectively called PETACT. The range, Petsoft says, "is the first microcomputer software written by a mainframe team to mainframe standards."

There will be several Pets on the stand, demonstrating various pieces of software.

Practical Computing
30-31, Islington Green,
London, N1.
Tel: 01-359 8451
Stand 17
THE 1979 Microcomputer Show marks the first anniversary of *Practical Computing* which was launched last year at the Do-it-Yourself Show, immediately selling-out that first edition.

The magazine is heavily involved once more with the show, producing the official *Showguide* which will be distributed from a stand in the hotel foyer, as well as devoting seven pages to it in this, our latest and biggest edition.

Practical Computing will be selling all issues dating from October, 1978, as well as our highly-successful *Computer Guides* and the invaluable *Checklist for Data Processing.* You will also have the chance of an introduction to our big sister, WHICH COMPUTER?

We will be taking subscriptions for both magazines and answering questions or solving any problems you may have. Don't miss this opportunity to meet the staff of Britain's number one microcomputer magazine.

Research Machines
PO Box 75,
Chapel Street, Oxford.
Tel: (0865) 49792
Stand 30
RESEARCH MACHINES will be demonstrating its British-built Research Machines 380-Z microcomputer. This general-purpose computer is offered in several versions, ranging from 16K RAM and single- or dual-cassette recorder backing store, to the top of the range with 56K RAM and dual full-size floppy disc drive (one megabyte on-line storage).

New or recent items on display will be a high-resolution graphics/memory add-on board, text processing software in use with the 380-Z and a daisywheel printer, and the new operating system extension, which also allows the use of a conventional VDU with the 380-Z.

Other software demonstrated will include the RML Interactive Text Editor with Immediate Mode Editing, extended Disc Basic, Cobol, Fortran IV, Algol, and Terminal Mode Software. Those interested in Z-80 program development or microprocessor training should ask for a demonstration of the 380-Z software front panel.

Rostronics
118, Wandsworth High Street,
London, SW18
Tel: 01-660 4805
Stand 31
ROSTRONICS, the Wandsworth shop specialising in TRS-80 business systems, promises a crowded stand. The Multiwriter 3, "the ultimate daisy-wheel", will be demonstrated as part of the Rostronics word processing system. The Multiwriter 3 is bi-directional, with full graphics capability, interchangeable print wheels, foreign language character sets, and is fully programmable.

Rostronics has been buying and testing chips and will be selling its own memory expansion kits.

Another own-brand exhibit will be the Rostronics system desk, which can be tailor-made for any system.

Available only on the stand will be the first issue of the British TRS-80 newsletter, which is bound to cause a queue.

Also on display will be the Rostronics small business system and appropriate software, as well as many books.

Sirton Products Ltd
13, Warwick Road,
Coulsdon, Surrey.
Tel: 01-660 5617
Stand 9
SIRTON is a dealer for SD Systems, Jade, Ithaca-Audio and Intergrand, and can obtain boards from many other U.S. manufacturers at competitive prices. It will be exhibiting its range of S100 boards, including three CPU boards and comprising many stock items.

The Sirton Data Preparation Unit will be exhibited for the first time. It is an integral unit with a keyboard, 20-character alphanumeric display and 2K RAM for data storage. The unit is microprocessor-controlled, has a text-editing facility and can transmit and receive data via an RS232 or 20 milliAmp serial data link.

Another new product is the Sirton single-board computer, featuring on-board 2K RAM, 1 or 2K ROM, serial I/O and 16 data-in and data-out lines. It is designed for dedicated control applications or intelligent interfaces.

Keyboards, VDUs and various disc-orientated packages will also be displayed.

Technalogics
8, Egerton Street,
Liverpool. L8 7LY,
Merseyside.
Tel: 051-724 2695
Stand 11
TECHNALOGICS will feature its TECS computer system and demonstrate Teletext reception, its computing facilities, and Prestel. The TECS computer system will be available in kit form as well as ready-built.

Technalogics will also be demonstrating pattern and colour bar generators – portable, battery-powered TV units for the amateur and TV service engineer.

It will also be showing a full Prestel editing terminal aimed at the information providers of Prestel.

The rev
started

TO START our series on U.K. microcomputer manufacturers, Kay Floyd visited Hertfordshire to meet Nascom Microcomputers, one of the top British companies. Its Nascom-1 kit has been a runaway success, selling more than 12,000 units in the last 18 months.

Kay spoke to Kerr Borland, marketing manager of Nascom Microcomputers and a director of the parent company, electronics distributor Nasco. Although he and John Marshall, chairman and managing director, are the brains behind Nascom, Borland describes himself as a "gofer" – at the top level, of course.

What prompted you to start Nascom?

I was managing director of Nasco at the time and Nascom was given to me as a kind of project. It took off because of the microcomputer revolution. John Marshall and I were very interested in everything that was going on and because Nasco had been distributing semiconductor products for nearly 10 years, we knew what it was about.

What role did Nasco play setting up Nascom?

There is a definite division between Nasco and Nascom, though Nasco gave us financial support at the beginning. The Nasco group includes Lynx Electronics and one or two other companies; Nascom Microcomputers is within that structure.

When Nascom was first set up we decimated Nasco and Lynx because I took all the staff I wanted with me. Only recently have we re-staffed them with managers and clerical people. We are now re-structuring Lynx and are about to open a new store in Amersham, which will offer a vast range of products for people who want to build microcomputers.

Two-man design

Who designed the Nascom-1?

John Marshall and myself. We wanted to see if we could make a small microcomputer. We had the ideas for the design but couldn't carry them out ourselves. We telephoned several people and did some market research but that wasn't much help as we found that there was really no existing market for the type of product we had in mind.

When we said that it had to be built for less then £200 they said it couldn't be done. Finally we went to Chris Shelton of Shelton Instruments. A top microcomputer engineer, he put our plan into practice. Now. 18 months later, we have the top-selling single-board computer in the U.K.

When was the Nascom-1 launched?

Officially, in January, 1978; that makes it one of the oldest microcomputers. We started delivering the following March.

What was the initial response?

By the end of the day of the launch we had more than 300 units ordered, and paid for, and we still didn't have a working machine to show anyone. That was followed by around 7,000 letters from people wanting to buy or know more about it.

The Post Office wasn't very pleased at having to sort and deliver that kind of mail in a rural backwater. It took us ages to plough through them but we managed to turn around a lot of the enquiries. When we started, no-one could foresee what a success it would be.

Distributors

How many distributors do you have?

We have 12 in the U.K. Some are multiple companies, so there are more retail outlets than that implies. Then there are seven main distributors abroad. In Germany, we have between 15 and 20 retail outlets.

Many of our components are from Nasco and through the semiconductor industry in the U.S. Because of these problems there are no Nascoms for sale in France at the moment. We can never supply enough.

Where is your manufacturing plant?

In Chesham. We are looking at a site in the U.S. and two others in the U.K. There are 25 people working there, out of around 50 in the company. We hope to increase the number in our manufacturing facility to between 80 and 100 within the next two years.

How reliable is the machine?

Very few of our kits or boards are ever returned to us. We have two repair engineers and that's all we need. They can manage to turn them around within a week.

What do you see as the company aim in the immediate future?

We shall end up selling built systems. Everything we sell is in kit form now but our overseas customers want everything built. Because we can't do it at the moment, they are prepared to build their own.

What was the thinking behind the recently-launched Nascom-2?

In no way is the Nascom-2 a replacement for the Nascom-1. Over the 18-month period it became obvious that there is a market for the Nascom-1 for the foreseeable future. There is also a large market, however, for an upgrade version which will have more of a computing bias. Many of the additions necessary to the Nascom-1 are integral to the Nascom-2.

Do you have an in-house design team or do you contract that work?

By the end of this year we aim to have one of the most complete design teams anyone has to offer in this field. We will not be aiming at an end result – a packaged machine. What we want to do is to produce a board with as much flexibility as possible.

As long as we stay with the standard components, this machine will do anything. Since the first was built in 1977, no component has been changed. There are some very good design houses around and we expect to be among them in the next five years.

Do you do much software development?

We do a reasonable amount, mainly in high-level languages and monitors. We get a good deal of material sent to us. We have developed an 8K Basic, Cobol and Pascal – that sort of thing. There are other standard packages which we would buy rather than develop ourselves.

How much have you spent on research and development?

So far, we have spent only £150,000 but next year it will be £500,000 or more. It is low at the moment because we have been sending a good deal of work outside the company. We have seven engineers, all specialists in their own right, who design our boards. We are attracting them because we are doing original research. We will have plenty of new things at the end of the year.

Turnover

What is the company turnover this year?

The estimated turnover from June, 1978 to June, 1979 is £1.5 million. That's in our first year of trading. We estimate that it will be £5 million next year.

How do you see the company as a whole?

I think we are the only British microcomputer company. No-one has any chance of getting close to us. No-one is doing the research we are. We produce microcomputer boards – that's the market we see and we understand it.

We do more than just selling packages. Our competition in Europe is nil but that's all going to change.

How do you see the company's future?

We are producing microcomputer boards – that's the market we see for ourselves. We feel that the Nascom-1 is only half our range and that there's a huge market for our complete computer boards.

Obviously, we shall expand very rapid-

olution
t

ly. We are already looking for more manufacturing space and we are increasing our product range all the time. By the end of 1979 we hope to have one of the most complete design teams of anyone in this field.

We want to be the country's top microcomputer designer and manufacturer, and the way things are going, that day will not be far away.

Our main overseas distributor is in Sweden, where the Nascom-1 has been accepted well. In fact, more than 70 percent of our output goes to Europe.

How many Nascoms have you sold?

So far we've sold 12,000 units worldwide. Last year we delivered 6,000 and in 1979 we estimate that we will ship 14,000. The problem is that we can't make them fast enough to satisfy all our customers.

If we could make 500 a week we could sell them with no difficulty. Shortly we hope to be manufacturing 500 Nascom-1s a month and that inevitably will increase.

Marketing

What is your marketing strategy?

We are badly constricted on the marketing side and we have cut our marketing budget because we do not need to advertise – we have no reason to push our product very heavily. We are swamped with orders, can't get the components fast enough, and we can't produce the machines fast enough.

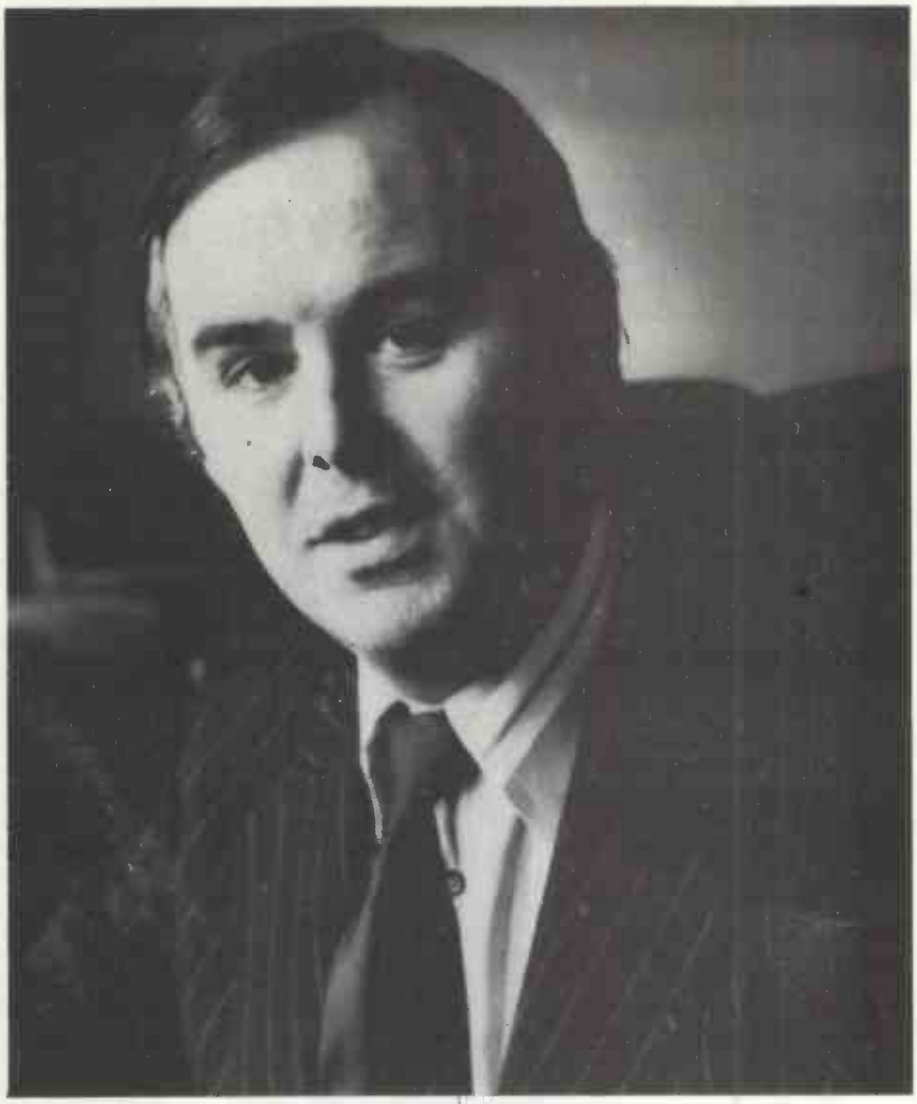
We are looking for a sales manager but he won't have any selling to do; he will have to explain to people why orders are late being delivered and that we can't possibly appoint more distributors for the time being. Three Far East companies want to take distributorships but there's no way we can do that, either. The saving grace of the Nascom-1 is its good value, which shows itself in expanding purchases.

What are the main market areas for the Nascom-1?

The Nascom-1 was created as an industrial board. In the beginning it wasn't fully socketed for various reasons; now it is, so we can add plenty of PCBs and extra chips. We found then that the biggest market area was the industrial user and the hobbyist.

It began as a hobbyist machine but now we sell most to industry, with the rest of our production split between the hobbyist and educational establishments. It is very popular with schools and we will be selling a case for the boards to comply with school safety regulations.

The biggest market we see for Nascom-1 is definitely a board market and we see a huge market for our complete computer boards. OEMs are already buying them and building their own configurations around them.



Kerr Borland.

Six or seven people are producing end-products based on our machine – not necessarily computer products but something totally different, where the computer has played a vital role in production.

In many cases people have built machines and ask us for 50 boards a month for a specific project on which they are working. Big OEMs order them in their thousands for just one project – we have two customers like that. The Nascom-1 is becoming a standard component for many development systems.

We feel that the market area for it will be in expansion boards which make it more acceptable for people who want to use it as a development system to look at a Z-80-based machine. Soon we shall have graphics and a disc controller, too.

It is a low-cost but powerful system, especially attractive for OEMs who want to interface it to other things.

To what do you attribute the success of the machine?

Nascom success is undoubtedly due to our use of the Z-80 processor. Many suppliers have given us a great deal of help as well, especially Mostek, which supplies our processors.

Parts problem

Why have you had problems supplying the Nascom-1?

One major problem is that you can't get the bits. No-one in the chip manufacturing business realised the sheer volume we were going to use. The industry goes through a four-year cycle of boom and disaster. At the moment, we are coming out of a disaster period, hence the lack of parts.

The determining factor of the cycle is the U.S. markets. Forget the Japanese. The Americans assess their cost production and work schedules on their home market; the overseas market is just an extra to them.

If the home market expands, they forget the outside business and we go short of parts. We try to buy as much of the product as we can in the U.S., but we have to get our high-technology parts from the U.S. because they are not made in this country.

(contd. on page 79)

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by Dr. David A. Lien

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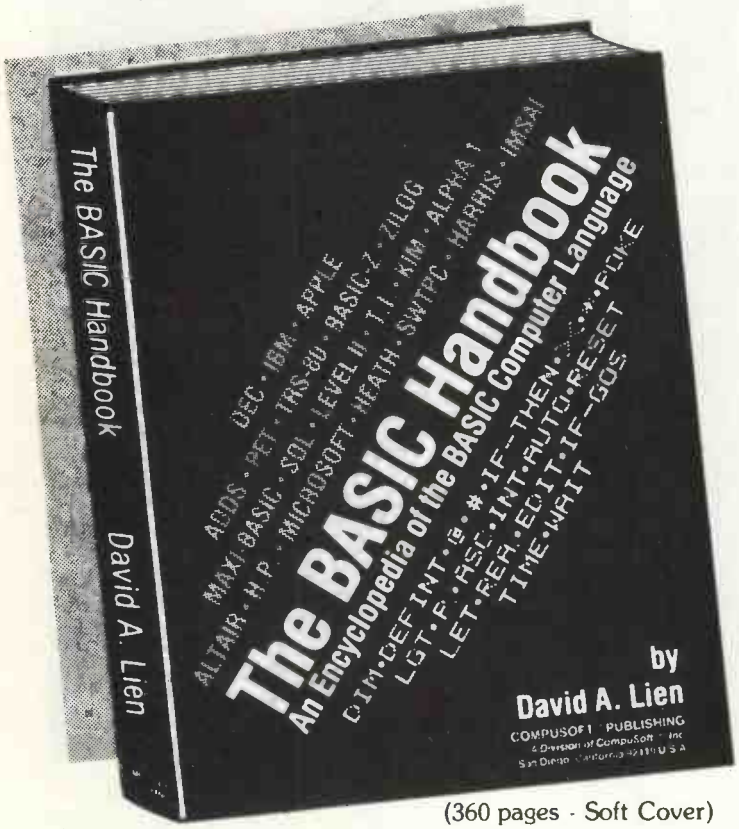

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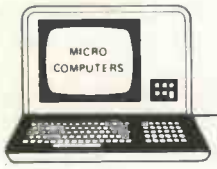

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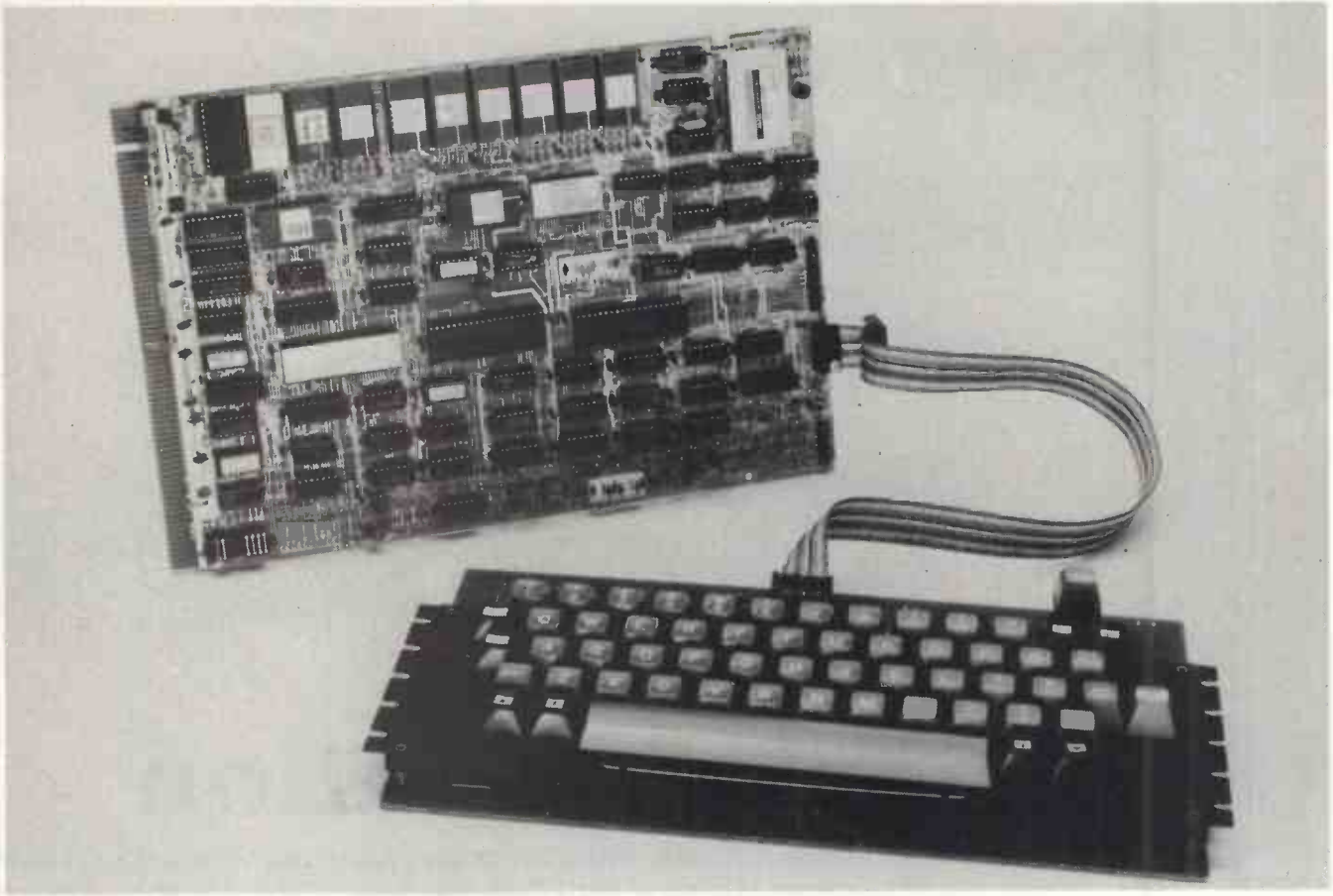


Nascom-2 prototype

THE long-awaited Nascom-2 was launched in April and has emerged, not as a replacement for the Nascom-1, but as an upgrade version which will have more of a computing bias.

It is based on the Z-80A processor – theoretically twice as fast as the Z-80 – with an 8-bit CPU. The hardware consists of a 12in. x 8in. card with all bus lines fully buffered to the Nasbus specification. There is 20K of on-board addressable memory which is made up of 2K Monitor, 1K video RAM, 1K work space/user RAM, 8K Microsoft Basic and 8K static RAM.

It has a new expanded keyboard built specially for Nascom, which uses standard Nascom monitor-controlled decoding.

The new machine uses 8K Basic which offers a high degree of compatibility with other system and programs published in magazines and books should run under Nascom 8K Basic with little or no modification. The language will also run on the Nascom-1.

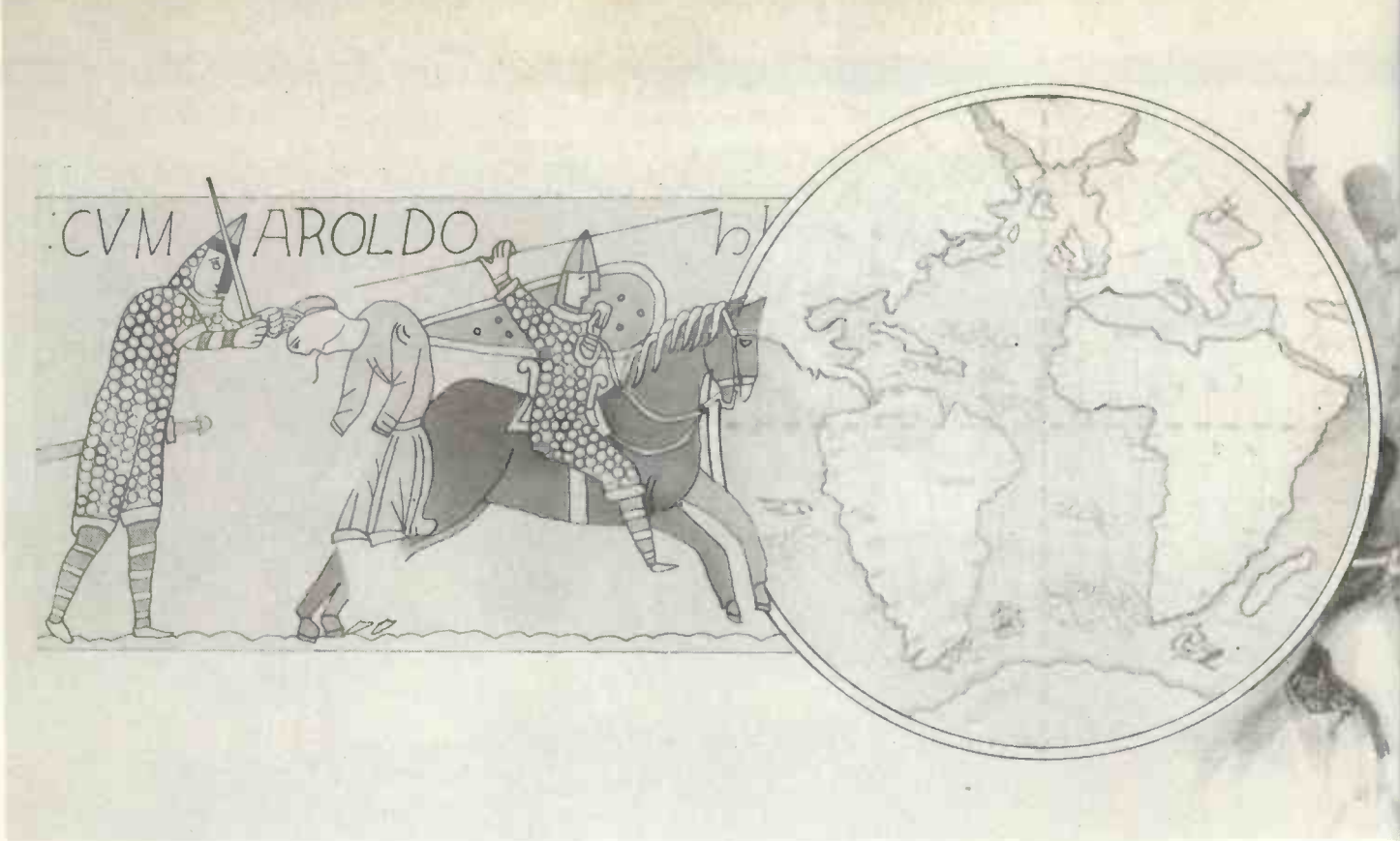
One of the most exciting features of the Nascom-2 is its ability to run with a completely new monitor which has been designed specially for it.

Called Nas-sys I, it incorporates all the features of the Nasbug 2K monitor with many additional functions. It uses a blinking, non-destructive cursor, with on-screen editing. The method of calling routines has been modified and rationalised so that users need only a two-byte RST operation.

It was designed originally to run with the new keyboard but can be used with the Nascom-1 keyboard by using combinations of keys.

ASCII terminals are fully-supported via the serial interface and users can addtheir own I/O drivers via the Nas-sys I/O driver table to support other devices. Forty-two user-accessible RST operations are provided.

The Nascom-2 will cost £295 plus VAT and deliveries will start this month. Two OEMs have already placed orders for the machines and Nascom says "We will satisfy the demands of the U.K. market first."



Historical simulation

Richard Ennals writes about the ideas which won top prize in the schools section of our Christmas competition. The entry was from the history and computer studies departments of Sweyne School, Rayleigh, Essex. Ennals is developing some of his history simulations on the Research Machines 380-Z he won.

AT FIRST SIGHT it might seem far-fetched to use the computer to assist in historical simulations in the classroom of a comprehensive school but I have been brooding on the variety of ideas involved over a period of at least 10 years.

During my own sojourn in a VIth form I became interested in the links between the disciplines. A scholarship to Massachusetts gave me the chance to learn Basic and an introduction to Probability and Decision Theory.

Later, at Cambridge, I spent a year immersed in the linguistic philosophy of Wittgenstein, especially his theories of games and languages. My studies included mathematical logic before I switched to a history degree.

While a student, I wrote and produced a number of plays on historical situations, all starting from the basis of simulation and role-play. Teacher training followed and on teaching practice in Southfields, I developed my first simulation 'kit', based on the United Nations Organisation and how its members handle a series of possible crises.

Based on briefing

My first teaching post, in Mitcham, was in a department whose head, John Waddleton, had considerable skill and experience in simulations; this produced further kits on the House of Commons and the workings of a factory.

No computer facilities were available for these; the simulations were based on the briefing of the individuals, and the free development of the situation by the group in their roles.

Last September, in my present post as head of the history department at Sweyne School, I found an ideal opportunity to develop my ideas further. My colleague, Martin Frampton, shared my interest in games, and I developed a range of new

HOW THE IDEAS WORK

Our use of the computer for history simulations on a set of principles from the classroom teaching situation:

- The logical structure of a computer analogue of a historical situation is similar to the equivalent classroom simulation, with the possible difference that the simulation game normally involves decisions by a number of participants rather than by a single player. So it should be feasible to make use of the computer analogue to enhance the classroom simulation, and vice versa.
- If the appropriate programming and role preparation are provided in advance, the input of data and classroom role-play can be carried-out without over-direction from the teacher.
- The computer can aid the simulation participants in carrying-out historically credible decisions, given the accuracy of information already stored.
- There is philosophically a clear link between mathematical and computer logic, language structure and the rules of games — as outlined, for instance in Wittgenstein's *Philosophical Investigations* and Braithwaite's *Theory of Games as a tool for the Moral Philospher).* This has clear, if undeveloped, practical implications, especially for people like teachers who have the task of explaining complex processes.
- The computer should not be used simply for its own sake of so doing, and it should not perform functions already carried-out adequately by other means. It should help clarify the decision processes involved and enhance the learning experience of the class. It should enable the participants to be aware of irrelation of two or more variables, and the consequences of their combination—hard to convey by conventional means.
- The computer work involved in class should not be too complex, with easily-understood input data and comprehensible conclusions printed-out or displayed on a screen.

kits based on the Russian Revolution, the Age of Discovery, the Wedgwood firm in the Industrial Revolution, the Norman Conquest, and the League of Nations—all for mixed-ability classes.

Next to my classroom at Sweyne is the computer studies room, run by John Ward. I showed him a range of programs I had devised for use in the games; he detailed three able 'O' level students—Andrew Wood, Martin Attwood and Keith Stewart—to help me as part of their computer studies course-work. They came to history lessons where the games were being used, and devised programs to facilitate the simulation process and enhance the students' understanding.

In an evening

Then Ward spotted the competition run by *Practical Computing*. The initial entry was written in an evening but a good deal of hard work was put in by all five of the team in developing the ideas, flowcharts and programs for the final submission, which ran to about 40 pages of typescript.

We have had to work so far with strictly limited access to a time-sharing terminal on-line to the county computer centre but our students have enthusiasm to start work at 7.30 each morning.

Helpful to all

The prize of a Research Machines 380-Z should expand our ability enormously to produce innovative materials for use with our classes, and in other schools. Essex County Council has been encouraging computer education for some years and recommends the 380-Z. It is helping us to modify our rooms to gain the most advantage from this new acquisition for our two departments.

Use of a television screen should enable a whole class, rather than just one individual, to benefit from the output of the computer; and the aim in our historical work is for the computer to become a major classroom teaching aid. *Practical Computing* and Research Machines have given us a chance to show how this can be done.

PUTTING THE PRINCIPLES INTO PRACTICE

Some examples of how the computer can be of use, based on classroom experience with simulation materials devised at Sweyne School.

- **Wedgwood Potteries**
  We use a simulation kit for third-year, mixed-ability secondary students based on Josiah Wedgwood and his pottery firm in the 18th century. Class members are allotted a separate role among the people connected with the Wedgwood Pottery. Each receives a historical briefing on an individual part so that decisions will be historically authentic. A range of Basic programs has been developed to aid the management in planning of wages, prices and research policy. Data input is straightforward, and the printed conclusions go beyond the complexity of reasoning and the calculation of which the students are capable. Participants react to the computer findings, and the game continues. This relies, in part, on simple economic theory and, in part, on the provision of historically-accurate background material.

- **Explorers**
  Second-year, mixed-ability history students have been using a simulation kit based on the Voyages of Discovery in the 15th and 16th centuries; the results have been very encouraging in terms of historical authenticity, the quality of written work and the level of enthusiastic participation. A fifth-year student, Andrew Wood, has written a program which clarifies the process of trading and makes possible many of the authentic variations in commodities and prices. Further programs will clarify the choices between routes, and their consequences, and enable the 'explorers' better to plan their strategies in the light of detailed historical knowledge.

- **Russian Revolution**
  Two fifth-year students, Keith Stewart and Martin Attwood, have devised a program based on decision theory to analyse the choices facing a Russian revolutionary in 1917. This will enhance the effectiveness of our existing fourth-year simulation kit for the Revolution. As with the other kits, each member of the class is allotted a different role through whose eyes they see the events of 1917 as they unfold. Properly used, the computer can enhance the authenticity of the simulation and throw the decision involved into sharper focus, so that a complex historical situation can be brought to life in the classroom.

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Man Eater

Cassette for Commodore Pet only. Available from Games Workshop, 1 Dalling Road, Hammersmith, London W6 0DJ Tel: 01-741 3445 Price, £4.

HAVING seen some of the other offerings from Games Workshop, I found this a little disappointing. The idea behind the game is reasonable and the method of playing looks to be well-designed but the layout of the board ruins what might have been a good game.

The aim is to surround a shark with a set of swimmers so that it cannot move and eat a swimmer. As the shark can eat only diagonally and move orthogonally – up, down, right or left – this seems easy. The problem is that the shark is visible only at the beginning and when it has just eaten a swimmer. Any two men can be moved in one turn by using the grid reference system on the board.

Cramped

It is there that the main criticism applies. The board is cramped into the top lefthand corner of the screen and is much too small for comfort. I found I was having to squint to decide exactly where my swimmer was and where I was moving him. As the rest of the board was used only to display prompts and error messages, I found this rather irritating. Even more annoying was the fact that if you entered a move and pressed "return" – the "return" not being needed – it moved your man and then displayed "Co-ordinate not on the board".

I feel this game could be good but it would take a major re-think of the layout and more careful programming.—K.F.

File Handling

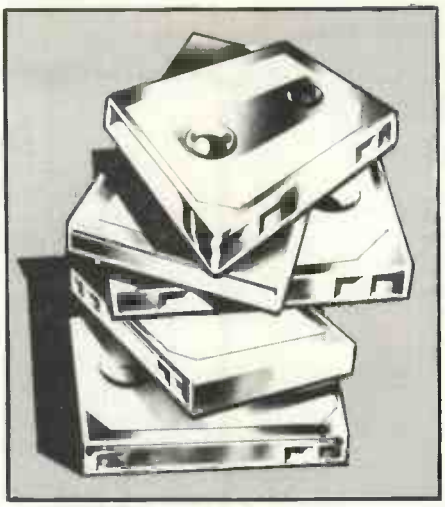
Cassette for Tandy TRS-80. Manufactured by Circle Enterprises Inc., Box 546, Groton, CT 06340.

THIS PROGRAM is very easy to operate and spells-out everything for you, taking only minutes to learn. Perhaps its simplicity is its greatest drawback because, despite its name, it is little more than a telephone book.

It has the capacity for 100 entries per file and the information you can put on each file is name, address, telephone number and birthday. We found that the last item was in most cases unnecessary but could be useful for, say, a small insurance firm.

The program begins by giving a menu of five options – input data, list names in file, search/edit, record on cassette and exit from program. You punch the corresponding number to each of these functions, from 0-4.

The input data allows you to create files; listing names in the file gives the subjects in alphabetical order with tele-



phone numbers; the search/edit facility gives several options. You can select the next or previous name in the file to the one you may already have chosen, search for the file by pressing the first letter or two of the surname.

Easy editing

Editing is easy. All you do is select the relevant file and take the line number to be edited, type in the whole line at the top of the screen with the correction, press the enter key, and all is done. Finally, by using the delete function you can erase anyone from your file completely.

It is unfortunate that the program will not identify a file by anything other than the surname of the person. If you forgot the name probably you would have to run through more than 50 entries to find it.

The program is very fast for putting a different format on to the screen and response times are a point in its favour. Sorting the names automatically into alphabetical order is another plus for the program.

A handy piece of software if you want to record names and telephone numbers but not much use if you want a file with a great deal of detail on it.—K.F.

Space Fighter

Cassette for Tandy TRS-80, by A. J. Harding. Available from most Tandy dealers. Price: £9.95.

YET another program to take you into the outer galactic regions, this time as a space fighter pilot. You meet five enemy ships and when they are in laser sights, you shoot them down.

You determine how many missiles you have to fire and there are three levels of play which you also choose. There is no time limit on the game, which is a pity, as this type of game lends itself to beating the clock.

Loses appeal

When you hit a ship the screen goes into a rather elaborate explosion simulation. Then the sequence starts again and the ship moves slowly from the left into your sights. By the way, you can destroy a ship only if you hit it on the nose – nowhere else counts.

The bottom of the screen displays how many ships you have destroyed and the number of missiles remaining. When you have eliminated all the ships, the computer congratulates you and tells you how many shots you had left. If you use all your missiles without destroying the enemy, you are advised to abandon ship.

Unfortunately, once you have mastered the technique of destroying the ships – after about half an hour's play – the game quickly loses its appeal. If a little more of the competition element had been included with say, a clock or faster-moving ships, it would have been more enjoyable.—K.F.

Android Nim

Cassette for Tandy TRS-80. Manufactured by 80-US Software, PO Box 7112, Tacoma, Washington, U.S.A.

ANDROID NIM is based on all the other Nim games but with a difference – this one has sound and excellently-produced graphic robots.

All you need to do to receive the sound is plug-in the cord which goes to the AUX of your cassette recorder into any audio amplifier and you will hear the robots shrieking when they are about to be eliminated, and also the sound of the laser which takes them off the screen.

The idea is to remove the last Android, excluding the controllers which appear at the left of the screen. There is one for each of the three rows of Androids to be eliminated. All you have to do is press the number of the row – the top row is one – and then the number of Androids you wish to eliminate.

Reminder

You have the choice of whether to start or allow the computer to start and your turn is indicated by a flashing display and sound. If you wait 45 seconds without making a move, you will be reminded in the same fashion that it is your turn.

The graphics were truly excellent on this tape but the response time was agonisingly slow. Once you had keyed-in your move all the Androids would move their heads one by one to look at the poor victim who was about to be zapped. This took a long time and was very infuriating.

The worst thing about the program is that we couldn't win. Time and again we tried, even following the pattern of the computer during its last game, but it was impossible.

If you have two hours to spare and you manage to beat the Android executioners, let us know – we would like to know how it's done.—K.F.

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CONTENTS

6 COMPLETE EXAMPLE PROGRAMS

MCDXCII

A PROGRAM TO CONVERT **ROMAN** TO MORE FAMILIAR NUMBERS.

THIS EXAMPLE DEMONSTRATES THE USE OF A *SYMBOL-STATE* TABLE ⇔ A STANDARD TOOL IN PROGRAMMING ⇔

ASSUME ALL VALID ROMAN NUMBERS ARE COMPOSED OF THE FOLLOWING ELEMENTS ⇔ NEVER MORE THAN ONE FROM EACH CONSECUTIVE BOX:

THOUSANDS	HUNDREDS		TENS		UNITS	
M = 1000	C = 100	D = 500	X = 10	L = 50	I = 1	V = 5
MM = 2000	CC = 200	DC = 600	XX = 20	LX = 60	II = 2	VI = 6
MMM = 3000	CCC = 300	DCC = 700	XXX = 30	LXX = 70	III = 3	VII = 7
ARBITRARY UPPER LIMIT	CD = 400	DCCC = 800	XL = 40	LXXX = 80	IV = 4	VIII = 8
	CM = 900		XC = 90		IV = 4	IX = 9

(IT SEEMS CLASSICAL ROME SELDOM USED THE *SUBTRACTIVE* PRINCIPLE INHERENT IN IV, PREFERRING IIII, BUT THIS PROGRAM REFUSES TO HANDLE MORE THAN THREE CONSECUTIVE LETTERS OF THE SAME KIND.)

THE LOGIC OF THE PROGRAM IS CONTAINED IN THE FOLLOWING SYMBOL-STATE TABLE:

		"SYMBOL"						
		M	D	C	L	X	V	I
STARTING STATE →	01	1000 & 02	500 & 03	100 & 09	50 & 05	10 & 10	5 & 07	1 & 11
	02	1000 & 02	500 & 03	100 & 09	50 & 05	10 & 10	5 & 07	1 & 11
	03	ERROR	ERROR	100 & 09	50 & 05	10 & 10	5 & 07	1 & 11
	04	ERROR	ERROR	100 & 04	50 & 05	10 & 10	5 & 07	1 & 11
	05	ERROR	ERROR	ERROR	50 & 06	10 & 10	5 & 07	1 & 11
	06	ERROR	ERROR	ERROR	ERROR	10 & 06	5 & 07	1 & 11
	07	ERROR	ERROR	ERROR	ERROR	ERROR	5 & 08	1 & 11
	08	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	1 & 08
	09	800 & 05	300 & 05	100 & 04	50 & 06	10 & 10	5 & 08	1 & 11
	10	ERROR	ERROR	80 & 07	30 & 07	10 & 06	5 & 08	1 & 11
	11	ERROR	ERROR	ERROR	ERROR	8 & 00	3 & 00	1 & 08

"STATE"

TAKE THE ROMAN NUMBER **CIX** AS AN EXAMPLE: BEGIN WITH A VALUE OF ZERO. YOU ARE IN *STATE* 01 (WHERE THE ARROW IS) SO LOOK DOWN FROM *SYMBOL* **C** AND FIND 100&09 WHICH SAYS "ADD 100 TO THE VALUE & CHANGE *STATE* TO 09". SO ADD 100 TO ZERO & MOVE THE ARROW TO 09. NOW LOOK DOWN FROM *SYMBOL* **I** AND FIND 1&11; SO ADD 1 TO THE VALUE (100+1=101) & MOVE THE ARROW TO *STATE* 11. FINALLY LOOK DOWN FROM *SYMBOL* **X** AND FIND 8&00; SO ADD 8 TO THE VALUE (101+8=109). THE 00 MEANS YOU'VE FINISHED.

THE TABLE IS PART OF THE COMPUTER PROGRAM AND PREPARED AS SHOWN BELOW. TO SAVE SPACE EACH ELEMENT OF A(,) IS MADE TO CONTAIN BOTH THE NUMBER TO BE ADDED *AND* THE NUMBER OF THE NEW STATE ⇝ THUS 5&07 BECOMES 100*5+07 = 507. THE ENTRIES SAYING "ERROR" ARE ENTERED AS −1.

```
10   REM     DECODE ROMAN NUMERALS
20   DIM     A(11,7),  C$(7)
30   REM  EACH ELEMENT = 100*ADDITION + NEWSTATE
100  REM          M,      D,      C,     L,    X,    V,   I
110  DATA  100002,  50003,  10009,  5005, 1010,  507, 111
120  DATA  100002,  50003,  10009,  5005, 1010,  507, 111
130  DATA      -1,     -1,  10009,  5005, 1010,  507, 111
140  DATA      -1,     -1,  10004,  5005, 1010,  507, 111
150  DATA      -1,     -1,     -1,  5006, 1010,  507, 111
160  DATA      -1,     -1,     -1,    -1, 1006,  507, 111
170  DATA      -1,     -1,     -1,    -1,   -1,  508, 111
180  DATA      -1,     -1,     -1,    -1,   -1,   -1, 108
190  DATA   80005,  30005,  10004,  5006, 1010,  508, 111
200  DATA      -1,     -1,   8007,  3007, 1006,  508, 111
210  DATA      -1,     -1,     -1,    -1,  800,  300, 108
220  REM
230  MAT READ A(11,7)
240  DATA  "M",  "D",  "C",  "L",  "X",  "V",  "I"
250  READ  C$(1), C$(2), C$(3), C$(4), C$(5), C$(6), C$(7)
260  REM
```

THE TEXTUAL ARRAY C$() IS NOW LIKE THIS:

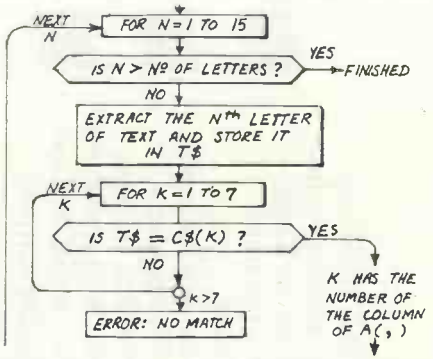
C$(1)	C$(2)	C$(3)	C$(4)	C$(5)	C$(6)	C$(7)
M	D	C	L	X	V	I

IDEALLY WE SHOULD NOW "INPUT" A SINGLE TEXT LIKE "MCDXCII" AND EXTRACT ITS LETTERS ONE BY ONE FOR MATCHING IN ARRAY C$( ). UNFORTUNATELY *BASICS* CAN'T AGREE HOW TO DO IT. SUPPOSE YOU HAD THIS TEXT:

```
LET P$ = "FRUSTRATION"
```

& WANTED TO PUT "RAT" INTO A$; HERE ARE JUST *SOME* WAYS TO DO IT.

```
LET A$ = SUBSTR(P$, 6, 3)
LET A$ = P$(6,8)
LET A$ = STR(P$, 6, 3)
LET A$ = MID(P$, 6%, 3%)
LET A$ = EXT$(P$, 6, 8)
LET A$ = P$(:6,3)
LET A£ = SUB£(P£, 6, 3)
```



SO WE SHALL BE CONTENT TO "INPUT" LETTERS ONE BY ONE ⇝ SEE OVERLEAF.

HERE IS THE MAIN BODY OF THE PROGRAM FOR DECODING ROMAN NUMERALS:

```
300  REM   MAIN PROGRAM STARTS
310  PRINT "TYPE ROMAN NUMBERS LETTER BY LETTER"
320  PRINT "END NUMBERS WITH *  END RUN WITH **"
330  PRINT "NUMBERS ENDING IV & IX NEED NO *"
340  PRINT
350  PRINT "START"
360  LET  R=1
370  LET  M=0
380  LET  C=0
390  LET  P=0
400  INPUT  T$
410  IF  T$="**"  THEN  610
420  IF  T$="*"  THEN  580
430  FOR  K=1 TO 7
440  IF T$=C$(K) THEN 480
450  NEXT K
460  PRINT "CRAZY ROMAN NUMBER"
470  GO TO  340
480  LET  X=A(R,K)
490  IF X<0  THEN 460
500  REM  ENSURE ONLY 3 OCCURRENCES OF ANY 1 LETTER
510  LET  C=(1-ABS(SGN(K-P)))*(1+C)
520  IF  C>2  THEN 460
530  LET  P=K
540  REM  ACCUMULATE RESULT IN M; CHANGE STATE R
550  LET  M=M+INT(X/100)
560  LET  R=X-100*INT(X/100)
570  IF  R<>0  THEN  400
580  REM  PRINT THE RESULT
590  PRINT  M
600  GO TO  340
610  END
```

INITIAL "STATE" IN THE TABLE

ACCUMULATE RESULT IN M

COUNT OCCURRENCES OF IDENTICAL CONSECUTIVE LETTERS

"PREVIOUS" LETTER

END OF RUN

PRINT ACCUMULATED VALUE IN M

NEW START

PICK UP ELEMENT FROM TABLE

-1 IN TABLE MEANS ERROR

IF "PREVIOUS"="CURRENT" THEN C=C+1 ELSE C=0

SET "PREVIOUS" TO "CURRENT"

1ST PART OF ELEMENT

2ND PART = NEW STATE

INPUT NEXT LETTER

NEW START

```
RUN

TYPE ROMAN NUMBERS LETTER BY LETTER
END NUMBERS WITH * END RUN WITH **
NUMBERS ENDING IV & IX NEED NO *
START
? M
? M
? I
? *
 2001
```

```
START
? M
? C
? M
? L
? X
? X
? X
? I
? V
 1984

START
? V
? *
 5

START
? **
```

NO * BECAUSE NUMBER ENDS IN IV

END OF RUN

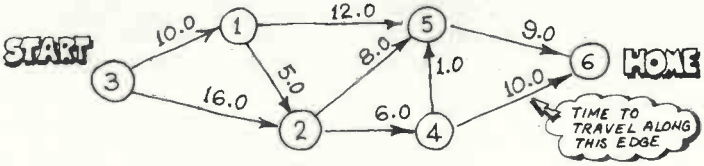
IN THIS EXAMPLE THE FIRST PART OF EACH ELEMENT OF THE SYMBOL-STATE TABLE IS SIMPLY A NUMBER TO BE ADDED INTO VARIABLE "M". IN MORE SERIOUS APPLICATIONS THIS WOULD BE THE LINE NUMBER OF A SUBROUTINE. AFTER PICKING UP AN ELEMENT (AS AT LINE 480) THERE WOULD BE AN "ON" INSTRUCTION CAUSING A JUMP TO THE PARTICULAR SUBROUTINE SELECTED BY THAT ELEMENT. AFTER RETURNING FROM THE SUBROUTINE THERE WOULD BE AN INSTRUCTION CAUSING A CHANGE OF STATE JUST AS THAT ON LINE 560.

CHAPTER 6

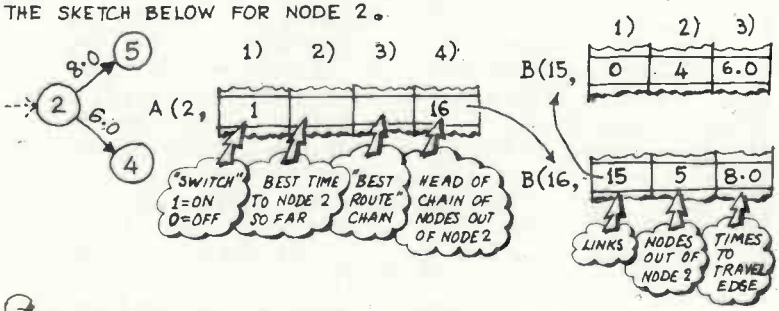
BEST WAY HOME

A PROBLEM COMMON TO INDUSTRY AND COMMERCE.

HERE IS AN EXAMPLE OF AN "ALGORITHM" (COMPUTER JARGON FOR "METHOD") BY WHICH YOU CAN TRACE THE QUICKEST ROUTE THROUGH A NETWORK OF "NODES" AND "EDGES". (ANOTHER APPLICATION OF THE TECHNIQUE SHOWN IS "CRITICAL-PATH ANALYSIS".) THIS ALGORITHM WORKS AS LONG AS THERE IS NO MORE THAN ONE EDGE IN ONE DIRECTION BETWEEN ANY TWO NODES.



THIS IS HOW IT WORKS. YOU KEEP TRACK OF THINGS AS SHOWN IN THE SKETCH BELOW FOR NODE 2.



STARTING AT NODE 3 VISIT EACH NODE IN TURN ⇝ 3, 4, 5, 6, CONTINUING ROUND AGAIN ⇝ 1, 2, 3, 4, 5, 6, 1, 2, *etc.* UNTIL ALL THE "SWITCHES" ARE "OFF". AT EACH NODE DO THE FOLLOWING ⇜ AS DESCRIBED FOR NODE 2 :

- ☆ LOOK AT THE SWITCH IN A(2,1). IF THIS IS "OFF" THEN GO ON TO THE NEXT NODE. IF IT IS "ON" THEN :
- ☆ PICK UP THE BEST TIME SO FAR ; THIS IS IN A(2,2).
- ☆ USE THE HEAD OF CHAIN IN A(2,4) TO START LOOKING AT ALL NODES RUNNING OUT OF NODE 2. FOR EACH LINK IN THE CHAIN DO THE THINGS DESCRIBED BELOW WITH SPECIFIC REFERENCE TO NODE 5 :

- PICK UP THE NODE NUMBER (INITIALLY THIS IS 5).
- PICK UP THE TIME TO TRAVEL ALONG THE EDGE TO THAT NODE (INITIALLY 8.0) AND ADD THIS TO THE TIME ALREADY PICKED UP FROM A(2,2) TO GIVE T; (THE TIME TO REACH NODE 5 VIA NODE 2).
- CONSULT A(5,2) TO SEE IF YOU HAVE JUST FOUND A BETTER ROUTE. IF SO :
  - SWITCH "ON" AT A(5,1).
  - REPLACE OLD BEST TIME A(5,2) WITH T.
  - PUT NODE NUMBER 2 INTO A(5,3) THUS BUILDING A CHAIN THROUGH NODES ON THE BEST ROUTE.

HAVING COMPLETED WORK AT EACH NODE, *SWITCH OFF* THAT NODE.

ARRAYS A(,) & B(,) MUST BE PREPARED BEFORE WORKING ROUND THE NODES AS DESCRIBED ABOVE. ALL THE SWITCHES MUST BE SWITCHED ON, SOME IMPOSSIBLY HIGH JOURNEY TIMES PUT INTO THE SECOND COLUMN OF A(,), AND EVERY NODE MUST BE LINKED TO THE NODES RUNNING OUT OF IT. THE JOURNEY TIME TO THE STARTING NODE MUST BE SET TO ZERO.

```
10  REM  QUICKEST WAY HOME: DEMONSTRATE ALGORITHM ONLY
20  REM  (DATA NOT CHECKED FOR ABSURDITIES)
30  REM  ALLOW FOR 50 NODES AND 120 EDGES
40  DIM  A(50,4), B(120,3)
50  PRINT "NO. OF NODES, NO. OF EDGES, START NODE, HOME NODE"
60  INPUT        N,          E,     S,        H
70  FOR I = 1 TO N
80  LET  A(I,1) = 1          <- SWITCH ON
90  LET  A(I,2) = 1000000    <- VERY HIGH TIME
100 LET  A(I,3) = 0          <- CLEAR HEADS
110 LET  A(I,4) = 0             & ROUTE CHAIN
120 NEXT I
130 LET  A(S,2) = 0          <- CLEAR TIME AT STARTING NODE
```

FOR THE PROBLEM ILLUSTRATED OPPOSITE THE FIRST LINE OF INPUT DATA WOULD BE: ? 6, 9, 3, 6 AND ARRAY A(,) WOULD BECOME:

	1)	2)	3)	4)
A(1,	1	1000000	0	0
A(2,	1	1000000	0	0
A(3,	1	0	0	0
A(4,	1	1000000	0	0
A(5,	1	1000000	0	0
A(6,	1	1000000	0	0

- PICK UP THE NODE NUMBER (INITIALLY THIS IS 5).
- PICK UP THE TIME TO TRAVEL ALONG THE EDGE TO THAT NODE (INITIALLY 8.0) AND ADD THIS TO THE TIME ALREADY PICKED UP FROM A(2,2) TO GIVE T; (THE TIME TO REACH NODE 5 VIA NODE 2).
- CONSULT A(5,2) TO SEE IF YOU HAVE JUST FOUND A BETTER ROUTE. IF SO :
  - SWITCH "ON" AT A(5,1).
  - REPLACE OLD BEST TIME A(5,2) WITH T.
  - PUT NODE NUMBER 2 INTO A(5,3) THUS BUILDING A CHAIN THROUGH NODES ON THE BEST ROUTE.

HAVING COMPLETED WORK AT EACH NODE, *SWITCH OFF* THAT NODE.

ARRAYS A(,) & B(,) MUST BE PREPARED BEFORE WORKING ROUND THE NODES AS DESCRIBED ABOVE. ALL THE SWITCHES MUST BE SWITCHED ON, SOME IMPOSSIBLY HIGH JOURNEY TIMES PUT INTO THE SECOND COLUMN OF A(,), AND EVERY NODE MUST BE LINKED TO THE NODES RUNNING OUT OF IT. THE JOURNEY TIME TO THE STARTING NODE MUST BE SET TO ZERO.

```
10  REM  QUICKEST WAY HOME: DEMONSTRATE ALGORITHM ONLY
20  REM  (DATA NOT CHECKED FOR ABSURDITIES)
30  REM  ALLOW FOR 50 NODES AND 120 EDGES
40  DIM  A(50,4), B(120,3)
50  PRINT "NO. OF NODES, NO. OF EDGES, START NODE, HOME NODE"
60  INPUT        N,          E,     S,          H
70  FOR I = 1 TO N
80  LET  A(I,1) = 1          <- SWITCH ON
90  LET  A(I,2) = 1000000    <- VERY HIGH TIME
100  LET  A(I,3) = 0
110  LET  A(I,4) = 0         <- CLEAR HEADS & ROUTE CHAIN
120  NEXT  I
130  LET  A(S,2) = 0         <- CLEAR TIME AT STARTING NODE
```

FOR THE PROBLEM ILLUSTRATED OPPOSITE THE FIRST LINE OF INPUT DATA WOULD BE: ? 6, 9, 3, 6 AND ARRAY A(,) WOULD BECOME:

	1)	2)	3)	4)
A(1,	1	1000000	0	0
A(2,	1	1000000	0	0
A(3,	1	0	0	0
A(4,	1	1000000	0	0
A(5,	1	1000000	0	0
A(6,	1	1000000	0	0

HERE IS THE MAIN PART OF THE PROGRAM. VARIABLE K COUNTS THE NUMBER OF TIMES NODE 1 IS PASSED WHILST CYCLING THROUGH THE NODES. BUT K IS SET BACK TO ZERO IF A CHANGE IS MADE TO THE ROUTE. THUS WHEN K GETS TO 2 ALL SWITCHES ARE OFF AND THE SOLUTION CAN BE PRINTED.

```
230  LET I=S                    <- START AT NODE S
240  GO TO 320
250  LET I = I+1                <- NEXT NODE
260  IF I <= N THEN 300
270  LET I = 1                  <- BACK TO NODE 1
280  LET K = K + 1              <- COUNT THE CYCLES
290  IF K > 1 THEN 440
300  REM
310  IF A(I,1) = 0 THEN 250     <- IF SWITCH IS OFF
320  LET J = A(I,4)
325  IF J = 0 THEN 420
330  LET K = 0                  <- RESET CYCLE COUNT
340  LET T = A(I,2) + B(J,3)    <- T = TIME TO NODE L VIA NODE I
350  LET L = B(J,2)
360  IF A(L,2) < T THEN 400
370  LET A(L,1) = 1             <- SWITCH ON NODE L
380  LET A(L,2) = T             <- REPLACE TIME TO L
390  LET A(L,3) = I             <- ADD LINK TO ROUTE CHAIN
400  LET J = B(J,1)
410  IF J <> 0 THEN 340
420  LET A(I,1) = 0             <- SWITCH OFF NODE I
430  GO TO 250
440  REM  PRINT RESULT
450  PRINT "QUICKEST WAY FROM";S;"TO";H;"TAKES";A(H,2);"THRU"
460  PRINT H;
470  LET X=A(H,3)               <- HOME LINK OF ROUTE CHAIN
480  IF X=0 THEN 520
490  PRINT X;
500  LET X = A(X,3)
510  GO TO 480
520  PRINT
530  END
```

RUNNING THIS PROGRAM WITH THE DATA SHOWN OPPOSITE PRODUCES THE RESULT:

```
QUICKEST WAY FROM 3 TO 6 TAKES 31 THRU      <- UNITS OF TIME
6 5 4 2 1 3
```

AT THE END OF A RUN THE SECOND COLUMN OF A(,) STORES THE QUICKEST TIMES FROM NODE S TO ALL OTHER NODES IN THE NETWORK.

Introducing Communications Protocols

by Logica; published by NCC Publications, 1978; A5, 83 pages (softback); £5.50

LOGICA is one of the top UK consultancies and its speciality is data communications; both are good qualifications for a compact and fact-filled introduction like this.

The book begins by providing the background to the growth of communication needs. It lays great emphasis on the fact that good computer systems should not grow but should allow for possible expansion and connection into sophisticated networks. That probably doesn't apply to the smaller system but if you're investing a six-figure sum you ought to bear it in mind.

Although many data transmission techniques exist, the underlying principles dictating protocol requirements are always similar and must include message format and protocol procedures so that a meaningful dialogue can ensue.

Security aspects

The protocol must also ensure that the security aspects are dealt with properly and so the book describes vertical redundancy checks, block checks and cyclic redundancy checking.

There is a brief discussion of the major protocols available from computer manufacturers, including the IBM, SNA and the Digital Equipment DECnet architectures. Of particular use is a section on the new European standard X25 protocol for public switched networks. Although not a definitive guide to X25, Logica manages to provide a useful overview which should be a solid basis to further research.

The book also provides an extensive glossary and bibliography which should enable the reader quickly to supplement these areas of special interest.

The book suffers from having been written, one assumes, by a variety of people in a hurry, and consequently proceeds in jumps and starts, but the information contained in its few pages are of immense practical use.

Conclusion

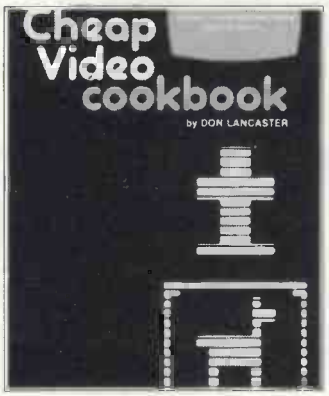
● An extremely useful and well-written book, low on waffle and high on information content, and geared to the computing professional who needs to grasp the concepts and need for communications protocols quickly.

Cheap Video Cookbook

by Don Lancaster; published 1978 by Howard W. Sams – handled here by Prentice Hall International; A5 paperback, 256 pages; £6.55.

ANOTHER offering from Lancaster, this time not so cheap but certainly informative and, as always, well-written. Lancaster has the kind of enthusiasm so often lacking in technical texts.

Cheap Video Cookbook is something of a departure from his familiar Cookbook series on RTL, TTL and CMOS in that it's the first to cover a



specific microprocessor application – and, indeed, a particular hobby microcomputer kit, the Kim-1.

Briefly, the text explains the theory behind the construction of an add-on module for the Kim-1 which provides character and graphics displays on a suitably-modified TV set.

Comprehensive

The book divides easily into four parts, the first expounding the advantages of a microprocessor-based approach and explaining two special design concepts, the upstream tap – a means of allowing the graphics software to access central memory – and the SCAN micro instruction, which ensures high-speed output of generated characters.

There's a comprehensive section on designing and programming the necessary software, for which you'll need a fairly good knowledge of the architecture and instruction set of the 6502. Following that Lancaster has a "getting-it-together" chapter on hardware which won't tax your brain too much.

Lastly, he offers a short section on transparency utilising spare processor time to run a user's program. This is rather disappointing, as it hints at what to do instead of describing any specific transparency techniques; still, it is but a minor complaint.

There are two potential pitfalls for the U.K. reader using this Stateside book. One is at the components level. In a sense the book is a construction manual, so you'll need the chips – two are rather specialised – and the American-made PCB. Another is the problem of adapting the design ideas for other microprocessors more popular with British-based kit manufacturers, notably the Zilog Z-80, as used for the Nascom.

Drive and humour

In fact, for various reasons, your reviewer is convinced that the Z-80 is the only microprocessor other than those from the 6800/6502 family which could easily support the suggested design. The display (TV set) will also need modification, which is curious since it would have been easy to add-in a UHF modulator to the basic design.

Don't be deterred, though. The book is a veritable mine of information and it is written with the kind of drive and humour one doesn't find in corresponding British texts.

Mercifully, it's also free of the kind of condescending writing which seems so much in vogue nowadays. All credit to Lancaster for realising that we don't need to be told, yet again, how dynamic RAM works – how refreshing.

Conclusion

● A specialist book and certainly not for the software pundit. You'll need to be very practical to get the most from the text, but the technical aspects are so well presented and the writing so persuasive that I defy you not to take up your soldering iron and work. – A.W.

Do-It-Yourself Computing

Compiled and edited by Martin Banks; published 1978 by Input Two-Nine Ltd; limp convers, 119 pages; £9.95

If you want to buy a technical book it's for a purpose. You want to obtain some information. The more specialised the information you want, the harder it will be to find a book to meet your requirements.

Conversely, if you choose a book at random from a shelf it should be possible to say from the contents what kind of learning need it would fulfill.

This is not a happy book. No matter which way you look at it, it's hard to imagine any need it could satisfy, other than the financial one. It is certainly expensive. Of its nominal 119 pages excluding introduction, quotes from previous reviews and a poor index – there are at most the equivalent of 90 pages of print. As they are in typewriting style, the large-format pages carry only the equivalent of a paperback of 100 pages.

The book is divided into sections dealing with State-of-the-Art, The Personal Computer in Business, Software and the Personal Computer and The Industry View. In all there are 13 articles, of which at least five are written by personnel of various companies.

Supplement A is an article from *Practical Computing* of December, 1978, reprinted without even the benefit of editing to remove such redundancies as the fact that the Pet "was reviewed in our October issue" and "In forthcoming issues of *Practical Computing* we shall examine the three approaches to buying a business system".

Supplement B is another reprint, a glossary of microcomputer terms from the material Digital Equipment issues with the LSI-11.

Conclusion

● Definitely not recommended. An expensive way to obtain a small amount of information. The contents are definitely lightweight. If you know the difference between a Pet and a poodle you won't learn anything.–R.G.

Printer tip

WE HEARD this one from reader Benny Thomson of Norwood. It looks good for business users and others writing frequently to a printer. It seems you can PEEK at (decimal) location 14312 to find the line printer status. If it contains value 63, it is on and ready to print; 233 means 'on but unavailable'; and 255 signifies 'off'.

The point is that programs which do a great deal of printer output can grind to a halt if the printer is not available. So Thomson offers this subroutine to be called before an LPRINT:

```
9000 C = PEEK (14312)
9010 IF C = 63 RETURN
```

and the rest of the subroutine takes you away to do something else before trying again.

Business user's view

THE AUTHOR works for a large commercial group which makes extensive use of time-sharing bureaux but which is now interested in the idea of cheap microcomputers for its staff. Company policy dictates that the writer remains anonymous.

ALONG with many others, at the Tandy presentations in London, we saw only the Level 1 TRS-80; we were impressed and subsequently we bought a 16K 2 Level 2 machine at a local Tandy store.

It has been in constant use since then and its performance has been sufficiently impressive for it now to have a major impact on our entire approach to the use of computer-based techniques.

That is not to say there have not been problems. First, Level 2 is essential for sensible computing, though you need a good grasp of Basic before you can use the manual – in contrast to the superb Level 1 introduction.

Twice as fast

With the Level 2 system, the cassette tape is read and written twice as fast as Level 1; this must be close to the reasonable limits of a domestic cassette recorder, as our system has been very prone to load errors, in spite of the fact that we use digital-quality tapes and have had our cassette recorder modified to reduce hum and to improve the control of the mechanism. In our view, both are absolutely essential modifications, though load errors have still not been eliminated.

It is critical to check volume levels and stay at the one which is acceptable. We clean the tape-heads each day and have a tape-head de-magnetiser. As a matter of procedure we save four copies of long programs and we always use CLOAD? to check the integrity of each copy.

There has also been a distinct lack of software until recently, a situation which is now improving. We have bought a renumbering system and are about to obtain the Electric Pencil word processor – it is difficult to appreciate the full power of this software because it is all priced very economically.

TANDY FORUM is devoted to the Tandy TRS-80. We will be using it to pass on news about the TRS-80 and its supplier and product announcements from Tandy and other vendors of compatible equipment. Above all, these are pages for users, and would-be users, of this personal computer. We want you to send tips, queries, moans and comments, and we want this page to become a market-place for TRS-80 information.

Our only other major complaint is that without the disc system we are limited to one system routine at a time and there can be a noticeable impact on memory. Still, one can at least assess the pros and cons – which is of course the Tandy intention – and then make the disc upgrade.

Startling

We were fortunate that we already had a Texas Instruments Silent 700 ASR, a 30cps thermal printer terminals. For £50 we could buy a TRS 232 interface to link it to the TRS-80. As the associated software diverts the print output to the cassette recorder leads, we obtain hard-copy on this terminal without the Tandy expansion interface. Even more startling to us is the claim that the associated software can drive a printer at 9,600 baud – so much for the 1,200 baud limitation that the bureau was using.

Two interesting considerations emerged from the interface exercise. We had already discovered that there was a high degree of overlap between the TRS-80 Basic and that of the time-sharing bureau. This overlap provided the mechanism for using the TRS-80 for program development. The cassettes on the Silent 7000 ASR provided the means of capturing this program and transmitting the tested program to the bureau.

We consider that the TRS-80 can also work as a fairly sophisticated data-capture device working in a similar manner. Given that intelligent terminals cost £10,000 or more, the TRS-80 can provide many of these features – arguably with more processing power – at an impressively low cost. If we can obtain a two-way RS232 interface we will be able to load both data and programs into the TRS-80; that will duplicate all the features of an intelligent terminal completely.

Characters lost

The second point is that we were able to alter the associated software for the RS232 interface. With program lines greater than the 80-character print width of the Silent 700, characters were lost while the carriage return was operating. This also occurs with the time-sharing bureau and is due to a lack of delay characters (nulls) with a terminal-generated as opposed to a system-generated end of line.

The print software now counts the length of each line and when the specified print width is exceeded will supply the necessary nulls. It also proved possible to provide some extra code, so that we could also obtain a screen print from the contents of the disc memory – though not for the graphics, unfortunately.

This is done by making the extra code a USR with a CALL to the print driver routine for each character to be printed. As it is written in machine code, this routine should also operate at up to 9,600 baud.

Outlay saved

We see the TRS-80 as a very versatile piece of equipment. It can be considered a word processor, intelligent terminal, or key-to-tape for processor. We feel our initial outlay has already been saved several times in terms of a reduction in external expenditure with time-sharing bureaux. It has also opened the door to many applications which could not be justified in a £20 to £30 per hour cost environment.

Given that micros compete with many of the peripheral activities of a mainframe installation and often with much better response times, the next few years will show exactly how far the design concept can go.

The only real constraint, it seems to us, is data storage – for both reliability and volume. When this becomes available at a cost comparable to that of the CPU, one really will be close to having an IBM 370 on one's desk top. ●

User group news

SINCE April, when the user group came into being and was first publicised, response has been good, but it could be better. Membership is growing daily and every post brings more enquiries: the problem is, however, that most of them are from the hobbyist.

There is nothing wrong with that but many Apples have been sold into business; so businessmen, please note you need the Apple Users' groups, too.

User groups form an important back-up service; the more members they have the more information available to all. Surprisingly, one group from which response has been small is the Apple dealers. So far we have had only one reply from the 14 distributors.

Making life easy

Applesoft II is an easy language to use but in it there are a few traps for the unwary. For instance, this statement will cause problems:

```
IF Y = A THEN PRINT I
```

Apple won't print I; in fact, you'll get SYNTAX ERROR.

This is because the Applesoft parsing action causes the statement to be read as:

```
IF Y = AT THEN PRINT I
```

Hence the syntax error.

The solution is simple; enclose 'A' in parenthesis. This will stop Applesoft parsing of the letter combination and thus 'recognising' the reserved word AT. So if this statement is entered everything will be fine:

```
IF Y = (A) THEN PRINT I
```

All roads lead to ROM

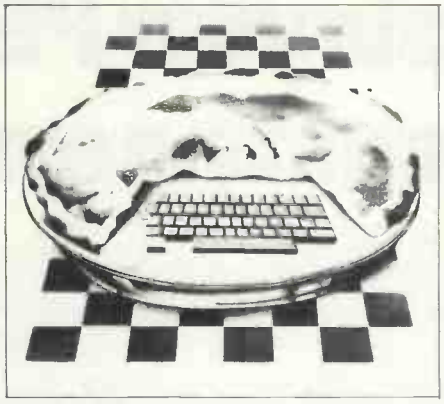
PROGRAMS written using the Applesoft ROM card will not run if Applesoft is loaded from tape or disc; programs written without a ROM card, using the tape or disc Applesoft, won't run either, but don't despair. To run a program written using the ROM card, LOAD the program and then CALL 3314. It should then run.

A program written using the disc or tape Applesoft can be run with the ROM card by LOADing the program and typing CALL 54514.

These CALL statements move the memory pointers to the appropriate place; the tape or disc Applesoft will occupy a different location in the memory from the ROM version and consequently the program will start at a different position.

Manual problem

THOSE users who have bought disc drives will probably be disappointed with the rather brief documentation. Apple has promised a new manual, but until it appears we'll try and smooth out some of the hassles.



One problem with the disc is understanding its information format. Data can be written as fixed-length records or random-length records. All data is written in ASCII.

Fixed-length records are written when you OPEN the file with an 'L' parameter. So OPEN DAN, L 40 will create a file named DAN whose records are all 40 bytes long. If you put only 20 bytes of information into each record, you will waste 20 bytes per record of space.

Random-length records are one byte each but are grouped into blocks which are up to 32K bytes long. Each block or logical record ends with a carriage return. Note that this means that the number '1' requires two bytes – the number followed by a RETURN – and the number '10' will require three bytes. If you forget this and later replace '1' with '10' you will destroy part of the following record, which is not exactly good programming practice.

Graphics programs

LENGTHY programs involving a fair amount of string handling and graphics may be limited because the string space fills with old data and runs over into the high-resolution screens.

To initiate some house cleaning and avoid this problem, two things can be done:

- Insert X = FRE (Ø) into your program, which deletes all unused strings.
- Set the address of the lowest memory location the program can use above the H resolution graphics screens. LOMEN: 24576 will enable you to use both pages 1 and 2 of the high-resolution graphics.

Graphics re-visited

LOOKING through an issue of *Contract*, the American Apple User Group newsletter, we found a neat summary of how to use both pages 1 and 2 of the memory.

Ordinarily, Apple displays only page 1 of its memory locations – locations 1024-2047 – but it is possible to display page 2 – locations 2048-3071 – as well; if you know how to do this, use of page 2 will give you 'instant' black screens and snap your graphics or text material on and off clearly.

Before you can use page 2, however, you must tell Apple not to put any variables in locations lower than 3072 – in other words, set LOMEN: 3072. After you have done this, you are free to move the contents of page 1 to page 2, re-load page 1 with new data and switch back and forth between the two pages.

Here is how to do it, using the general-purpose block movement routines built into the Apple monitor:

```
POKE 60          (old starting address mod 256)
POKE 61          (old starting address /256)
POKE 62          (old ending address mod 256)
POKE 63          (old ending address /256)
POKE 66          (new starting address mod 256)
POKE 67          (new starting address /256)
CALL-468         (the actual move command)
Now, to use page 2 (remembering to set LOEME: 3072 (or higher):
10               POKE 60, 0: POKE 61, 4: POKE 62, 255:
                 POKE 63, 7: POKE 66, 0: POKE 67, 8: CALL-468:
                 POKE – 16229.0
To switch back and forth between pages 1 and 2:
POKE – 16299.0   (display page 2)
POKE – 16300,0   (display page 1)
```

If both pages contain similar graphics figures, switching between them will yield simple animation. Further effects may be gleaned from an inspection of the list of POKES on page 30 of the *Apple II Reference Manual.*

Note that this will not work with Applesoft in ROMs. It starts at hex 800, the second page of graphic space. A block move into this area will lose your Applesoft Basic.

Apple Shoppe

APPLE Shoppe is the name of an interesting newsletter we received from a Californian computer shop, Computer Components of Orange County. Volume 1 Number 1 was produced on the Apple II with a $50 word processor package and a Trandcom thermal printer – somewhat ugly workaday output with no true descenders.

Most of its 16 pages are interesting and/or useful. We have asked permission to reprint two pieces, including a neat introduction to the Apple disc and a clever workshop, article on How to write a mailing list program.

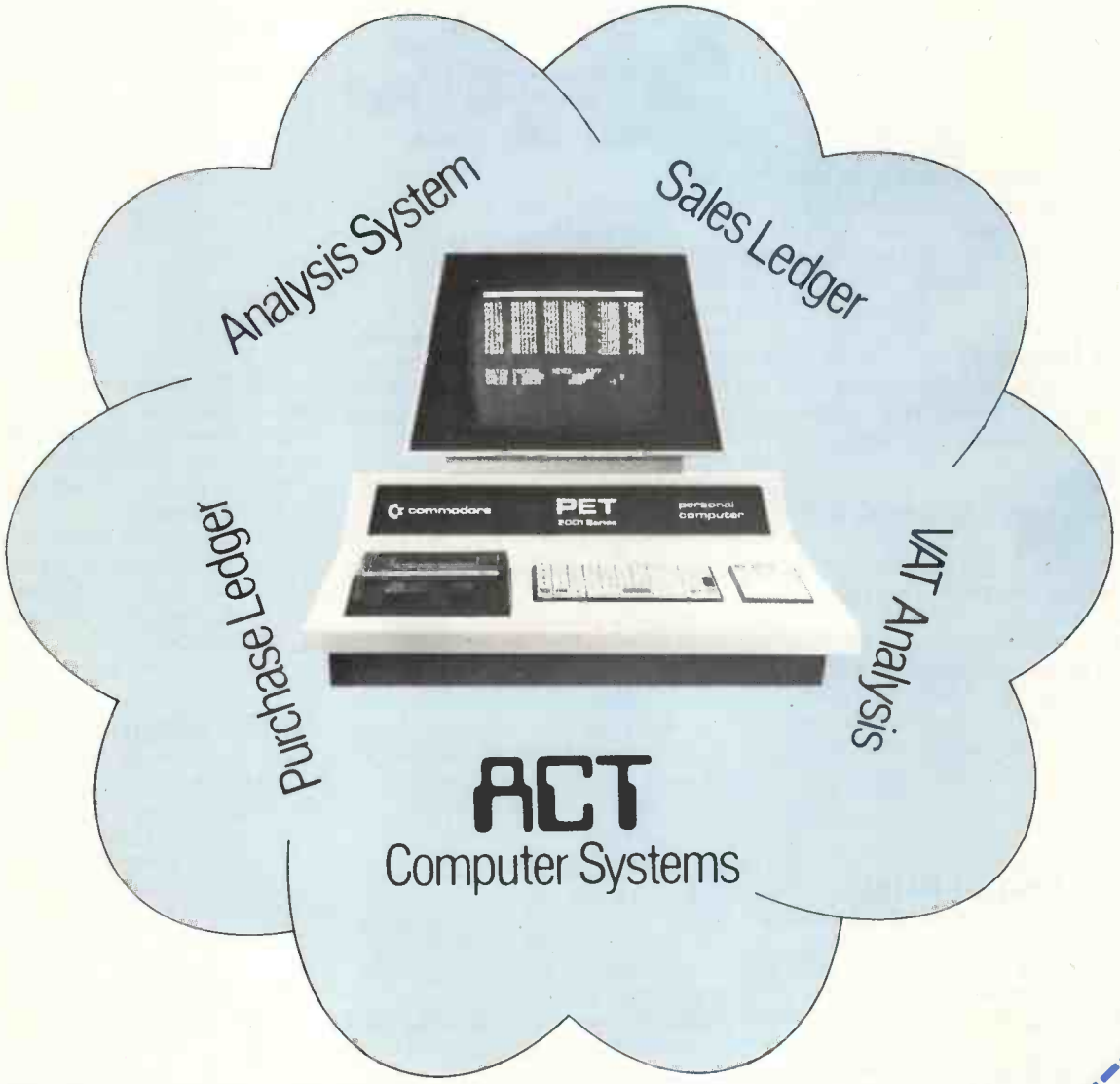
PAM

PAM is a Pet add-on memory from OMB Electronics. It is available in 8K, 16K, 24K and 32K versions. The 24K version upgrades the Pet memory to the full 32K addressable in Basic; 8K cards are available separately to augment 8K, 16K and 24K versions at a later date.

Operation if by plugging-in to the memory expansion port, using the connector provided, and to the mains. Pet power consumption, temperature and, most important, the Commodore warranty are unaffected.

The cash-with-order price of the 24K unit is £310 plus £4·75 carriage and insurance, excluding VAT. Delivery is normally ex-stock but telephone 0322 863567 for confirmation. ■

Train your PET in accounting systems



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● Circle No. 186

How to interface to a mainframe computer

THIS is the first of two articles which discuss how microcomputers – specifically the 8K Commodore Pet – can be used to communicate with other computers in distributed networks. The author is technical director of Computastore Ltd, a Manchester-based company primarily concerned with business systems.

COMPUTERS can talk to each other. In particular, microcomputers can talk to minis or large mainframes and there are good reasons to do so, as a great deal more than aesthetic pleasure can be derived from their union. Distributed processing of this form can be used to implement data entry systems, point-of-sale data capture, and many other cost-effective organisations. At the very least the micro can save the mainframe user the price of a VDU.

These articles will deal with the Commodore Pet because of its popularity, though the unusual design of the keyboard on the 8K Pet and its interfaces make it an unlikely prospect for intelligent terminal work.

First let us deal with interfacing the Pet to a mainframe computer. Do you have a hard-wired line, or will you be using a modem? A direct connection via a hard-wired line is the easiest to work with but it requires close proximity.

Given that you are more likely to use a modem, you can chose one of two ways. You can stay with the IEEE interface on the Pet and buy an IEEE-standard modem – a somewhat esoteric device in today's context; or you can opt for an RS232 modem plus an RS232 interface adaptor.

Two options

I prefer the latter course. An RS232 modem is much easier to obtain second-hand and bi-directional IEEE 488/RS232 interface adaptors are available widely – I use the one from Bailey Associates.

The cost of the two options is about the same but having an RS232 interface on the Pet also provides the great advantage of being able to use any RS232 printer on the market.

by Michael Whitehead

If you decide to implement the project outlined in these articles, you can obtain an RS232 modem in the form of an acoustic coupler – which is just an ordinary telephone handset – from any manufacturer of computer peripherals. Anderson-Jacobson has a good reputation, though a new AJ coupler will cost more than £200.

You probably will not be able to beat Modular Technology for price for a new one. You might also be able to get one from a second-hand dealer like Electronic Brokers Ltd or possibly you could contact an amateur computer club which has one.

Remote-access bureaux use them a great deal, so if you have contacts in one of them try that source.

For the interface adaptor, though, you do not have much alternative but to order new; try Bailey Associates, Amplicon or SDK Projects.

The second requirement is the dial-up number of the destination, plus information on the communications protocol, transmission rates and parity, passwords if relevant, operating system, editor, and high-level languages available. If you are using a mainframe, most of this information should be relatively easy to obtain, except perhaps for details on the protocol.

The most common transmission rate is 300 baud (bits per second) which equates roughly to 30 characters per second; each character consists of eight data bits, plus a start bit and a stop bit. You cannot use an acoustic coupler at data rates above this, incidentally.

A rate of 110 baud is also common; it represents the transmission of 10 characters per second, as each character is followed by two stop bits at this slower rate.

The Bailey interface contains a number of switches which allow your Pet to talk to other RS232 devices at any of a wide range of speeds, although it may take a little trial and error to decide on the correct parity and stop-bit settings.

Then the only thing you need is some software to allow your Pet to drive its built-in IEEE interface quickly and efficiently. Although the Bailey adaptor permits the Pet to communicate at the RS232 standard, all data entering or leaving the Pet must go through the IEEE interface, so this must be the target for your software.

Novelty

To start, you want to be able to input and output characters. It can be done from Pet Basic, a novelty with which you may want to experiment for an hour or so. Once the excitement wanes, however, it becomes very clear that Pet Basic is not even fast enough to simulate a dumb terminal running at 110 baud. Surely we are aiming for a much higher form of life.

With Basic out of the running, that leaves Assembler. But where, you might ask, are all the ROM routines which Pet Basic uses to drive the IEEE interface? How can I assess them from Assembler?

(continued on page 101)

(continued from page 99)

Let us deal first with output, as it's easier. The general steps required are to assign an IEEE listener device, output one or more characters to that device, and then to de-assign that listener. The routine in figure 1 may be called from an assembler program to output a character in the accumulator.

This routine is only 39 bytes long and if used intelligently will run at speeds of up to 9,600 baud. You may also want to add some code to it to convert lower-case characters from their Pet representation to ASCII, though it is suggested that the Bailey interface will soon do it for you.

Note that the aforementioned code assumes a listener-device-address of four, which is that of the Bailey interface; later my input routine will assume a talker-device-address of six, for the same reason. Also note that some Pet Assemblers will not assemble this code, as it involves symbols with a value higher than 32K. If this is a problem for you, use the Computastore assembler – it does not have this restriction.

When we feel confident of being able to output at least one character to another computer, how about input? Sadly the answer is not perfectly satisfactory. The general scenario for inputting a character from the IEEE interface is:

- Assign an IEEE talker device.
- Listen until it either comes up with a character or times-out.
- De-assign all talker devices.
- If you still have no character, go back to the first step. This scenario is implemented by the routine in figure 2, which always returns with a valid character in the accumulator.

Unfortunately, there is a problem which centres on a PIA register at location SE84D used to control the 64-millisecond time-out on input. Unless it can be re-set to zero, any call to the ROM IEEE input routine will be doomed to fail immediately on a time-out.

Not solved

Although I have spoken to Commodore about the problem, it has not yet been solved. For the moment the solution is to copy the ROM routine but to use some other mechanism to effect a time-out, such as looping around the input-status-test instruction a maximum number of times.

That is the approach which has been taken in the input program presented in figure 2. It works well but unfortunately it slows the whole process somewhat, so that it will not run reliably at speeds greater than 600 baud.

As with the output routine, you may wish to modify the input routine in figure 2 to convert incoming lower-case characters to their equivalent Pet representation.

So we can input and output characters. How do we assemble our building blocks? A feasible project might be a dumb terminal simulator, often called a termulator routine. That kind of program, while executing, might convert your Pet into, for example, a 300 baud full-duplex upper-case-only VDU.

Next month I shall offer such a program and discuss some of the more interesting aspects of distributed computing of which Pet owners are capable.

Figure 1. IEEE Output routine for the Pet.

```
OUTPUT   STA   CHAR      SAVE CHAR FOR OUTPUT
         JSR   LISTEN    TELL DEVICE 4 TO LISTEN
         JSR   OUT232    OUTPUT A CHARACTER TO DEVICE 4
         JSR   UNLSTN    UNLISTEN ALL DEVICES
         RTS             RETURN
LISTEN   LDA   # 0       INITIALISE ACCESS MODE OF
         STA   ACCMOD    LISTENING DEVICE
         LDA   # 4       ASSIGN LISTENING DEVICE NUMBER
         STA   DEVCNO    AS BEING NUMBER 4
         JSR   $F6EA     ROM ROUTINE
         RTS             RETURN
OUT232   LDA   # 4       ASSIGN OUTPUT TO DEVICE
         STA   OUTDEV    NUMBER 4
         LDA   CHAR      LOAD BYTE FOR OUTPUT
         JSR   SYSOUT    ROM OUTPUT ROUTINE
         LDA   # 3       REASSIGN SCREEN AS
         STA   OUTDEV    THE OUTPUT DEVICE
         RTS             RETURN
UNLSTN   =  $F17E        UNLISTEN ROM ROUTINE
ACCMOD   =  $F0          ACCESS MODE OF CURRENT DEVICE
DEVCNO   =  $F1          PHYSICAL DEVICE NUMBER
OUTDEV   =  $264         OUTPUT DEVICE NUMBER
SYSOUT   =  $F230        OUTPUT TO ANY DEVICE FROM HERE
```

Figure 2. IEEE Input routine for the Pet.

```
INPUT    JSR   TALK      TRY FOR A CHARACTER
         LDA   # 2       DID I GET ONE?
         AND   STATUS
         BNE   INPUT     NO? TRY AGAIN
         LDA   CHAR      LOAD INCOMING BYTE
         RTS             RETURN

TALK     LDA   STATUS
         AND   # $FD     RESET TIME-OUT STATUS BIT
         STA   STATUS
         LDA   # 6       ASSIGN TALKER DEVICE
         STA   DEVCNO    NUMBER SIX
         JSR   $F0B6
         JSR   $F161
         JSR   IN232     TRY FOR A CHARACTER
         JSR   UNTALK    UNTALK ALL DEVICES
         RTS             RETURN

IN232    LDA   # $34     SET NDAC
         STA   $E821
         LDA   $E840     RESET NRFD
         ORA   # 2
         STA   $E840
         LDX   # 6       SET UP LOOP COUNTERS
         LDY   # 255
TEST     BIT   $E840
TEST     BIT   $E840     HAS A CHARACTER ARRIVED? (DAV)
         BPL   GOTONE    IF YES, TRANSFER TO GOTONE
         DEY             LOOP 1535 TIMES
         BNE   TEST
         DEX
         BNE   TEST
         JMP   $F146     TIMEOUT!!! (WILL SET STATUS BIT)
GOTONE   LDA   $E840
         AND   # $FD     SET NRFD
         STA   $E840
         LDA   $E820     FINALLY .... THE DATA!
         FOR   # $FF     NOW ACTIVE HIGH
         STA   CHAR      SAVE IT
         LDA   # $3C     SIGNAL 'DATA ACCEPTED'
         STA   $E821     (RESET NDAC)
WAIT     BIT   $E840     WAIT TILL DAV IS RESET
         RPL   WAIT
         LDA   # $34     SET NDAC AGAIN
         STA   $E821
         RTS             RETURN
UNTALK   =  $F17A        ROM UNTALK ROUTINE
STATUS   =  $20C         BASIC VARIABLE ST
DEVCNO   =  $F1
```

Addresses

Computastore Ltd
16 John Dalton Street
Manchester 2
061-224 9545

R. Bailey Associates Ltd
62 New Cavendish Street
London W1M 7LD
01-637 0777

Anderson Jacobson Ltd
The Estate Office
Station Approach
Shepperton, Middlesex TW17 8AP
09322 44439

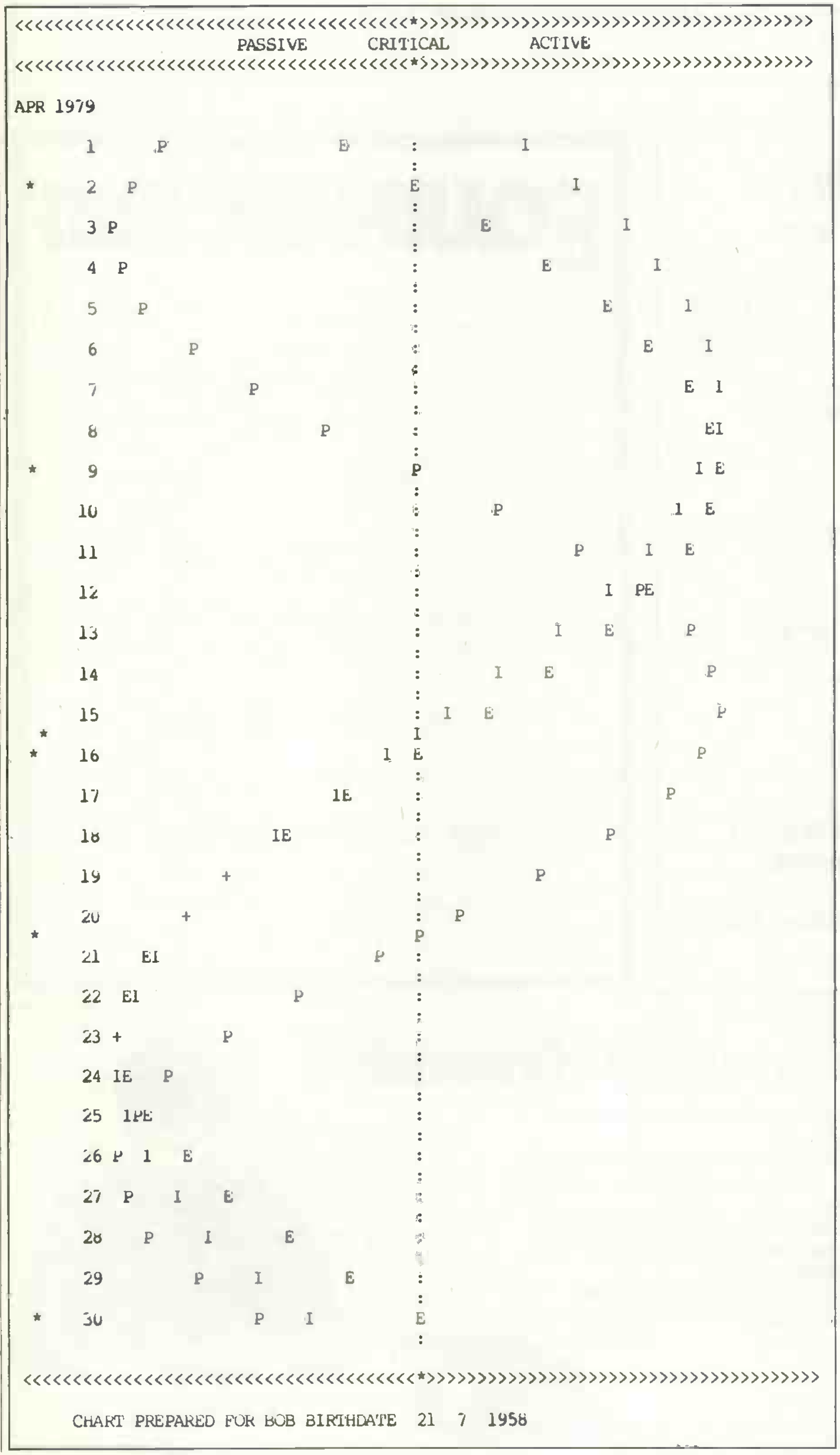
Electronic Brokers Ltd
49-53 Pancras Road
London NW1 2QB
01-837 7781

Modular Technology
PO Box 117
Watford, Herts WD1 4PD
01-421 0626

SDK Projects
39 Eveline Road
Mitcham, Surrey
01-640 5492 ■

Finding the good days

Everyone has ups and downs. Biorhythm theory suggests that those ups and downs aren't as arbitary as they seem. There is some evidence to suggest that good and bad days follow regular cycles throughout your life from the moment of birth. It's possible to calculate those cycles – and here is a program to do it.



THERE are three biorhythm cycles, and while each may vary in intensity of effect, they do not vary in length. The shortest is the 23-day physical cycle, affecting energy and self-confidence. The sensitivity, or emotional cycle, is 28 days, and governs mood, optimis, irritability. The intellectual cycle, 33 days, controls the ability to be logical, to absorb and recall facts, and powers of reasoning.

Each cycle goes through a positive – plus or active – phase and a negative or regenerative – minus or passive – phase.

On the physical cycle, the 11½ days are held to be a good time for intensive training in athletics or for any activity requiring physical stamina. Those plus days represent physical strength, endurance, energy, resistance to infection and disease, and physical confidence. Some doctors, we gather, will perform scheduled surgery only between the second and ninth day of this cycle.

On the minus days of your physical cycle you are re-charging and you tend to tire more easily. That is a good time for athletes to train to store energy.

by Martin Collins

The 28-day emotional cycle corresponds approximately to a woman's mentrual cycle; it is not identical to it, though, and it occurs in both men and women. On the plus days you are likely to be cheerful, co-operative, considerate, creative and loving; generally you should have a positive outlook on life.

Conversely, the 14 minus days are conducive to moodiness and negativism. You may exhibit signs of irritability. Awareness of that fact is important to drivers, operators of complex machinery and others who need to react quickly and rely on sound judgment.

The first half of your 33-day intellectual cycle is the best time to absorb new subjects. A person finds it easier to study, write creatively, understand mathematics or pursue any intellectual efforts. Equally, your intellectual faculties will be less keen during the last half of this cycle.

The highs and lows vary with individuals. Factors such as age, excitability and health determine to what degree these traits will apply to each person. The day your cycle changes from a plus to a minus or from a minus to a plus is critical;

(continued on page 105)

(continued from page 103)

you are neither up nor down but in a state of limbo.

Tied to the biorhythm theory is the theory of body harmonics – that ups and downs are stresses which spend themselves in curving, pendulum-like waves.

The critical period does not necessarily mean you will make mistakes or have accidents; it means you are more likely to make errors of judgment and be generally less acceptive. Once you know when to expect mistakes, you can also use that information to your advantage, most obviously by timing important decisions and actions to avoid your critical days.

If one day per cycle is critical, things can be difficult. With criticals coinciding on two or three cycles, your vulnerability and your problems are magnified. Similarly, if two or three cycles peak at the same time, you ought to be at your most effective.

Perhaps it may be regarded as trivial nonsense, but the body of scientific and statistical opinion suggests otherwise.

Doctors and sportsmen seem the two groups who are keenest on biorhythm theory. Around the world there are research centres of varying degrees of authenticity, including the Biorhythm Research Association at Normanton-on-Soar, Loughborough, Leicestershire. BRA has an impressive suite of documentation on the subject if you want to pursue it.

The program was written originally for a minicomputer and converted for a Pet. We have tried to keep the Basic as non-specific as possible, so most of the statement lines should transfer easily to other microcomputers.

The exceptions are line 3, which clears the screen, and several lines which reference a printer channel, including line 1, which opens the channel.

We ran the printout on a Diablo daisywheel printer without English characters, so the hash sign # is printed as a pound sign. All our **PRINT** statements (line 90 onwards) send data to the print channel; in the Pet Basic it is done with the statement **PRINT # 4** (print on channel 4) but our listing reproduced this as PRINT£4, for which we apologise.

For the sample run we omitted lines 1024 and 1026. They give a row of dots on the right of the printout for each date; is a kind of diary facility for you to add notes but obviously it requires you to have a printer capable of printing more than 80 columns across the page.

The program asks for your birth-date, then calculates and prints your biorhythms. Obviously, 'I' denotes the intellectual cycle, 'P' the physical 'E' the emotional.

When two cycles coincide, the letters are replaced by a plus sign. The dotted line down the centre shows the crossover point; critical dates are flagged by asterisks in the left.

```
1 OPEN 4,4,1
3 PRINT"3"
5 REM  BIORHYTHMS
6 DIM N$(20),D(12),L$(61),P(23)
7 DIM E(28),I(33),M$(36),H$(40)
8 FORI=1TO20:N$=N$+" ":NEXTI
9 FORI=1TO61:L$=L$+" ":NEXTI
10 FOR I=1TO36:M$=M$+" ":NEXTI
11 FORI=1TO40:H$=H$+" ":NEXTI
15 M$="JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
60 FOR I=1 TO 23:READ P(I):NEXT
70 FOR I=1 TO 28:READ E(I):NEXT
80 FOR I=1 TO 33:READ I(I):NEXT
90 FOR I=1 TO 12:READ D(I):NEXT
200 FORI=1TO10:PRINT:NEXTI:INPUT"           ENTER YOUR NAME";N$
210 PRINT"           ENTER YOUR DATE OF BIRTH"
230 GOSUB 1100
240 INPUT"ENTER DATE FOR CHART (MONTH,YEAR)";S2,S3
250 IF S2>12ORS2<1THEN 240
260 IF S3<100 THEN S3=S3+1900
270 IF S3<1900 THEN 240
275 IF S3+S2/12<B3+B2/12 THEN 240
280 S1=1
290 A=0
295 IF B3+1>S3-1THEN340
300 FOR Y=(B3+1)TO(S3-1)
310 IF INT(Y/4)*4<>Y THEN 330
320 A=A+1
330 NEXT Y
340 D1=(S3-B3-1)*365+A
350 IF INT(Y/4)*4<>Y THEN 380
360 IF B2<>2 THEN 380
370 D1=D1+1
380 D1=D1+D(B2)-B1+1
385 IFB2=12THEN420
390 FOR I=(B2+1)TO 12
400 D1=D1+D(I)
410 NEXT I
420 IF S2=1 THEN 500
430 FOR I=1 TO S2-1
440 D1=D1+D(I)
450 NEXT I
500 P1=D1-INT(D1/23)*23
510 E1=D1-INT(D1/28)*28
520 I1=D1-INT(D1/33)*33
550 D(2)=28
570 M=S2
630 GOSUB 1200
635 FOR J=1 TO D(M)
670 FOR K=1 TO 61
680 L$(K)=" "
690 NEXT K
700 L$(31)=":"
710 P1=P1+1
720 IF P1<24 THEN 740
730 P1=1
740 L$(P(P1))="P"
750 E1=E1+1
760 IF E1<29 THEN 780
770 E1=1
780 L$(E(E1))="E"
790 I1=I1+1
800 IF I1<34 THEN 820
810 I1=1
820 L$(I(I1))="I"
830 IF E(E1)<>I(I1) THEN 850
840 L$(E(E1))="+"
850 IF E(E1)<>P(P1) THEN 870
860 L$(E(E1))="+"
870 IF P(P1)<>I(I1) THEN 890
880 L$(P(P1))="+"
890 PRINT£4," ";
901 IFE(E1)=31 THEN PRINT£4,"*";:Z=Z+1
902 IFP(P1)=31 THEN PRINT£4,"*";:Z=Z+1
903 IFI(I1)=31 THEN PRINT£4,"*";:Z=Z+1
910 PRINT£4,SPC(4-Z):Z=0
940 IF J<10 THEN PRINT£4," ";
1000 PRINT£4,J;
1001 FOR I=1 TO 61:PRINT£4,L$(I);:NEXT I
1002 FOR K=1 TO 39
1003 H$(K)=" "
1004 NEXT K
1005 H$(40)=":"
1007 IF P(P1)<>35 THEN 1015
1009 H$(2)="*"
1011 H$(40)="P"
1015 IF I(I1)<>34 THEN 1024
1016 IFH$(2)<>"*"THENH$(2)="*":GOTO1019
1017 H$(3)="*"
1019 H$(40)="I"
1020 IF I(I1)=34 AND P(P1)=35 THEN H$(40)="+"
1024 PRINT£4,SPC(17);"....................................................."
1025 FOR I=1 TO40:PRINT£4,H$(I);:NEXT I
1026 PRINT£4,SPC(47);"....................................................."
1027 NEXT J
1028 GOSUB 1400
1030 GOTO 200
1100 REM
1101 INPUT"           DAY";B1
1105 INPUT"           MONTH";B2
1110 INPUT"           YEAR";B3
1119 IF B2>12 THEN 1100
1120 IF B1=29 AND B2=2 THEN 1137
1137 IF B3<100 THEN B3=B3+1900
1138 IF B3>1979 THEN 1100
1199 RETURN
1200 GOSUB 2000
1210 PRINT£4:PRINT£4
1230 GOSUB 2000
1275 GOSUB 1300
1280 PRINT£4,"                    PASSIVE      CRITICAL        ACTIVE"
1285 GOSUB 1300
1286 PRINT£4
1287 PRINT£4,MID$(M$,(M-1)*3+1,3);
1288 PRINT£4,S3;TAB(78);"NOTES"
1290 PRINT£4
1295 RETURN
1300 PRINT£4,"<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*";
1310 PRINT£4,">>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>"
1320 RETURN
1400 PRINT£4
1410 GOSUB 1300
1420 PRINT£4
1430 PRINT£4,"     CHART PREPARED FOR ";N$;" BIRTHDATE ";B1;B2;B3
1440 GOSUB 2000
1460 RETURN
1900 DATA 31,39,47,53,58,60,61,59,56,50,43,35,27,19,12,6,3,1,2,4,9,15,22
1910 DATA 31,38,44,50,54,58,60,61,60,58,54,50,44,38,31,24,18,12,8,4,2,1,2
1920 DATA 4,8,12,18,24
1930 DATA 31,37,42,47,52,55,58,60,61,61,59,57,54,50,45,39,34,28,23,17,12,8
1940 DATA 5,3,1,1,2,4,7,10,15,20,25
1950 DATA 31,28,31,30,31,30,31,31,30,31,30,31
2000 FOR XX=1 TO 6:PRINT£4:NEXTXX
2001 RETURN
9999 CLOSE 4:END
```

To catch a good idea

DID YOU read the results of the *Practical Computing* Christmas competition? Cleaning-up oil slicks, dieting for diabetics and re-creating historical episodes in the classroom were only a few of the ideas submitted; and I would be willing to bet that there were other really good ideas doomed to oblivion simply because they didn't win.

The other day I was chatting to a doctor and a naval engineer about prosthetics. The ones we were dreaming up were hands. There are two main problem areas in the design of a useful artificial hand, the power supply and the control system. The most sophisticated modern ones use compressed gas for power and, while it is far from convenient, it can do the job pretty well. Yet, the only word to describe the control is crude and it was this aspect that we were discussing.

Most generally-available prosthetic hands rely on muscular movements in other parts of the body – typically the upper arm and shoulders – to provide both power and control. The nett result is that to light a cigarette can involve expenditure of considerable amounts of energy, as well as producing movements reminiscent of a circus contortionist.

As it happens the nerves supplying a missing hand are still intact over most of their course from brain to limb and are hard at work trying to control the non-existent extremity. In addition, they are conveniently firing-out pulses of real live electricity which can be detected easily with little more than a good amplifier and filter arrangement. Until now most ideas of linking nerves to transducers have involved microsurgery at the nerve endings, as well as a need for wires physically to cross the skin barrier.

What we wanted was a receptor system which could be implanted anywhere in the general region of the nerves concerned by any competent surgeon and what we evolved was a simple web of wires, each linked to an op-amp and feeding its signals direct to a microprocessor, which could then do all the decoding necessary to turn these signals into some sort of sense.

by Nick Laurie
who specialises in popularising high technology

The CPU chip, complete with op-amps, a little memory and one or two other things could, we decided, be packaged in such a form that the owner's blood supply could pass right through it to help dissipate the odd couple of watts of heat it gave off.

Extending ourselves further, we realised that with a power requirement of only a few hundred milliamps at around five volts we could bury a few square centimetres of thermocouples up the arm to give a completely self-contained unit needing no batteries, radioactive sources or anything else.

As a final step we had to cross the skin barrier, but with the aid of any one of a dozen or more transducers ranging from LEDs to Hall-effect semiconductors, we reckoned that that problem qualified as minor.

My doctor friend could see nothing wrong with the idea; the naval engineer reckoned he could construct the hand quite easily – powered by compressed gas – and I could see nothing over-difficult about the computing side of things.

So why won't we be seeing the bionic hand in use this year? Are we really doomed to a sort of electronic voyeurism, watching a never-ending stream of applications being discussed while the best we can do is reach out and occasionally grab one for further development while the rest of them slide off into oblivion?

I don't pretend to know the answer, but if you do, feel free to write and tell me. ■

June

19-21 **International Microcomputers Minicomputers Microprocessors.** Venue: Palais des Expositions, Geneva, Switzerland. The Exhibition will be displaying computers – mini and micro – peripherals, components and services from more than 100 international companies. The technical conference is designed to provide an exchange of applications, development and design technologies in many areas of the industry. There will also be two ICS Advanced Technology courses, run simultaneously – Microprocessor Applications Development and Small Computing Systems. Technical sessions and courses will be in English only. More information from Kiver Communications, S.A. (U.K. branch office), Millbank House, 171-185, Ewell Road, Surbiton, Surrey, Tel: 01-390 0281.

26 **Microprocessor Seminar for Non-Electronic Engineers.** Venue: Manchester. One-day seminar for mechanical and production engineers, supervisors and managers in industry. Fundamentals explained, demonstrations, examples of applications and discussions. Attendance limited to 10 people and the cost is £30 per delegate. More information from Mektronic Consultants, Linden House, 116, Rectory Lane, Prestwich, Manchester, M25 5DB. Tel: 061-798 0803.

29 **Computers in Small Businesses.** Venue: London. This one-day course introduces guidelines for organisations taking their first steps towards computerisation. It is designed for the first-time user and assumes little knowledge of computer techniques. The course costs £50 including lunch and light refreshment. Highly recommended for those about to enhance a business with a computer. More information from Course Registrar, MSS Computer & Business Consultancy Ltd, MSS House, 49 Chapel Road, Worthing, West Sussex.

July

4 **Introduction to Basic Programming.** Venue: Lecture Room, Sumlock-Anita House, London, EC1. A three-day course which will continue on the following two Wednesdays. It goes through various elementary stages such as explaining what a program is, to file structures and applications packages. Full course fee is £90 plus VAT. Sumlock-Bondain advises early booking as only 12 places per course are available. Tel: 01-253 2447.

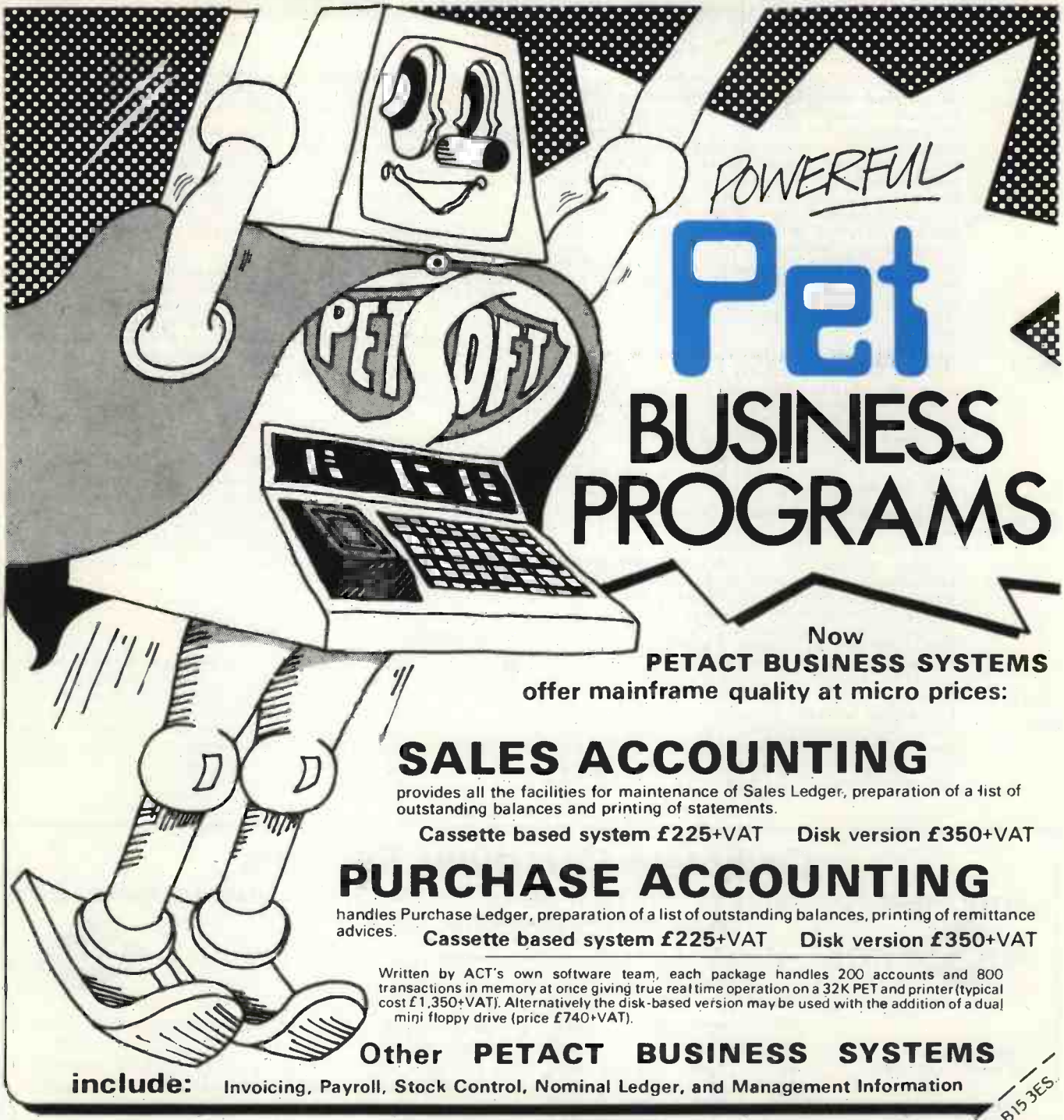
5-7 **The 1979 Microcomputer Show Incorporating The DIY Computer Fair.** Venue: Bloomsbury Centre Hotel, London. Essential for all computer freaks. This year there will be a record number of exhibitors who will bring all the latest microcomputer equipment to the heart of London. Entrance fee £1. For more information, see our seven-page guide, which tells you all you need to know about this event.

10-13 **International Word Processing Exhibition and Conference.** Venue: Wembley Conference Centre, London. Those who are considering buying a word processor could do worse than go to this comprehensive exhibition. All you ever wanted to know about the subject will be available in the form of literature, demonstrations of all the latest equipment, and a two-day advanced conference, and special-interest, half-day seminars. Admission is £2. More information from BETA Exhibitions, Business Equipment Trade Association, 109 Kingsway, London, WC2.

23-25 **Advanced Basic.** Venue: London, EC1. This three-day course is a follow-up to the Sumlock-Bondain *Introduction to Basic Programming* and is intended for those who have taken one of the previous courses or have a ground knowledge of the language. Full course fee is £130 plus VAT. More information from Sumlock-Bondain Ltd., Sumlock-Anita House, 15 Clerkenwell Close, London, EC1.

September

18 **Microprocessors** is a two-day seminar at the Cafe Royal, London, organised by Informex in association with the Institute of Data Processing Management. Speakers include experts from the major semiconductor companies. Cost for the two days is £78 plus VAT, which includes lunch and refreshments for both days. Contact: Jan Clarke, Informex-London Ltd., 61, Harland Avenue, Sidcup, Kent. Tel: 01-300 0380.



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'Selling properly' aim of Rostronics

ROSTRONICS Computer Centre can scarcely be described as off the beaten track. The shop is sandwiched between a photographer's studio and an undertakers in Wandsworth High Street, in south London.

Such a location is evidently good for the microcomputer business, though, as Rostronics has sold a steady 15 to 20 systems a month since opening in January.

This shop is owned and run by its three directors, John Barton, John Pendreich and Rhoda Battersby, who decided to specialise in selling Tandy systems. Barton spent a year looking at all the equipment available on the market and settled on the Tandy "because it offered best value for money".

Critical

Like many people, he is critical of the way Tandy sells computers through shops which do not provide what he considers adequate software and support.

'Specialist in computer business machine systems' reads the shop letterhead and Rostronics is orientated firmly towards selling commercial systems. It is not really a hobbyist shop, although they are catered for. Barton had his own business printing commercial stationery for a number of years; when he became interested in micros he soon perceived the potential for dealing with paperwork.

"Within a couple of years all businesses with a turnover of £50,000 will have a micro. Everyone will have one, so why not sell them and do the job properly?"

To do the job properly, Rostronics writes its own software and provides its own engineering service. The latter has become so renowned that Tandy owners telephone from all over the country, Rhoda says, for help and advice. The shop employs a full-time engineer and, if necessary, can call upon another four specialist engineers – moonlighting from leading computers manufacturers, who can afford to employ the best.

Repair service

Rostronics is very proud of the maintenance contract it offers. Under the terms of the agreement, Rostronics guarantees to replace an item or repair any fault on a business system within 24 hours of receiving the call.

For that service the user pays 15 percent of the cost of the system per annum; a business system will cost £2,000, so the maintenance agreement would be about £200 pa. This apparently appeals to schools, which are only too conscious of the effect sticky little fingers might have on the school micro.

Rostronics is very particular about the equipment it sells. Everything is tested thoroughly before it leaves the shop and only suppliers with a large maintenance force to be called upon receive orders from Rostronics.

The shop also tries to supply anything a customer may need. "If someone is to have a business system from us, we aim to have everything they need, down to the printer ribbons".

Software is written in-house; off-the-shelf packages available include accounts, inventory, cash registers, and sales analysis, as well as the well-known Electric Pencil word processor from the States.

"Our word processing system", Barton says, "is probably our strongest selling point". The Rostronics word processing system comprises a TRS-80 plus the Electric Pencil software and a daisywheel printer. The printer is a Canadian machine, manufactured by Alain Sapper, and Rostronics is the sole importer at the micro end of the market.

Rostronics can also supply continuous stationery and business forms. "There is no other system on the market", Barton claims, "which will give you, at that price, full screen-editing facilities". About 10 word processing systems have been sold to date and, of course, the customer, receives a computer as well.

Tandy shops sell two kinds of printers; Rostronics sells three – the standard friction-feed and tractor-feed line printers plus the Teletype 43 and the Alain Sapper daisywheel. Rostronics buys its Centronics printers directly from Centronics and can thus sell them for less than the Tandy price.

System desk

Mail order accounts for a large amount of Rostronics business and it is from all over the world. "We even have customers in Bahrain who telephone orders".

"We are always looking at new products appearing in the States", Barton says, "and we also have our engineer working on some 8in disc drives" – from Tinker Toy, Shugart and Micropolis.

A Rostronics-designed system desk is about to go into production. The desks, available through Tandy shops, are constructed to accommodate the Shugart Micropolis drives in this country and they do not fit the desk.

So Rostronics is building desks which will hold either Shugart or Micropolis disc drives. The desk will also have a line filter to protect the drives from fluctuation in the electric current, and a power supply which will box the eight wires which straggle from the average configuration.

With a view to taking a second machine on board, Barton has been looking around the market again. "The most likely candidate is the ITT 2020; it has good software and is cheaper than the Apple".

Rostronics is in no hurry to adopt another system, though. As Barton points out, "Tandy has sold so many systems that people will be looking for Tandy software and hardware for a long time". ■

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Double density plotting on Pet

BY USING the amazing collection of graphics symbols on the Commodore Pet, it is possible to set up a sequence of logic operators which increase the screen size from 40 characters wide by 25 deep to an apparent 80 × 50 plottable points.

The characters used for this Double Density Plot (DDP) are contained in

by A Clark

table 1 in the sequence required for the routine – the importance of this particular order will be apparent later.

Say the new co-ordinate system has its origin (0,0) at the bottom left-hand corner of the screen, giving maximum values of 49 and 79 for Y and X respectively. A normal-sized blank screen character can then be considered as divided into four possible DDP points:

DDY odd	**C**	**B**
DDY even	**D**	**A**
	DDX even	**DDX odd**

If you know the screen position (DDY/2, DDX/2) and whether X and Y are odd or even, the character required can be found from table 1.

If A was to be filled (DDY even, DDX odd), the character used from table 1 would be number 2; if C, we would use character number 4.

A problem arises when we want to plot a character at A if the block already contains one or more DD points.

The method used in my subroutine is to construct a byte whith the four least significant bits representing the four possible quarters of the character square. So originally the byte would be 0000/0000 for a blank.

If we consider bit 0 to represent A, 1 to represent B, 2 to represent C and 3 for D, the byte would change to the following values (U) and configurations when each corner only is filled:

Position	Byte	Value	Y	X
A	0000/0001	1	Even	Odd
B	0000/0010	2	Odd	Odd
C	0000/0100	4	Odd	Even
D	0000/1000	8	Even	Even

As can be seen from table 1, there are 16 possible arrangements for A,B,C and D, ranging from a blank square to a completely filled-in square. There are also 16 possible values of u if the four most significant bits remain constant.

It is now possible to show why table 1 is arranged in that particular order. If we want to add B to a square which already contains A, the result and value of u must be 3 (bits 0 and 1 set); from table 1 it can be seen that when u is equal to this number, the result is a vertical half-square, which is correct. This rule follows for all the other combinations. Try a few.

Strictly speaking, it is not correct to add the values of the bytes together. If that quarter is already occupied the next bit will be set by a carry rather than the correct one remaining. For example, if B is to be re-plotted one would have added:

```
0000/0010
0000/0010
---------
0000/0100
```

which results in C being set rather than B remaining. This problem of over-plotting is overcome by using the logical OR rather than adding. Each bit in turn is compared and if either bit is set to one, then the result is set to one. So the example becomes:

```
0000/0010
0000/0010
---------
0000/0010
```

'or'

(continued on next page)

Table One

Character	Value	Least significant bits
	0	0000
	1	0001
	2	0010
	3	0011
	4	0100
	5	0101
	6	0110
	7	0111
	8	1000
	9	1001
	10	1010
	11	1011
	12	1100
	13	1101
	14	1110
	15	1111

(continued from previous page)

which leaves us with bit one set and no carry to bit 2.

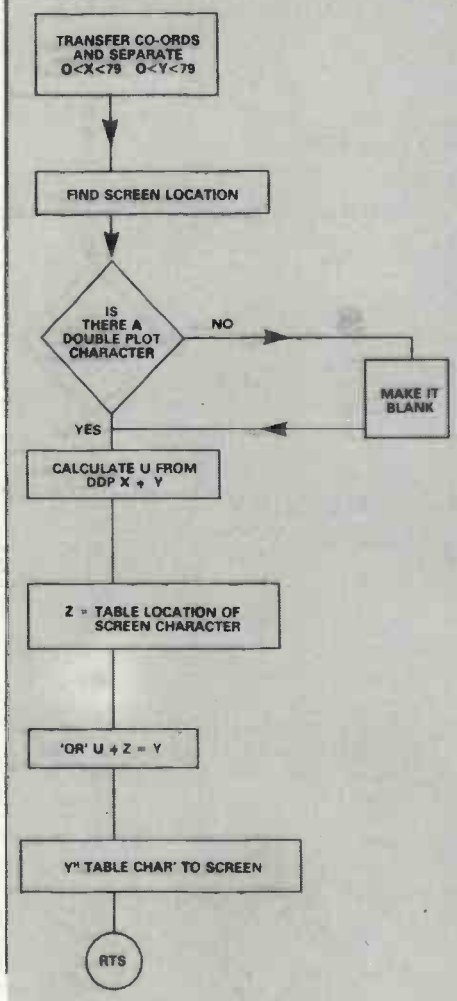
At this stage, look at the preliminary flowchart for the subroutine. This routine can be constructed in Basic in about five lines by PEEKing and POKEing at the screen; but if we include checks for valid DDP co-ordinates as well as the facility to erase squares, the plot routine length doubles.

That is not excessive use of memory by any means but the time factor becomes important, especially on 3D plots. The obvious answer is a machine code routine for which a disassembled listing is given at the end of the article.

The first problem to be overcome in it was the passing of three values to the subroutine by the USR function. The number passed to the machine code is converted to an integer in locations $B3 and $B4 by subroutine $D0A7. The method employed was to place the DDY co-ordinate in the most significant byte ($B3) by multiplying by 256 and leaving the X co-ordinate in the least significant byte, $B4.

The third variable, whether to plot or erase, is controlled by setting bit seven in the least significant byte if an erase is to be carried-out. So typical USR commands would run as follows:

Table Two



10 W = USR (Y*256 + X)...plots at DDP X,Y

20 W = USR (128+Y*256+X)...sets bit seven and erases DDX,DDY

Among other ideas incorporated, I decided to transfer back from the subroutine into W the value of the screen character at X, Y before alteration; and if either DDX or DDY were invalid – not on the screen – USR would return with W = 1024.

Glitchless plotting is also featured by using a subroutine – WAIT in listing – which stops the machine code looking at or writing to the screen at the wrong time, which means during a screen refresh cycle.

Cassette offer

Remarks contained in the program listing explain the sequence of events simply, so a detailed flowchart is not required. If anybody has any comments or improvements on my first attempt at machine code, I will be only too grateful to receive them.

For those who would like double density graphics and who do not yet have the experience necessary I will be happy to supply a cassette tape which loads the routine automatically into the second cassette buffer, for a nominal £1.50. The only line required in your program would be:

10 POKE 1, 58 : POKE 2,3

The program which plotted figure 1 follows:

```
  1  POKE 1, 58: POKE 2, 3
  2  PRINT "CLEAR PAGE"
  3  T = 200: T1 = 30: T2 = 99: T3 = 4: T4 = 1521: T5 = 23: T6 =
     0.7: T7 = 40: T8 = 256: T9 = 24: V = 1
  4  S1 = 79: S2 = 44: S3 = 48
  5  DEF FNA (Z) = T1 * EXP (-Z*Z/T)
110  FOR X = -T2 TO T2
120  L = 0
130  Y1 = T3 * INT (SQR(T4 - X * X)/T3)
140  FOR Y = Y1 TO -Y1 STEP - T3
150  Z = INT (T5 + FNA (SQR (X*X + Y * Y)) - T6 * . Y)
160  IF Z < =L THEN 190
170  L = Z
180  W = USR (X + T7 + T8 * (Z-T9)
190  NEXT
200  NEXT
210  FOR X = -T2 TO T2
220  Z = INT (T5 + FNA (X))
230  FOR I = T5 TO Z
240  W = USR (X + T7 + T8 * (I - T9))
250  NEXT
260  NEXT
270  PRINT "CLEAR PAGE"
300  FOR I = 0 TO T2: FOR J = 0 TO 1:
     W=USR(I+(T3+V+J)*T8)
310  W=USR(S1-I+(S2-J)*T8): NEXT: NEXT
320  PRINT "CLEAR PAGE"
330  FOR J = 0 to S1: FOR I = 0 TO S3 STEP 2:
     W = USR (J + I*T8)
340  W = USR (S1-J + (I+V) *T8): NEXT: NEXT
350  GOTO 2
```

Happy plotting, and the address for the tape is: A. Clark, 107 Haydon Close, Red House Farm Estate, Gosforth, Newcastle-upon-Tyne NE3 2BZ.

Disassembled machine code listing

```
033A  20A7DO          JSR DOA7      : Converts argument to
                                      integer in B3,B4
033D  A5B4            LDA B4        : LSB ( x coord)
033F  3005            BMI Erase     : Checks for bit 7 set
0341  A9CC            LDA# CC       : Alters jump address in 03C7
0343  4C4CO3          JMP Label
0346  26B4    ERASE:  ROL B4        : Removes bit 7 from B4
0348  46B4            LSR B4
034A  A9CA            LDA# CA       : Alters jump address in 03C7
034C  8DC803  LABEL:  STA 03C8
034F  A5B4            LDA B4        :Divide DDP X by 2 to give screen X
0351  4A              LSR A
0352  85B2            STA B2        : Screen X into B2
0354  9005            BCC EVEN 1
0356  A903            LDA# 03       : DDP X is odd, V = 1 or 2 = 3
0358  4C5DO3          JMP LAB 1
035B  A90C    EVEN 1: LDA# OC:      DDPX is even, V = 4 or 8 = 12
035D  85B5    LAB 1:  STA B5        : V temp into B5
035F  A5B3            LDA B3        : Divides DDPY by 2
0361  4A              LSR A
0362  85B1            STA B1        : Screen Y' into B1
0364  9007            BCC EVEN 2
0366  A5B5            LDA B5        : DDPY is odd, V = 2 or 4
0368  2906            AND# 06       : Result is actual V
036A  4C7103          JMP LAB 2
036D  A5B5    EVEN 2: LDA B5        : DDPY is even, V = 1 or 8
036F  2909            AND# 09       : Result is actual V
0371  85B5    LAB 2:  STA B5
0373  A918            LDA# 18       : Change screen origin to top of scree
0375  38              SEC
0376  E5B1            SBC B1
0378  3023            BMI ERR1      : DDPY too large
037A  85B1            STA B1        : New screen Y
037C  38              SEC
037D  E919            SBC# 19
037F  1023            BPL ERR2      : DDPY too small
0381  A980            LDA# 80       : Load (0,0) Screen ram position
0383  85B4            STA B4        : Screen hi
0385  A900            LDA# 00
0387  85B3            STA B3        : Screen lo
0389  A4B1            LDY B1        : Find Y position in screen ram
038B  FOOE            BEQ LAB3
038D  6928    LABL:   ADC# 28
038F  9005            BCC LABL 1
0391  E6B4            INC B4
0393  18              CLC
0394  EA              NOP
0395  EA              NOP
0396  88      LABL 1: DEY
0397  DOF4            BNE LABL
0399  85B3            STA B3
039B  A5B2    LAB 3:  LDA B2
039D  3049    ERR 1:  BMI ERR       : DDPX too small
039F  85B2            STA B2
03A1  38              SEC
03A2  E928            SBC# 28
03A4  1042    ERR 2:  BPL ERR       : DDPX too large
03A6  A5B3            LDA B3        : Final screen ram positions
03A8  65B2            ADC B2
03AA  9002            BCC LAB4
03AC  E6B4            INC B4
03AE  85B3    LAB 4:  STA B3
03BO  A000            LDY# 00       : Find character at X, Y
03B2  A20F            LDX# OF
03B4  20DCO3          JSR WAIT
03B7  B1B3            LDA (B3), Y   : Finds Character in X, Y
03B9  A8              TAY
03BA  DDEFO3  LOOP:   CMP TABLE, X
03BD  FOO5            BEQ LAB 5
03BF  CA              DEX
03CO  10F8            BPL LOOP
03C2  A200            LDX# 00       : if no table character:-Blank
03C4  8A      LAB 5:  TXA
03C5  05B5            ORA B5        : Plot addition
03C7  4CCCO3          JMP 03XX      : Variable Jump: past or to erase
03CA  45B5            EOR B5        : Erase point
03CC  AA              TAX
03CD  20DCO3          JSR WAIT
03DO  BDEFO3          LDA TABLE, X
03D3  A200            LDX# 00
03D5  81B3            STA (B3,X)    : Plot on screen
03D7  A900            LDA# 00
03D9  4C78D2          JMP D278      : Return with integer to FLP
03DC  AD40E8  WAIT:   LDA E840      : Subroutine which waits for
                                      a screen refresh
03DF  4920            EOR# 20
03E1  2920            AND# 20
03E3  FOF7            BEQ WAIT
03E5  60              RTS
03E6  EA              NOP
03E7  EA              NOP
03E8  A904    ERR:    LDA# 04       : ERROR MESSAGE (W = 1024)
03EA  A000            LDY# 00
03EC  4C78D2          JMP D278      . Returns W = 1024
03EF  20      TABLE:  20            : Character Table
03FO  6C              6C
03F1  7C              7C
03F2  E1              E1
03F3  7E              7E
03F4  7F              7F
03F5  E2              E2
03F6  FB              FB
03F7  7B              7B
03F8  62              62
03F9  FF              FF
03FA  FE              FE
03FB  61              61
03FC  FC              FC
03FD  EC              EC
03FE  AO              AO
```

Real-time clock for M6800 D2

DESIGNING a real-time clock for a microcomputer development kit, factors like the Motorola MEK6800 D2 should be considered. Among them – is the system clock stable enough for use as a time standard? Is the MPU to be used for tasks other than time-keeping, so that a software-only solution is impractical? Can the 50Hz mains be used as a timing signal? Can the final choice of timing signal be interfaced to the MPU with minimum external hardware?

by Brian Wilkie

Motorola Semiconductors, East Kilbride

Assessing these in relation to a D2 microprocessor requires some appreciation of the hardware already in the kit.

- The D2 uses a crystal oscillator at 614.4KHz which is divided down to 4,800Hz for use in a Kansas City Standard cassette interface.
- It has a hexadecimal keyboard and associated debug monitor, which is ideal for initial clock setting.
- It uses six seven-segment LED displays for output of information. This is ideal for time display, with the proviso that they must be driven in a multiplexed mode by software, using one PIA port as segment drives and another – outputting only one bit high at a time – for digit drives.
- It has provision for using two MCM2708 EPROM. The one located at hex address $6000 – the dollar indicating hexadecimal notation – was selected for this program, although it could be altered easily to fit into the RAM locations lower in the memory map.

Nucleus

We can eliminate some of the options in choice of time standard. The intention of this program was to act as the nucleus of a central heating controller, so a software-only solution can be put aside. Since six LED displays must be refreshed at least 25 times a second – which means 150Hz – a 50Hz interrupt from the mains would be too slow.

Fortunately, the designer of the D2 kit used a 12-stage CMOS counter, the MC14046, to divide down from the crystal clock to drive the cassette interface. The final stage of this counter therefore has a 300Hz square wave which is crystal-controlled and at an ideal frequency for driving the LED display. The only hardware modification necessary on the D2 kit is to connect this 300Hz signal from U18 pin 1 to the user PIA interrupt input CA1, U20 pin 40.

The flowchart and listing show a program to turn this 300Hz signal into a clock. Note that the initialisation puts the start of the interrupt service routine into location $A000, which is, in turn, referred to by the internal JBUG interrupt service routine.

The interrupt service routine is short and simple; such routines are difficult to debug without professional equipment and since the wait-for-interrupt loop has its own software timer, the program can be checked in the absence of an interrupt signal.

The time is stored as three bytes of packed binary-coded decimal information, to facilitate the addition of alarm and on/off time routines to the program.

Time is increased not by an increment instruction but by an add immediate one; this sets the half-carry flag for the subsequent decimal adjust accumulator to restore the number to BCD format.

Expanded easily

In normal operation, the software enters a wait loop, checking continually for the flag byte to be incremented for zero. When this happens every 1/300 second the time counters are incremented; if the displayed time has altered, the new time values are translated into suitable format in the display buffer locations. This facilitates changing to other display formats, such as ASCII for output on a VDU.

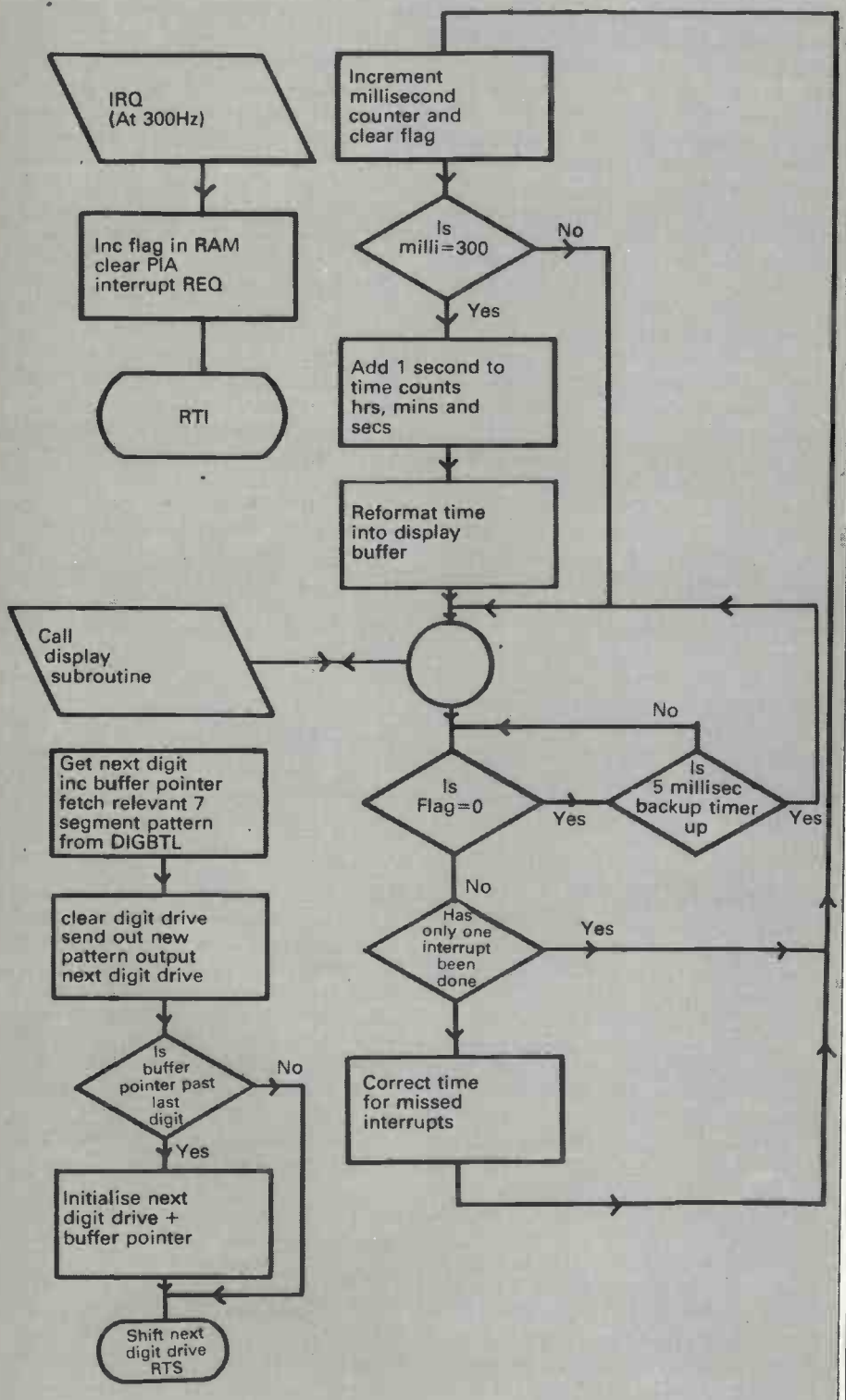
The software then calls a display subroutine which converts one character at a time to seven segments, using a look-up table DIGTBL in JBUG and outputting it to all six LEDs in parallel.

Finally, a new digit is selected by shifting the scan count mask SCNCNT one bit left. At this point the program returns to the waiting loop to await the next interrupt; extra routines such as alarm time checks could, however, be added here.

The software is organised so that even if extra routines like this occasionally last more than the three milliseconds between interrupts, the IRQ service routine will count the unserviced interrupts in the flag register in memory. On returning to the clock program, the time counter is then incremented as many times as required to compensate for missed interrupts.

This program provides a short, efficient and easily-expanded real-time clock facility for the D2 kit. Its major problem is that the clock circuit used in the kit has no facilities for frequency trimming such as is usually employed in electronic watch circuits. Those kits we tested in our laboratory ran to within a few seconds a day; this could be adjusted easily in software – for example, by detecting midnight and making the necessary adjustment in the software.

Real-time clock flowchart



Kim Project – Morse Code Generator

This month's Kim project shows the Kim-1 microprocessor in a dedicated application as a Morse code generator.

BEFORE an individual is allowed to use the amateur radio frequencies, a Post Office test in Morse proficiency must be passed. Having satisfied that requirement, the radio ham need never look at a Morse key again.

Nevertheless, Morse has many advantages over the other forms of radio transmission; the equipment required is simpler and cheaper than that needed for voice telephony, for instance, particularly at the higher power outputs.

Reception is possible over longer distances and under less favourable circumstances, again requiring less sophisticated receivers.

While it is a slower transmission method than RTTY methods or voice telegraphy, it has the dual advantage of being possible both to send and receive Morse without any specialised equipment. Further, the Morse code can be generated automatically and it can be received by machine as well.

Samuel Morse devised his code originally in 1832, basing it on the newly-discovered properties of electricity and electromagnetism. His initial design for a transmitter involved a series of projections shaped to form the code on template 'portrule', which could be moved under a contact lever to generate the codes.

Shaped by hand

At the receiving end, an electromagnet deflected a pencil over a moving reel of paper; the wavy line on the paper would then be deciphered and the message could be read normally.

In succeeding models, the portrule was replaced by the Morse key we know today, each character being shaped by hand. It was nearly 10 years before someone realised that the dot and dash made different sounds on the receiving solenoid and that they could be understood directly; so the writing receiver was abandoned.

Morse code became very popular for telegraph methods but in the 1920s, with Baudot code teleprinters and the like, the Morse code became less widely used. Early radio transmitters provided an excellent medium for it. The crudest or the most sophisticated transmitters could be used, albeit with relative risk of electrocution, to almost equal effect.

Morse has all but disappeared for telegraph transmission but it remains a firm international standard for radio; and the SOS signal has become the definitive distress call.

Each letter, digit, and punctuation mark along with various procedural signals – like invitation to type, end of transmission, error – is represented in Morse code by a combination of between one and eight dots and dashes. A dot is a short period during which signal is present, a dash a somewhat longer period.

There is no specification as to how long a dot should last – typically between one-tenth and one twenty-fifth of a second – but Morse transmission is defined in terms of 'dot' periods. A dash is defined as a period equal to three dots. The spaces between dots and dashes of the same character are equal to one dot. The space between one character and the next is equal to three dots and the interval between adjacent words is equal to seven dots.

Post Office test

The Post Office Morse test specifies a rate of 12 five-character words per minute. A radio amateur, who must transmit a call sign at the beginning and end of each contact and at 15-minute intervals during it, may send the call sign either on telephony or Morse telegraphy at a rate of up to 20 words per minute.

One of the applications of the automatic code generator is to repeat the call sign with a single key stroke. In fact, it can be made to repeat any ASCII character string in Morse, although the full ASCII character set is not implemented. Table 1 shows the various ASCII characters with their Morse and hexadecimal equivalents.

A subroutine to translate ASCII characters into Morse equivalents may be used in any number of ways. For instance, the program STRING retrieves bytes successively from the Kim memory and calls the subroutine CHAR to sound the character as Morse, stopping when it reaches a byte containing zero. CHAR will convert an ASCII character in the A-register into Morse and put it out on to two of the user PIO lines.

Unfortunately 'consecutive' Morse characters have unrelated code representations. Whereas in ASCII code the character 'A' is represented as $41 and 'B' as $42, the Morse is '.–' and '–...' respectively. So we cannot rely on program code to generate Morse from ASCII using simple rules. Because of this each character has its corresponding Morse representation in a look-up table ($026E-$0357).

As each character is a different length, there must be some way of determining where it begins and ends. An initial idea was to store the ASCII byte with the Morse characters and then search sequentially down the table until the required code was found.

A more efficient and elegant solution generates a second table containing the addresses for the start of each letter, digit and symbol ($0200-$026C). Each of those entries is a two-byte address with the letters and digits organised in ASCII order.

Powerful feature

To find any particular Morse character, for instance the letter 'C', the numeric value of 'A' ($41) is subtracted from that letter ($43 minus $41), showing that this is the second letter (A is at zero). Because each address is two bytes, this result is multiplied by two, a single shift-left.

One of the most powerful features of the 6502 processor chip used in the Kim is its indirect indexed addressing mode. In this mode any two consecutive bytes in the first 256 bytes of memory may be used as a pointer to some other location in memory. Their contents then act as a pointer to some other location in memory, forming an operand to the current instruction. There is an added bonus that the current contents of the Y register are added to the pointer before the indexing is done.

Figure 1 shows that the process of indirect pointer addressing is used twice to find each Morse character. Consider a call to the subroutine CHAR with the ASCII character 'C' in the A-register. First a jump to INTER is made; it produces the three-dot inter-character silent period. The parity bit, if there is one, is ANDed out.

Next the character is tested to see if it is a space ($20). If it is, a further six-dot duration of silence will occur and the subroutine returns. Since it is not, and since it is greater or equal to 'A' (BCC) and also less than 'Z-1' (BCS), the value of ASCII 'A' is subtracted from it.

The shift left (ASL) multiplies the result by two and it is loaded into the Y register. The instruction LDA (LET), Y loads the A register with the contents of the location pointed to by LET offset by the contents of the Y register ($4). Looking at the start of the program shows that LET contains the address of LETTER (0$200).

So location $0204 contains the low-order byte of CHARLY, the Morse for the letter 'C' ($74). The next byte, Y=5 ($0205), contains the high-order byte ($02). Those two bytes are transferred into the locations STARTC and STARTC+1, employing the 'zero-page, X' addressing mode to store the bytes. The code starts at label C100. STOPC is loaded with the next two bytes ($0206 and $0207) containing the address of DELTA ($0278).

Using this scheme, if STARTC is loaded with the beginning address of one character, then STOPC is loaded with the start address of the next, irrespective of the length of the Morse code.

Digits are handled in essentially the same way, except that zero (0,$30) is subtracted from the initial contents of the A register, and the addresses loaded into STARTC and STOPC are those offset from DIGIT – the address of which is stored in DIG.

Procedural and punctuation characters are handled by testing for each in turn, the code from label C5 to label C15. Whenever such a symbol is located the Y register is loaded with the relevant offset from SYMBOL, whose address is stored in SYM. If the character was not found at all, STARTC is loaded with the ERROR character, eight dots '.....'.

Sound label

By the time the program reaches the label SOUND, STARTC contains a pointer to the first dot or dash of one of the Morse characters LDA (STARTC), Y with zero in Y loads either a dot or a dash into the A register. If it is a dot, the subroutine DOT is called; otherwise DASH is called.

Instead of adding one to Y the next dot or dash, a full 16-bit increment by one is performed on STARTC. All 16 bits of STARTC are compared with STOPC; if they are equal, the subroutine exits. If they are not, the new value in STARTC – modified by the zero in the Y register – points to the next dot or dash.

Subroutine DELAY ($00B0) is called by both DOT and DASH. It uses one of the internal timers provided on the Kim board. DELAY will delay a period of time corresponding to one dot; it will be called three times for a dash. During a dot or dash the microprocessor has to produce a tone, which will appear on the applications port PAO.

On PA1 an on/off signal provides the capability to modulate a transmitter or external oscillator using a relay or transistor switch, in place of the Morse key. DELAY is used for sounding the dots and dashes as well as the silent space periods; it has to act as an oscillator during the sounded dots and dashes but it must also be muted during the silent periods.

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To obtain the oscillator function 21 is loaded into the 64-microsecond counter location C64D. The program then remains in a tight loop for 1,334 microseconds. After that the location OSC is incremented, changing the least significant bit from zero to one or from one to zero.

By loading this into the A register and ANDing it with %00000001 the bottom bit oscillates at 372Hz; during a tone period this will be transferred to PAO.

By ORing it with %00000010 the second bit is always set and will be transferred to PA1. Just before it is stored into the output port PA0-7 it is further ANDed with MASK. If MASK was loaded with zero before calling DELAY, DA is always loaded with a cleared byte and DELAY is silent. On the other hand, if MASK was loaded with %00000011 then PA0 oscillates at the rate determined by the timer and PA1 is set for the duration of DELAY.

The variable SPEED ($0002) contains the number of half-cycle timer delays DELAY will perform per call. It is initialised to $40. If this number is reduced the Morse will be sounded faster; if it is increased the rate will fall.

The number loaded into C64D to effect the delay determines the frequency of the tone; by changing this the pitch will be altered. SPEED will have to be adjusted to compensate for the rate change caused.

Subroutine DOT will call DELAY twice. The first time MASK will enable the output channels and the program will produce a tone for one dot period. DELAY is called a second time with MASK set to zero, so the program will be silent for one dot period; this is the inter-dot/dash spacing.

Subroutine DASH is almost identical in operation, except that DELAY is called three times in quick succession to sound a dash. Subroutine INTER generates an inter-character delay, three silent dots. Subroutine INIT must be called before any attempt is made to use DELAY; it sets the user peripheral port PAO-7 to be an output device.

Four programs

These subroutines have been incorporated into four distinct programs. They are given as examples and you will no doubt find they do not match your particular requirements exactly. The important feature is that CHAR will translate the ASCII character passed in the A register into Morse, at a rate determined by the value in location SPEED. This includes an inter-character delay. A space is interpreted as an interword delay.

Setting-up the start address of the program STRING ($0013) and pressing the GO key on your Kim causes the program to sound a string of characters from memory in Morse. You will notice that the start of the string is not mentioned explicitly in the program; instead, the indirect indexing mode is used again.

A string of ASCII characters terminated by a $00 byte is placed in any consecutive locations in the Kim memory space. The low- and high-order bytes of the beginning address are then loaded into the location BUUFER ($0000).

Note that the test string MORSE TEXTO starts at the label TEXT. This means that the text to be used may be anywhere in memory and that it is data locations, not program, which are altered to show where a new string begins. Apart from making the code somewhat tidier this means that the program could be blown into memory with no further modification.

STRING sets the Y register to zero and extracts the first byte of the text into the A register. If it is not the zero terminator it calls CHAR. Y is incremented and the next byte is obtained by jumping to STRG.

This will continue until Y overflows, in which case it will start to repeat the first 256 byte of the message, or until a $00 byte is encountered, in which case it will go into the tight loop 'HERE JMP HERE'. Use of the RESET button will allow the string to be played again by pressing GO.

This could be extended to play a number of strings which could be called with a little operating system, by using the Kim-1 keyboard to form a Morse 'jingle-machine' for radio amateur use. By retaining the indirect indexing technique, the strings can easily be of varying lengths and spread through the memory wherever there is unused space.

Inconvenient

The second program KEYED ($002C) initialises the port with INIT and then alternates between the Kim-1 keyboard fetch routine GETCH ($1E5A) and our CHARI routine. The code will wait for a character inside GETCH until one is typed, return and then jump to CHARI. CHARI is identical to CHAR except that there is no inter-character delay; this will be provided by the time to type the next character.

Because GETCH simulates the serial-to-parallel conversion of an ACIA device in software, the program must return to this routine before the next key is pressed. This feature is somewhat inconvenient; the user must predict the end of the last Morse character and start the next one just as it finishes.

By adding an ACIA – like the Motorola MC6850 – and setting-up a circular buffer to store characters if they are typed too quickly, a more usable system would result. Still, as it stands the main penalty is slightly-increased inter-word

spaces and lost characters if the next is typed before the last one is finished.

The third program CHATER ($0038) sounds Morse characters at random. It could be used for Morse code receiving practice. Part of the Post Office Morse test for radio amateurs requires candidates to transcribe 36 words in three minutes and 10 five-digit groups in one-and-a-half minutes; four errors in the words or two in the number test will result in failure.

A random code generator would not represent a fair practice medium for the test but could assist the beginner with individual character recognition.

A pseudo-random number generator ($007A) places the next 'random' number in a series into location RND ($000F). The series is obtained by multiplying a seed – in RND, which holds the last 'random' number – by 13. All but the bottom eight bits are then discarded and the result is incremented by one. Any integer can be multiplied by a constant in this way.

This program will sound any of the first 48 characters of the defined Morse set. A 'random' number in the range 0 to 47 is obtained by calling RANDOM and ANDing off the top three bits in RND, to produce a number in the range 0 to 31. RANDOM is called again and this time the top four bits are cleared, leaving a number in the range zero to 15.

Adding together these two numbers results in one in the desired range; Y is loaded with this number multiplied by two. This is then used as the offset from LETTER, loading STARTC and STOPC as before. Subroutine SOUND, which is part of CHAR, does that and INTER forms the required inter-character delay.

Three no-operation instructions are placed at $0062 but they could be replaced by a JSR PRINT routine call. PRINT would print-out the character just

(continued on next page

Table 1: ASCII characers with hexadecimal and Morse equivalents.

ASCII	HEX	MORSE
A	41	.–
B	42	–...
C	43	–.–.
D	44	–..
E	45	.
F	46	..–.
G	47	––.
H	48	....
I	49	..
J	4A	.–––
K	4B	–.–
L	4C	.–..
M	4D	––
N	4E	–.
O	4F	–––
P	50	.––.
Q	51	––.–
R	52	.–.
S	53	...
T	54	–
U	55	..–
V	56	...–
W	57	.––
X	58	–..–
Y	59	–.––
Z	5A	––..
	ERROR	..... (any unspecified ASCII character code)
0	30	–––––
1	31	.––––
2	32	..–––
3	33	...––
4	34	....–
5	35	.....
6	36	–....
7	37	––...
8	38	–––..
9	39	––––.
.	2E	.–.–.– (full stop)
,	2C	––..–– (comma)
:	3A	–––... (colon)
	3F	..––.. (question mark/ repeat misunderstood transmission)
'	27	.––––. (apostrophe)
–	2D	–....– (dash/minus/hyphen)
/	2F	–..–. (oblique)
(	28	–.––. (open bracket)
)	29	–.––.– (close bracket)

(continued from previous page)

sounded on a terminal, so the user could check the accuracy of transcription. Remember that you would have to translate the 0 to 47 number into its ASCII equivalent; a 48-byte long look-up table is a possibility.

Test routine

The last program ALTERN ($0068) is a test routine which sounds dots and dashes alternatively.

All the programs are designed to be exited from by use of the RESET key.

If you are a Morse code user it is possible that the four demonstration programs STRING, KEYBD, CHATER and ALTERN will not match your requirements exactly; but CHAR, INIT, RANDOM, DOT, DASH, DELAY and INTER are all complete routines and could be embedded in a program of your own construction in a vast number of ways.

Sorting large files

A BUBBLE sort requires all data to be held in the internal store. This is feasible with small quantities of data but with large files it may be impossible (insufficient storage space) or expensive (reduction in the number of programs running to provide space).

On minis and mainframe computers a different sorting technique is used; it utilises three or more files including the one holding the source data.

Some microcomputers are not able to access so many files at the same time but if two are available, one for input and the other for output, sorting of large files is possible, though it may be somewhat slow.

The example given used a bubble sort with a 100-element array to form the work area. The data is taken in small quantities from one file, sorted and output to the second file.

The data on the output file is in small sorted sets and if the output data is sorted a second time, the result would be no different from the first. That is because the work area is of a fixed size.

To overcome the problem, the data has to be sorted using work areas of different sizes. When the data is being transferred from file A to file B, the work area is set to the maximum size 100; when the data is passing from B to A, the work area is varied between 61 and 69.

The work area is allowed to vary to avoid the possibility of the program getting into a loop which cannot be broken. Consider the problem where the work areas are set at 100 and 60. Any file having more than 600 items would be in sorted in order up to the 600th and another sorted sequence would start from the 601st.

As the program stops only when the whole file is in sorted order – and it never would get into sorted order – the program will run indefinitely.

When the program listed is running, the user is informed as to which direction the data is being passed by the symbols:

```
A > B Input A, Output B
A < B Input B, Output A
```

This example us for a file of more than 300 items:

```
RUNNH
A > B
END OF RUN. SORTED DATA ON FILE B
READY
```

This printout is for the following file, unsorted on the left and sorted on the right:

TAKE IN PRINTOUT 3 HERE TAKE IN PRINTOUT 4 HERE

The records comprise Part Number (characters 1-9), Price (10-15), and quantity (16-20). The word END is used to indicate the end of data.

Fixed format

To use the sort on records, the data has to be assembled as fixed format. This means that data has to be in a specific place and of a specific type – alphabetic or integer, for example and length.

It is not too difficult to alter the program so that a user can enter the name of the file to be sorted or reduce the working areas if space is limited. A further article will show how data can be sorted internally using a linked list.

Silly Basic

WE FOUND this stuck in a cracker left over from an April 1 party which never happened. Take an aspirin before entering:

Teensy Basic for MK14

```
!! 16 BCD Arithmetic                    !!
!! Variety of Diagnostics               !!
!! Fully protected System -             !!
   requires logon password
```

Yes! All usual Basic functions and more packed into in amazing 40 bytes!

How to use Teensy Basic:

(i) Enter the following program into memory.

```
OF12 C4 01 37 C4 84 33 C4 OF 36 C4 30 32 3F
OF1F 90 00 C4 42 32 3F 90 00 90 F2 A9 00 9C
OF2C 06 BA FB 94 00 00 6E 5E 77 79 50 00 00
OF39 05 00 00 50 69 00 00 05 00 00 00 50 5C
OF46 50 50 79 00 00 00 00 84 42 71 OF FF
```

(ii) Run the program from OF12.
You are now set to enter your first Basic program.

The display will now show 'Ready'.
To log on to the system, press any key for exactly 23.58829 ms. This prevents any unauthorised person using your Basic programs.
If you should press a key accidentally for, say, 23.58828ms, the display will show 'Error' and you can re-try after pressing 'GO'.
Happy programming.

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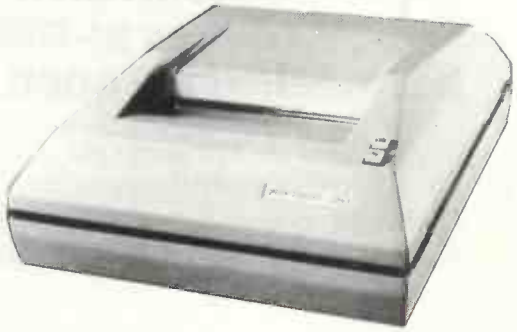

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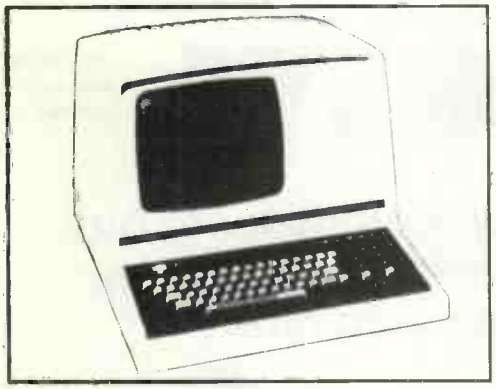

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THE BUYER'S GUIDE is a summary of low-cost computers available in this country. It appears each month; we add new computers and amend existing information as required to keep up-to-date. The cut-off point is taken as £5,000, because we feel that computer systems costing more than that for a minimum configuration cannot be summarised adequately in a brief table. Systems are listed by manufacturer.

If a computer has been reviewed by *Practical Computing*, the date of the appropriate issue is indicated.

MANUFACTURER	HARDWARE/SOFTWARE & APPLICATIONS/AVAILABILITY	PRICE
ACORN COMPUTERS	**Acorn.** Single Eurocard-sized microcomputer with 6502 processor, IKB RAM, 16-way I/O. Max size: a second Eurocard adds hex keypad and CUTS cassette interface. Monitor and machine-code programming now, Basic and disc operating system in the future. "Highly cost-effective basis for a computer or an industrial development system". Sold by post or from Microdigital (051-236 0707).	£70.20 inc VAT and postage for kit. £81 complete for assembled Acorn.
APPLE COMPUTERS	**Apple II.** Min size: 16K memory; 8K ROM; keyboard; monitors; mini assembler; colour graphics; Pal card; RF modulator; games; paddles and speakers; 4 demo cassettes. Max size: Expandable to 48K memory; floppy discs and printers are now available. Two versions of Basic, PASCAL; Assembler; games; business packages. An American system regarded as suitable for any kind of applications. Maintenance contracts offered. Personal Computers Ltd (01-283 3391) is the sole U.K. agent but has a distributor network of 20 dealers. (Reviewed July, 1978.)	Around £1,000
ATTACHE	**Attache.** Min size: system with 10 slots, S100 bus, 8080 processor and 16KB housed in desk-top case with built-in keyboard. Max size: 64KB, parallel printer interface, two single- or double-density 8in. floppies, video screen. Disc Basic; business applications produced by Moncoland, the sole U.K. agent. Distributors include Keen, GBH, Alba, and Lion.	From £1,737 without video or external storage. Full business system with screen, discs and printer about £5,000
BRUTECH ELECTRONICS	**BEM-CPUI:** Single-board processor with 6502 and no RAM. No applications software. Available from Data Precision Equipment (04862 67420). (Reviewed March, 1979.)	From £116
COMART	**Microbox.** Chassis with three to six PCB sockets for S100 boards, plus fan. Several S100 boards available. Aimed mainly at OEM industrial users and perhaps the serious hobbyist. It will take Cromemco, North Star and other processors. Available from Comart (0480 215005).	£255 for full package plus case
COMMODORE SYSTEMS DIVISION	**Pet.** Single unit containing screen, tape cassette and keyboard. Floppy disc, printer and full-size keyboard are options, as are external cassettes. Basic; games; business packages. The British subsidiary of Commodore Systems of the U.S. sells Pet for home, educational and small business applications. About 80 distributors.	£460–£795 exc VAT
	KIM I, processor (6502 chip); small calculator-type keyboard; LED six-digit display; built-in interfaces for audio-cassette and Teletype; IK RAM; 2K ROM (can add up to 64K). No software available, 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. Twelve to 15 dealers. (Reviewed October, 1978.)	£99.95
COMPELEC ELECTRONICS	**Series I.** Z-80 processor 512MB floppy, 32KB, Centronics printer, VDU. Up to 4MB disc and 64KB. CP/M, Basic, Cobol, PASCAL, Fortran IV, Assembler, Business and word processing packages available. From Compelec (01-580 6296), which is also sole supplier of Altair systems.	Less than £5,000 for basic system
COMPUCOLOR	**Compucolor II.** Packaged system including 13in. eight-colour display with alphanumerics and graphics, 72-key detachable keyboard, 8KB, and built-in mini-floppy. Max size: 32KB. Extended disc Basic in ROM, graphics programs and games. The system now ranks fourth behind Pet, TRS-80 and Apple in personal computer sales. Abacus (01-580 8841) is sole U.K. agent and is arranging distributors, including the Byte Shop and Transam. (Reviewed June, 1979.)	From £1,390
COMPUCORP	**610:** desk-top unit using Z-80 and incorporating screen, 150KB floppy, 48KB. Up to 60KB memory, four floppies, printers. Basic, Assembler, DOS, text editor, file manager; business packages. Nine dealers.	From £3,890
COMPUTER CENTRE	**Mini kit:** Z-80 CPU, CTC, USART, serial and parallel I/O. 16 bytes memory, Western Digital disc controller, SA400 5in. drive plus CP/M, cables and connectors.	Mini kit: £786.
	Maxi kit: As above but with DRI 7100 8in. drive instead of 5in. drive. All (33) volumes of CP/M user group library available for cost of media. Library includes utilities, games. Basic compilers/interpreters and Algol compiler. Microsoft Basic, Cobol, Fortran also available. Computer Centre (02514 29607).	Maxi kit: £886.
COMPUTER WORKSHOP	**System I.** Typical size: 40K memory; dual 8in. 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 1, £5,000 plus, System 2, around £3,000.
	System 3. 12K memory, cassette interface; 40-column dot matrix printer. Editors, Assemblers, Basic, games, information retrieval package. The systems were designed and built in Peterborough and are suitable for educational and small business users and perhaps the more serious hobbyist. Twenty-five dealers.	System 3, from £1,350
CROMEMCO	**Single-card computer.** 4MHz Z-80 CPU, S100 bus, IKB RAM, sockets for 8K ROM. 20mA/RS232 serial interface and parallel bi-directional interface. Basic in ROM and Z-80 monitor. For OEM and industrial users; used with backplane for "full computer capability". Comart is the sole agent and has 12 distributors. (Reviewed February, 1979.)	£247–£281

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MANUFACTURER	HARDWARE/SOFTWARE & APPLICATIONS/AVAILABILITY	PRICE
CROMEMCO continued		
	Z-2. Min size: chassis, 30A power supply, motherboard, Z-80 processor, 16KB memory. Max size: 512KB, 21 sockets, three minifloppies or four 8in. floppies. Basic, Fortran, Cobol, assemblers. For serious hobbyists, OEMs, educational applications, and industrial/scientific users.	£372 (in kit form) to more than £4,000
	System Two. Min size: factory-assembled system with 32KB, dual 90K minifloppies, dual printer interface, serial interface. Max size: two additional floppies, 512KB, up to seven terminals. CP/M-compatible operating system (DCOS), Fortran, Cobol, Basic, assemblers, word processing, database manager. Multi-user system for software development, or scientific/industrial/business users.	£2,294 upwards
	System Two/64. New configuration featuring mini-diskette drives and 64K bytes memory. Software and application as System Two.	£3,050
	System Three. Min size: 32KB, dual 256KB floppies, dual printer interface, 20mA/RS232 serial interface, Z-80 processor. Max size: two additional discs, 12KB, seven terminals, multi-channel A/D and D/A interface, PROM programmer. Software as for System Two. Described as appropriate for small to medium business, scientific and industrial users–"rivals minicomputers at more than twice the price".	£3,444 to more than £10,000
	System Three/64. New configuration featuring dual 8in. diskette drives; Z-80A processor; 64K of 4MHz memory; console and printer interfaces. Macro Assembler, Fortran IV, Extended Basic, Cobol, Multi-user Basic.	£4,385
EQUINOX	**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. Basic, Lisp, PASCAL, Macro Assembler, Text Processor. All software bundled. The system is a multi-user, multi-tasking, time-sharing system for two to 12 users. Application software available for general commercial users. Sole distributors Equinox Computers Ltd (01-739 2387).	£5,000–£40,000 plus.
EXIDY	**Sorcerer:** based on Z-80. 16K and 32K; cartridge and cassette interfaces; 79-key keyboard; 256-character set (128 graphics symbols), 12in. video monitor; expandable with Micropolis floppy discs. Basic, Assembler and Editor; games, word processor. Other pre-packaged programs plus EPROM pack for your own programs on cartridges. There is no sole importer for U.K.; sold through various importers and dealers. (Reviewed March, 1979.)	£760 for 16K, £859 for 32K (excludes video monitor); £1,200 with floppy discs.
HEWART MICROELECTRONICS	**Mini 6800 Mk II.** IK monitor; IK user RAM, IK VDU RAM; CUTS. Upper-and lower-case VDU with graphics option. 128-byte scratchpad; decoder/buffer; power supply Basic in ROM; monitor command summary, SWTPC programs; Newbear 6800; Scelbi 6800 Cookbook. Markets are small business, education and home user. Cash with order to Hewart. (0625) 22030.	From £127·50 plus VAT
	6800S. 16K dynamic RAM; IK Mikbug-compatible monitor; room for 8K Basic in ROM; upper-and lower-case graphics; single floppy disc drive; printer and high-speed tape interfaces. "Mountains of software available". Test tape with CUTS test tones, test message and games with kit.	From £275 plus VAT.
DIGITAL MICROSYSTEMS	**DSC-2.** Min size: 32KB, but 64K standard; Z-80; over IMB floppy disc on two single-sided 8in. drives; four programmable RS232 and one parallel interface. CP/M and Basic included in price. Extended Basic, Fortran, Cobol, text processing, Macro Assembler, Link Loader, business packages and CAP-CPP business software. Add-on rigid disc system (14 and 28MB) available soon. Modata (0892 39591) is sole U.K. distributor; dealers being appointed.	From £4,465.
IMSAI	**VDP 40:** 32K or 64K RAM memory 9in. display screen, standard keyboard. Two 5¼in. floppy disc drives; serial I/O. No software support, but packages for the larger VDP-80 could be converted for smaller system. This would be from about £700 per package. Computer Mart, Norwich (0603 615089), is the main U.K. supplier but there are other distributors.	£4,507 for 32K model.
ITT	**2020.** Identical to Apple II. Min. size: 4K memory; 8K ROM; keyboard, monitor, colour graphics, mini assembler; Powell card; RF modulator, games, paddles and speaker; Max size: 48K with floppy discs and printers. Basic, Assembler, games, business packages. Generally suited to any type of application. Fifteen wholesalers, including Fairhurst Instruments.	From £827 for 4K and cassette, to £1,114 for 32K plus floppy and printer. £3,003 for 48K version, two floppies and serial printer.
MICRONICS	**Micros.** Typical size: iK monitor; 47-key solid state keyboard; interfaces for video, cassette, printer and UHF TV; serial I/O, dual parallel I/O ports; 2K RAM; power supply. 2K Basic; British-designed and manufactured system. Claimed to be the cheapest data terminal – a system with an acoustic coupler and VDU for £1,020. Prospective applications for small businesses, process controllers and hobbyists. Manufacturer is sole distributor (01-892 7044).	From £400, assembled.
MICRO V	**Microstar.** Single box with twin 8in. floppy discs, 64K RAM, three RS232 serial inputs, STARDOS operating system enables system to have three VDUs, plus a fourth job running simultaneously. Word processing software available. Packages being developed include invoicing system, payroll, accountancy type system. Price includes a reporter generator language. Imported by a Data Efficiency subsidiary, Microsense Computers, Microsolve is London agent; other distributors being arranged.	£4,950 or machine and software.
MIDWEST SCIENTIFIC INSTRUMENTS	**MSI 6800.** Min size: 16K memory Act I terminal; cassette interface. Max size: three disc systems – minifloppy system with triple drives of 80 bytes each and 32K memory, large floppy system with up to four 312K-byte discs and 56K of memory mounted in a pedestal desk, or hard disc system with 10MB and 56K. Basic interpreter and compiler; editor; assembler; text processor on small disc system. American-designed system being manufactured increasingly in the U.K. Sole U.K. agent is Strumech (SEED) (05433 4321) but a distributor network is being established.	Basic system: £1,100 (£815 as kit); Minidisc, £2,500; Large floppy disc £3,200, plus £1,400 for quad system; hard disc, £8,000–£12,000.
NASCOM MICROCOMPUTERS	**Nascom I.** Min size: CPU; 2K memory; parallel I/O; serial data interface; IK monitor in EPROM. Max size: CPU; 64K memory; up to 16 parallel I/O ports. Mostly games, but also a dedicated text editor system written by ICL Dataskil. Nascom is working on large versions of Basic, and 8K Microsoft Basic should be available soon. Eleven distributors in U.K. Nascom is negotiating to increase the number. (Reviewed January, 1979.)	£165 exc. VAT.

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MANUFACTURER	HARDWARE/SOFTWARE & APPLICATIONS/AVAILABILITY	PRICE
NATIONAL MULTIPLEX	**Pegasus.** Min size: 48K; Z-80; double-density floppies (320KB); S100 bus; 12in. CRT; 58-key keyboard; two serial and one parallel interfaces; bi-directional printer. Options: 8in. drives; 1·2MB additional drives; digital recorder 9,600 baud. Assembler, Cobol, Fortran, Extended Basic. General business package available as well as text editing and mailing list. All run under CP/M. Suitable for education, business and home users. London Computer Store (01-388 5721) sole supplier.	£2,700 exc. VAT.
NETRONICS	**Elf II:** single-board computer in kit form or assembled. RCA Cosmac 1802 processor, hex keyboard, 256 bytes RAM; options include up to 64KB, ASCII keyboard, cassette and RS232 I/O, and video output. Machine code or Tiny Basic. Promoted as a teaching system in minimal form, but expandable for more general use. Sole U.K. distributor HL Audio (01-739 1582).	Basic kit £115·50 inc VAT, p&p, power supply. Assembled plus user manuals, £164·10. I/O board adds £40·95; Basic is £14·95.
NEWBEAR	**7768.** CPU board, 4K memory, cassette and VDU interfaces. Range of Basics and games, British-manufactured system for hobbyists. Expandable to 64K memory, available only in kit form. From Newbear; also from Bearbag dealers, Microdigital, Microbits.	From £45.
NORTH STAR	**Horizon.** Min size: 16K memory; Z-80A processor, single minifloppy disc drive (180KB). Max size: 56K memory, four minifloppy disc drives (180KB), any acceptable S100 peripheral boards. Basic (includes random and sequential access), disc operating system and monitor. Options: Basic Compiler, Fortran, Cobol, Pilot, PASCAL and ISAM. The system is suitable for commercial, education and scientific applications. Application software for general commercial users. Twenty distributors. (Reviewed April, 1979.)	£995 to £2,500.
OHIO SCIENTIFIC	**Ohio Superboard II:** Min size: 6502 processor, 8K Basic in ROM; 2K monitor in ROM; 4K RAM; Cassette I/F. full keyboard; 32 × 32 video I/F, 8K Basic in ROM; Assembler/ Editor; American single-board system with in-board keyboard. Aimed at hobbyist/small business. Ohio makes games, personal maths tutors, and business programs. This and other Ohio products have six U.K. distributors. (Reviewed June, 1979.)	From £298.
	Challenger C24P: similar to Superboard but with a 32 × 64 character set. Supplied as two separate boards with open slots for expansion. The 'professional portable'; similar to Superboard but packaged and ready to use. Aimed at small business, education, research.	£620 to £1,595.
	Challenger C28P: similar to 4P but expandable to include two 8in. floppies, allowing use of Ohio software. Personal computer for larger business/commercial programs. Aimed at small business, education and research.	£825–£2,670.
	Challenger C3. Min size: 32K RAM, dual 8in. floppies, triple processor architecture (6502A, Z-80, 6800). Max size: 768K RAM, 74MB hard disc, multiple terminals, printers. Can run virtually all 6502, 6800, 8080 and Z-80 code. Runs Basic, Cobol and Fortran under OS CP/M. Full business software packages available, including word processing and database management. Multi-programming available.	£3,425–£13,000.
PERTEC	**System 1300.** Min size: 32K memory; dual minifloppy discs 71 bytes each, formatted; serial interfaces. Max size: 64K memory; four serial ports. Basic (single and multi-user), Fortran, Cobol. The hardware for Compelec Altair systems is from Pertec but the software is Anglo-Dutch. Sole distributor Compelec (01-580 6296).	£3,000–£5,500.
PROCESSOR TECHNOLOGY	**Sol.** 808-based S100 microcomputer packaged with cassette and video interfaces (including graphics), keyboard with numeric pad, and 16KB RAM. Basic, assembler, word processors. Floppy disc systems available. Several distributors including Comart (0480 215005), which can offer nationwide maintenance contracts. (Reviewed, July, 1979.)	From £1,750 (excluding monitor and cassette). Complete floppy disc systems with word processing about £5,000.
RAIR	**Black Box.** Min size: 32K memory dual minifloppy discs, 80K bytes each; two programmable serial I/O interfaces. Max size: 64K memory; eight serial interfaces; IMB disc storage (or 10MB hard disc); range of peripherals. Basic, Fortran IV; Cobol. Hardware distributors are being signed and agreements made with software houses to add software. A warranty and U.K.-wide on-site maintenance is given. From manufacturer (01-836 4663) and systems houses.	From £2,300.
RESEARCH MACHINES LTD	**380-Z.** Min size: 4K memory; 380-Z processor, keyboard. Max size: 56K memory. Options: cassette, single or dual minifloppy discs, dual 8in. double-sided discs (IMB); serial interfaces; parallel interfaces; analogue interface; printer available. Basic Interpreter, Z-80 Assembler; interactive text editor: terminal mode software; data logging routines; CP/M, DOS, text processor, C Basic, Fortran, Algol, Pilot, Cobol, CP/M users' club library. Sold principally to higher and secondary education, and for scientific research, data processing and data logging. Available from Sintel and the manufacturer. (Reviewed December, 1978.)	From £830–£3,500.
	280-Z. Board version of 380-Z system. 4K or 32K (identical in performance to the 380-Z). Interfaces, software as for 380-Z.	4KB version at £398; 32KB for £722.
RCA	**Elf II:** RCA 1802 micro with hex keypad and output to TV screen. Assembler and machine code programming; options include Tiny Basic. Available by mail order from HL Audio (01-739 1582).	From £99·85 in kit form; £164·10 including postage and VAT.
ROCKWELL	**Aim-65:** Kim-compatible with full keyboard and on-board printer. IK or 4K RAM. The 4K version is described as a development system rather than a personal computer. Assembler, editor. Basic. Available from Pelco and Microdigital. (Reviewed July, 1979.)	IK – £249·50. 4K – £315.
SCIENCE OF CAMBRIDGE	**MK14:** SC/MP processor, 256 bytes user memory; 512-byte PROM with monitor program; hex keyboard and eight-digit, seven-segment display; interface circuitry; 5V regulator on board. To this can be added: ½K 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). No software 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. Mail order from manufacturer (0223 312919) and by selected dealers. (Reviewed May, 1979.)	£39·95 basic.

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MANUFACTURER	HARDWARE/SOFTWARE & APPLICATIONS/AVAILABILITY	PRICE
SDS	**SDS 100.** Single unit containing 32K memory (expandable to 64K); up to 8K PROM; twin double-sided floppy disc drives of 500 bytes each, serial and parallel RS232 interfacing; keyboard; 12in. video display; power supplies; SD monitor program; line printer available. CP/M, 8080 assembler, E Basic, Editor supplied with system; M Basic, Fortran, Cobol available for business use, industrial process monitoring and control (with additional hardware). All CP/M games and business packages. Sole supplier Airamco (0294 65530).	From £3,750 (basic machine) plus £890 (printer); £4,500 combined.
SORD	**M100.** Min. size: 16K RAM; 4K ROM monitor; full keyboard plus function keypad; two-channel joystick dual cassette I/F; IIK EBasic on cassette; video; graphics; printer; S100 buts; converters; speaker; 24-hour clock. Max size; 48K RAM; 8K ROM; black and white or colour graphics; mini-floppy discs. Suitable for OEMs, small business, education, laboratory and scientific and home computing. Main distributor is Dectrade, but for London and South contact Midas Computer Services (0903) 814523.	From £726
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A PRACTICAL GLOSSARY

Continuing the terminological gamut from I to M

Interface

A word much-loved by the jargon writers, an interface is the boundary between two systems, and within that can be practically anything from an airy concept to a piece of very solid hardware.

On the one hand it is possible, and even sometimes helpful, to think of the man-machine interface as residing somewhere in the brain of the human, who perceives what is happening and who decides to interact with the machines.

On the other hand, it is generally more useful to think of an interface as a plug, a socket, or a cable; or all three. The interface between a cassette player and a microcomputer is the connection between them, the connection which passes information or data from one to the other.

Programs can have interfaces, too, which is where the 'logical' bit comes in; they aren't solid, physical interfaces, but those parts of a program which can pass information or data to other programs. And so on.

The crucial aspect of interfaces is that they should be well-defined, wherever or whatever they are; so that both sides of the connection should know what to expect, and so that information can be passed satisfactorily from one to the other.

Take the CCITT V24 standard, also known as the EIA RS232-C specification. This is a well-accepted standard for connecting things physically; it defines which wires go to which pins in a plug-and-socket connection, and effectively it defines the shapes of the plug.

It is widely used and most terminals and printers offer a V24 connection; even so, there is plenty of room for variety and many terminals require you to juggle the wires around before the plug is satisfactorily into the socket.

IS

Conventional abbreviation for index sequential (qv).

Label

Like the literal descriptive definition, it's a descriptive identifier. Typically a label is a group of characters used to identify a file, a message, or a record; very specifically, the term also denotes an instruction in a program.

Some programming languages allow you to reference a label rather than an absolute address or a particular line number; so instead of a branch instruction like GOTO 40, where 40 is a line number, you might be allowed to say GOTO SUBROUTINE "B".

Language

This one's tricky. Between them Wittgenstein and Chomsky had some difficulty composing a simple definition. Still, it's obvious that the essential element is communication; and in computing, a programming language is a code – or a defined set of symbols or a notation or a systematic means of communication – whereby humans can communicate with computers.

The analogy with human languages is very good. There is no point in using Swahili to a Pathan if the Indian doesn't know the language. Speaking in Swahili to someone who knows that language is a good way to impart information. In fact, the only simple way for two people to pass information is by agreeing, probably implicity, on what a set of written squiggles or spoken grunts means.

So it is with computers. Basic and Cobol and the rest are alternative ways of expressing information; if you and the computer both 'know' one of them, you can write a program which will run on that computer.

With a definition like this, it should be said that languages are in several varieties. There are three – machine code, assemblers, and high-level languages. All are being defined as we go, but briefly **machine code** relates directly to how the computer processes instructions, so normally it consists of a binary code, a string of 0s and 1s which will be meaningless to anyone who doesn't know this is a code the computer can understand.

Assembler is one step up, coding the binary instructions into more or less meaningful alphanumeric symbols but it's still related directly to the way a particular computer operates.

High-level languages are distanced one step further from the insides of the processor; the instructions usually bear some resemblance to English but, more important, the high-level language can, in theory, run on more than one computer. In practice, for each computer there's a different translator which converts the high-level language into machine code.

Latency

It is just possible you might meet this word. It refers to a delay or a waiting state in the middle of some operation. You might encounter it among the fine print of a floppy disc manual – it's the delay while the read/write head is moving, plus the time the disc takes to rotate to the required data position. In other words, nothing happens during latency, but something is about to happen.

LCD

Liquid crystal display. Some crystals are liquid, and some liquid crystals light if you tickle them with a burst of electricity. LCDs are used in pocket calculators and digital watches, normally as an alternative to **LED** displays. The technology probably isn't a serious contender when a great deal of information has to be displayed quickly; you can't beat the cathode ray tube for that.

Leased line

If you want to link your computer to another, there are realistically two ways of doing it – a cheap way and an expensive way. The cheap way is via the ordinary dialled telephone system. You'll need a modem or an acoustic coupler but you'll pay only the normal dial rates.

You will be competing with crossed lines and other interference, though, so if you know where the recipient of your transmission is, and if you need a high-quality transmission signal, and if you have the extra money, you might lease your own private telephone line to do the job. You will still need modems – more of that later.

LED

Light-emitting diode. Most digital read-outs on laboratory instruments, calculators and watches use LED display. A diode is a simple electron tube which lights when you pass electricity through it, so where you need a simple display – exactly what they are – LED displays are the natural choice.

Liebniz

Gottfried Wilhelm von Leibniz was one of those 17th-century polymaths you usually see wearing an unlikely curly wig and looking coolly benign. Leibniz was reportedly a cheery soul who dabbled with law, logic, religion, politics, diplomacy, philosophy, history, librarianship, inventions and maths. He has a place here because, around 1694, he invented a mechanically unreliable and economically unmarketable calculator. Pascal had already built one to add and subtract; the Leibniz version could multiply and divide, too. Since it didn't work he moved to other things, notably letter-writing – there are at least 15,000 of his letters around – and philosophy.

Library

A collection of program subroutines to insert in programs or data files.

Light pen

A photo-electric device which can detect the presence of light at a particular point on a CRT display screen. It looks like a pen but it's connected by cable to a controller. You point it at the place on the screen you want to reference; the controller detects where you are. Depending on the programming, the computer could then modify the display or perhaps accept something as input data.

Line

It's a connection, usually a cable, between one part of the system and another – like screen and keyboard – or one computer and another. See *line speed*.

Line feed

The command which moves the paper in a printer up by one line; on a display screen then

(continued on page 133)

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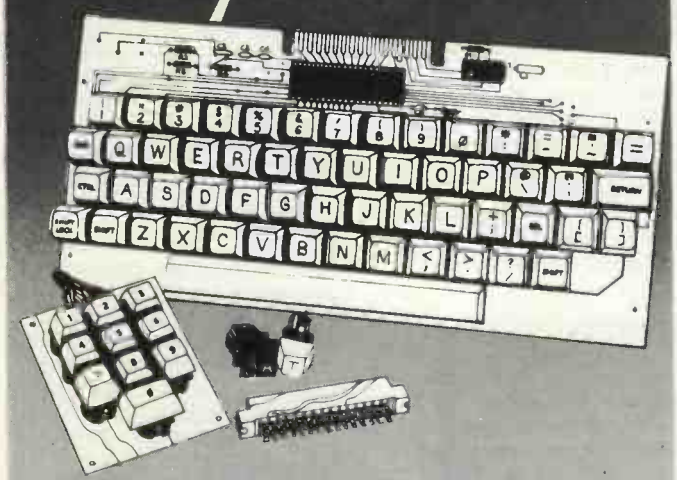

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(continued from page 131)
effect is to move the *cursor* on to the next line.

Line speed
This is about the only time you'll use the word 'line' in the communications context. Line speed is the data rate, which means the maximum rate at which data can reliably be sent down a line.

Linear programming
Some programming techniques are mathematical; they utilise equations, follow mathematical logic, and essentially calculate things. Linear programming is a branch of this esoterica, much used in 'what if' problems-like routeing vehicles to optimise fuel consumption, economic planning to balance all the variables, and so on.

Line printer
A line printer is a printer which prints one line at a time. It contrasts with a **serial** printer, which prints one character at a time. Line printers are generally faster and more complicated, so they tend to be more expensive.

LISP
Processing language which belongs to the intellectually refined reaches of programming. List processing is processing data in the form of lists.

Load
To transfer something from memory to backing store, or vice versa, you load a program from cassette into the memory when you read it in.

Two other loads are of some importance. One is the obvious physical action of placing a cassette or floppy disc or paper in the appropriate device. The other usage refers to internal operations of moving around data – your programming language may well allow you to load specific locations with specified data, especially if it's an assembler.

Location
Loosely, it's a synonym for **address**. More precisely, it means the same as **absolute address**, a particular storage area in memory

Logic
Computers are fast idiot rule-followers because they are electronic and logical. In rarefied terms, logic is the formal and systematised interconnection of discrete components. The emphasis in on the interconnection – logic relates things together – and on the formal bit – logic doesn't necessarily have any relationship to physical matters like a hardware organisation.

In practice, and in microcomputers, logic means the circuitry which performs logical functions, and since much micro circuitry does this, the term 'logic' is applied loosely to any of its circuitry.

Loop
A loop is a group of instructions in a program which may be executed more than once before the program continues. The loop includes one instruction which increments some kind of counter and another which checks the counter it sees if it's reached a specified exit total. All this is the same as *iterate* (qv).

LSI
Large-scale integration. See *integration*. All micros use LSI, a loosely-defined term meaning electronic circuitry with a large number of logical operations per component.

LSI-4
A minicomputer from Computer Automation. It does not have as much LSI circuitry as the micros and Computer Automation doesn't generally sell them on a one-off basis. If you can obtain an LSI-4 it would make an interesting contrast with the upmarket micros.

LSI-11
The 16-bit micro from Digital Equipment, which builds a computer around it (the PDP-11/03). So do other companies, Plessey among them. Not many personal computers utilise the LSI-11, so the Heathkit H-11 is an honourable exception.

Machine
All-purpose jargon word for processor, computer or system.

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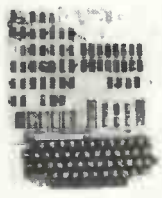

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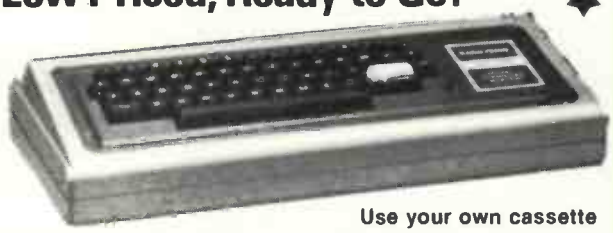

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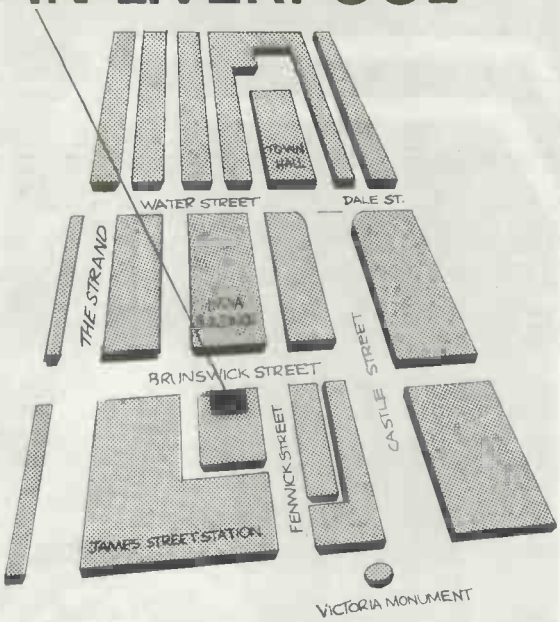


Introduction

Our company is one of the first in the country set up to cater for the exciting new world of microcomputer.

We sell a wide range of computers, each selected for its value, ability and reliability, brief notes of each are included on the following pages.

Not only do we serve as a retail outlet for the machinery of the second industrial revolution but also we offer a myriad of other service to help you to decide which machine best fits your requirements, this is backed by providing a hire service which allows potential customers to try a machine before they buy it.

Secondly we sell the widest range of literature concerning microcomputers available in the U.K. today. The books are imported directly from the U.S. and our current range exceeds 250 titles. Magazines include all the U.K. magazines with as many back issues as possible held in stock. The best of the American Magazines are also available, the latest possible issues always being in stock.

On the hardware side we have the proven ability to design, manufacture, maintain and repair; likewise on the software side we have the proven ability to produce and maintain commercial application programs.

In addition to all the foregoing we also provide support with magnetic media, engineering tools, test equipment etc, etc.

All in all we try and provide the most competent service in the microcomputer industry.

B. Everiss

BRUCE EVERISS

TERMS AND CONDITIONS

In addition to cash we accept Access, Barclaycard, Diners Club and cheques covered by a bankers card.
VAT in this brochure has been calculated at the rates of 8% and 12½% current at the time of writing. Please allow for any changes in the rates.
Postage and carriage is offered free of charge within the United Kingdom.
All products are covered by our 90 limited warranty against failure due to faulty materials or workmanship.
We offer an after sales service which is second to none, technical expertise is always available from our well informed staff and repairs are handled by our own service department at very competative rates.
Terms are implemented at the discretion of management.

TECHNICAL QUERY SERVICE

We have a free technical query service, for written queries only. If you have any question you want answered write us a letter and we will reply with your answer by return of post.

WHY YOU SHOULD BUY FROM US

We want and appreciate your trade. As a direct consequence of this, we do our upmost to ensure that our customers are, and remain, happy. To this end we provide full technical support with fast and efficient service for all our customers.

commodore

The Commodore Pet

A complete Computer for the price of a good typewriter! With a library of over 200 programs in business, science, education and entertainment costing as little as £1.25 each.
The Pet is made with Commodore's own advanced technology to bring you the benefits of recent dramatic advances in microprocessor technology.
Pet can store and retrieve data which conventially occupies hugh storage capacity, and solve numerical problems traditionally tedious and time consuming.

NEW AT MICRODIGITAL

COMMERCIAL APPLICATIONS

The Commodore PET brings to the commercial user for the first time, a really cost effective business computer for use in payroll, stock control, amortization calculations, numerical analysis, etc.

FOR THE SCIENTIST AND ENGINEER

The PET has a comprehensive set of scientific functions designed for scientists and engineers. PET also has a built-in real time clock and is directly compatible with hundreds of instruments such as D.V.M.'s, dataloggers etc., enabling control of industrial plant and processes.

AS A TEACHING TOOL

As a teaching tool in computer programming and other fields, the PET has no equal in performance or cost. There is even a tutorial programme (Basic Basic) available for £9.00 — use the PET to teach you how to program PET!

IN THE HOME

As well as being used for all the previous applications the PET computer is an extremely creative and instructive learning medium of the future for young and old alike. There are also large numbers of entertainment programs available including chess and space games.

EASE OF OPERATION

The Commodore PET comes complete with a built-in T.V. screen, keyboard and cassette deck as well as its full computer circuitry. It is plugged into any 13 amp mains and no special computer knowledge is needed for running standard programs. Personal programs can readily be written in the BASIC computer language of PET which is easily learnt.

AN EXPANDABLE SYSTEM

Further expansion is a prime design concept enabling PET to be made the heart of a much larger system incorporating printers, floppy discs etc, as and when required.

		nett £	VAT £	Total £
COMPUTERS				
PET 2001-4	— Standard PET with integral cassette and calculator type keyboard. 4K bytes of memory.	460.00	36.80	496.80
PET 2001-8	— Standard PET with integral cassette and calculator type keyboard 8K bytes of memory.	550.00	44.00	594.00
PET 2001-16N	— PET with 16K bytes of memory and large keyboard. External cassette optional	675.00	54.00	729.00
PET 2001-32N	PET with 32K bytes of memory and large keyboard. External cassette optional	795.00	63.60	858.60
PRINTERS				
PET 2023	— 80 column dot matrix printer. Plain paper printer with full PET graphics.	550.00	44.00	594.00
PET 2022	— 80 column dot matrix printer as above, with forms handling capability and tractor feed.	645.00	51.60	696.60
FLOPPY DISC				
PET 2040	— Dual drive intelligent mini-floppy system. 343K net user storage capacity.	740.00	59.20	799.20
EXTERNAL CASSETTE DECK				
PET C2N		55.00	4.40	59.40
KIM RANGE				
KIM 1 Microcomputer System		99.95	8.00	107.95
KIM 3B 8K Memory Expansion		129.95	10.40	140.35
KIM 4 Motherboard		69.95	5.60	75.55
MANUALS (VAT free)				
PET Introductory Booklet				1.00
PET Users Handbook	included with PET Computer			5.00
6500 Programming Manual				5.00
6500 Hardware Manual	included with KIM 1			5.00
KIM Users Handbook				5.00
Strathclyde Basic Course Workbook (Without cassettes)				3.00
MISCELLANEOUS				
PET Users Club Membership				10.00

PART EXCHANGE

Nascom 1 owners — We will give up to £165 in part exchange for a well built, working Nascom 1 against the cost of a Commodore Pet.

A3

Exidy inc. SORCERER

EXIDY SORCERER is a complete and ready to use microcomputer, simply plug into a standard U.H.F. T.V. set and you are up and running in BASIC.

SORCERER is manufactured in America by EXIDY who have for the last five years been a leading manufacturer of microprocesser based T.V. games.

High quality materials are used throughout, and the SORCERER has proved to be a well constructed and reliable machine.

Subject of rave reviews, SORCERER offers far and away the best features of any machine in it's class.

FEATURES AS STANDARD

In alphabetical order:

BASIC.
SORCERER has 8K Microsoft BASIC, contained in a plug in "Rom Pak" which slots into a socket at the side of SORCERER. Microsoft BASIC is a well tried and trusted version of BASIC used on a number of other machines besides SORCERER.

CHARACTERS.
SORCERER has the full 128 character, upper and lower case standard ASCII. and also 64 useful predefined graphic characters.

DISPLAY.
The video display on SORCERER is "memory mapped", the characters displayed on the screen are a representation of a block of random access memory. This feature is very useful when working with graphics.
64 characters are displayed per line, and 30 lines can be displayed at once a total of 1,920 characters all seen at the same time.

GRAPHICS.
This is an area in which SORCERER scores high marks in the computer ratings SORCERER has 128 graphic symbols which may be defined by the user on an 8 x 8 dot matrix. Any symbol may be defined such as a mathematical symbol, part of a larger picture made up of many such symbols, or even a chinese letter! . . . Yes your computer can even speak chinese!
Each user defined character is formed by programming 8 bytes of memory and is assigned a key on the keyboard depending on where in the memory you place the 8 bytes of data. User defined graphics may be called up direct from the keyboard or under program control.

KEYBOARD.
SORCERER has a high quality keyboard with a light but positive "feel" to it. The keyboard consists of a 64 key, stepped, style keyboard with a 16 key numeric keypad to one side, the numeric keypad is very useful for programmes containing a great deal of number data.

MEMORY EXPANSION.
The standard SORCERER unit has 8K of user Ram. The memory capacity may be expanded to 16K or 32K without any additional hardware save the chips themselves, further expansion is available via the S100 expansion unit which is an optional extra.

MONITOR.
SORCERER has a power of 4K monitor in Rom. Facilities include, Memory display/modification, Input/output control (for instance you can link to user defined I/o routines), cassette file handling and creation of batch tapes. memory block move and system diagnostics.

PARALLEL INPUT/OUTPUT.
A (DB 25) 25 pin connector at the rear of SORCERER provides a parallel input/output port which can drive a Centronics printer or similar peripheral devices that require an eight bit parallel I/O port with full handshaking.

ROM PAKS.
There are a unique feature of the SORCERER, the Rom Pak provided with the SORCERER contains 8K Microsoft BASIC in Rom. APL, FORTRAN pascal in Rom Paks are in the pipeline also Eprom pak, Development Pak, and Word processing Pak will be available in the future. ROM Paks can contain as much as 16K of read only memory.

SERIAL INPUT/OUTPUT.
Standard RS232 serial output is available via another DB 25 connector at the rear of SORCERER, this socket also has connections for two cassette units furthermore the motors of these cassette units can be controlled by instructions contained in your programmes.

S100 EXPANSION UNIT.
The S100 expansion unit is a self contained 6 slot chassis styled in the SORCERER fashion with interconnect cable and s*100 transaltion interface. It serves to connect SORCERER to a standard bus structure enabling SORCERER to be connected to a multitude of peripheral devices including: Printers, Floppy Disk Subsystems, A.C. power line switching, Music Synthesizer units, Speech Recognition systems, Speech synthesizer units, and many other exciting devices.

TAPE INPUT/OUTPUT.
Facilities are provided on the SORCERER for connection to a standard commercial tape recorder. Just plug into the earphone and microphone sockets (leads provided) this gives you the ability to store and retrieve programmes you have written.

VIDEO OUTPUT.
Jack plug connectors at the rear of the machine give both modulated and un-modulated video.

	RETAIL PRICE (£)	*VAT (£)*	*TOTAL (£)*
Sorcerer Computer 8K RAM	650.00	52.00	702.00
Sorcerer Computer 16K RAM	760.00	60.80	820.80
Sorcerer Computer 32K RAM	859.00	68.72	927.72

Sorcerer Computer Expansion.
S100 Expansion Unit.
A completely self-contained 6-slot chassis styled in the Sorcerer fashion with interconnect cable and S100 translation interface.

	RETAIL PRICE (£)	*VAT (£)*	*TOTAL (£)*
S100 Expansion Unit	210.00	16.80	226.80

Video Display Unit
A 12" professional CRT monitor with high resolution and P31 phosphor styled in the Sorcerer fashion. Connects directly to Sorcerer computer with video cable supplied.

	RETAIL PRICE (£)	*VAT (£)*	*TOTAL (£)*
12" Video Display	240.00	19.20	259.20

I/O Expansion Kit
A cable and S100 translation interface card to interconnect any S100 chassis to the Sorcerer computer.

	RETAIL PRICE (£)	*VAT (£)*	*TOTAL (£)*
I/O Expansion Kit	98.00	7.84	105.84

16K Memory Expansion Kit
Component parts and instructions to ADD-ON memory within the Sorcerer computer enclosure. Maximum RAM expansion internally is 32K bytes.

	RETAIL PRICE (£)	*VAT (£)*	*TOTAL (£)*
16K Memory Expansion Kit	175.00	14.00	189.00

Sorcerer Computer Accessories	*RETAIL PRICE (£)*		
Manuals			
Sorcerer Operation Manual	6.95		
Sorcerer Technical Manual	8.95		
Standard BASIC Manual	8.95	No VAT on	
Development Tour Manual	8.95	these items	
Word Processing Manual	8.95		
S100 Expansion Unit Manual	6.95		
Video Display Manual	6.95		
Rom Pac TM Cartridges			
EPROM Pac	35.00	2.80	37.80
Standard BASIC Pac	70.00	5.60	75.60
Development Pac	70.00	5.60	75.60
Word Processing Pac	70.00	5.60	75.60
Miscellaneous			
Cassette Recorder Cable	3.95	0.32	4.27
Video Display Cable	3.95	0.32	4.27
Serial/Cassette Data Cable	16.95	1.36	18.31
Parallel Data Cable	16.95	1.36	18.31

A4

apple II AT MICRODIGITAL

JOIN THE MICROCOMPUTER REVOLUTION BY BUYING THE BEST APPLE PLUGS INTO A DOMESTIC TELEVISION AND CASSETTE RECORDER TO MAKE A POWERFUL, EASY TO USE COMPUTER SYSTEM

Apple II

Features

- A fast powerful integer BASIC is built into Apple II. The built-in assembler, disassembler and monitor will be appreciated by advance programmers in search of more speed or flexibility than BASIC can provide.
- Fifteen colour standard graphics in a 1,880 Point array for spectacular visual effects.
- High resolution graphics in a 54,000 point array for finely detailed display.
- Loudspeaker and sound capabilities that bring programs to life.
- Four hand control inputs for games and other human input applications.
- Internal memory capacity of 48K Bytes of RAM, 12K Bytes of ROM for big system performance in a small package.
- Eight expansion slots to plug in cards that give your Apple even more power.
- Superb, easy to follow documentation, so even a total beginner can use the machine.
- Fast (1500 baud) cassette interface.
- Proper typewriter style keyboard.

Apple II prices

With 16K of RAM		
Nett.	Vat.	Total
985.00	78.80	1063.80
With 32K Bytes of RAM		
1185.00	94.80	1279.80
With 48K Bytes of RAM		
1305.00	104.40	1409.40

Applesoft II Floating Point BASIC

An expanded version of Microsoft's popular floating point BASIC. Its 9 digit arithmetic and large library make it ideal for business and scientific programs. Applesoft II is supplied either with a cassette tape or a plug in ROM card. The tape version is supplied free with every Apple.

Apple II ROM card

Nett	Vat	Total
110.00	8.80	118.80

Floppy Disk Subsystem

Gives your system immediate access to large quantities of data. The subsystem consists of an intelligent interface card, a powerful Disk Operating System and one or two mini-floppy drives.

Features

- Storage capacity of 116 Kilobytes/diskette.
- Data transfer rate 156K Bits/second.
- Individual file write protection.
- Powered directly from Apple II.
- Full disk capability with systems as little as 16K bytes of RAM.
- Fast access time — 600 m sec (max) across 35 tracks.
- Powerful disk operating software.
- Load and store files ;by name.
- BASIC program chaining.
- Random or sequential file access.

Floppy disk subsystem

425.00	34.00	459.00

Second disk drive and connecting cable

375.00	30.00	405.00

Parallel Printer Interface Card

Allows you to connect almost any popular printer to your Apple, A BASIC program can produce hard-copy output as easily as it prints to the TV monitor screen. Command interpretation and printer control details are handled by the firmware built into the card, to eliminate user programming requirements.

Parallel Printer Interface Card

Nett	Vat	Total
110.00	8.80	118.80

Communications Interface Card

Allows your Apple to "talk" (though a modem) with other computers and terminals over ordinary telephone lines. Now you can load programs over the phone, send messages to remote terminals or access your office computer from the comfort of your home.

Communication Interface Card

Nett	Vat	Total
110.00	8.80	118.80

High Speed Serial Interface Card

Allows Apple to exchange data with printers, plotters and computers in serial format at up to 19.2 K Baud

High Speed Serial Interface Card

Nett	Vat	Total
110.00	8.80	118.80

Speechlab Voice Recognition Card

Allows the Apple to recognise a spoken vocabulary of up to 32 user-selected words. The computer can be programmed to perform any task desired upon recognition of a key word.

Voice Recognition Card

Nett	Vat	Total
165.00	13.20	178.20

Prototyping Card

Provides the User with a means of building up experimental circuitry for the Apple computer. The 2¾" x 7" double-sided board includes a hole pattern that accepts all conventional integrated circuits and passive components. Documentation includes a complete system bus description to aid the interface designer.

Prototyping Card

Nett	Vat	Total
18.00	1.44	19.44

Carrying Case

The Apple is truly portable and this padded vinyl, leather look case protects your Apple in transit and makes it easier to carry.

Carrying Case

Nett	Vat	Total
25.00	2.00	27.00

BARCLAYCARD VISA

accepted

Other Products

Apple maintains a 6 to 12 months technology lead over the competition. There is not sufficient space to give full details of all that is available, but the following is a sample to whet your appetite.

Light pen
Real time clock
Co-resident assembler on disk or tape
Programming aid ROM
Joysticks
PROM Burner

Apple Hire

The Apple is one of many machines from Microdigital (Hire) Ltd. For details ring 051-227 2535.

Software

We can supply application programs from a number of sources and advise you on your program requirements.

Our own software department has developed a Trade Counter program which keeps a round pounds debtors ledger in real time and advises trade counter staff when credit limits are reached.

This program is tried, tested and proven and helps reduce bad debts.

Nett	Vat	Total
25.00	2.00	27.00

Trade Counter Program (Integer basic, needs 32K of RAM and a single disk)

Lower case for your Apple II exclusively from MICRODIGITAL

- Plugs in — no modifications to your Apple
- Displays lower case letters with descenders
- Provides full 96 — character ASCII set
- Software included for use with integer BASIC.

	Nett	VAT	Total
Lower case adapter	40.00	3.20	43.20

NEWS FLASH

ITT 2020 SYSTEM

We are now dealers for the ITT version of the Apple at the following prices.

	Nett	Vat	Total
With 4K Bytes of RAM	827.00	66.16	893.16
With 16K Bytes of RAM	950.00	76.00	1026.00
With 32K Bytes of RAM	1114.00	89.12	1203.12
With 48K Bytes of RAM	1278.00	102.24	1380.24

PART EXCHANGE

Pet owners, trade up to an Apple at MICRODIGITAL. We can allow up to £300 for your old PET against the cost of a new Apple II

Other Prices

	Nett	VAT	Total
8 x 4116 RAMS 16K Bytes	100	8.00	108.00
Joystick	20	1.60	21.60
Diskettes	3	0.24	3.24
Diskettes Case	1	0.08	1.08
Centronics 779 Printers	825	66.00	891.00
Tractor feed on Printers	65	5.20	70.20
British ASCII on Printers	22	1.76	23.76
AXIOM micro Printers	349	27.92	376.92
AXIOM graphics Printers	699	55.92	754.92

Books

Apple operators manual	5.50	NO VAT ON THESE ITEMS
Applesoft extended Basic manual	4.00	
Basic tutor	4.00	
6502 programming manual	7.50	
6502 hardware manual	7.50	

A5

NASCOM 1 AT MICRODIGITAL

The most successful microcomputer in Europe, the Nascom 1 represents exceptional value for money.

	Nett	VAT	Total
NASCOM I	165.00	13.20	178.20

The Nascom I is the best possible introduction to the world of personal computing, yet it has the power and flexibility to be expanded into a full data processing system.
The specification includes a powerful Z80 processor, parallel 1/O controller with two 8 bit ports. UART driving cassette interface or most serial peripherals, video output to plug in the ariel sockets of your T.V., 2K bytes of RAM (1K user and 1K video), proven 1K byte monitor program in EPROM and a spare EPROM socket.
The kit is complete, all that is required is a power supply a domestic T.V. and a domestic cassette recorder.

POWER SUPPLIES
There are two power supplies available, a 3 amp supply which will power the basic kit and some expansion and an 8 amp supply with toroid transformer which will power a very large system. Both supplies can be mounted in the vero frame.

	Nett	VAT	Total
3 amp P.S.U. kit	24.50	1.96	26.46
8 amp P.S.U. kit	60.00	4.80	64.80

EXPANSION
Nascom I is expanded by connection to a buffer board which creates a 77 way bus structure "NASBUS" into which expansion boards plug directly. The bus structure is carried along a motherboard which allows future boards to be added and to keep your computer neat the Nascom I, power supply, buffer board, mother board and expansion boards can all be mounted in a vero frame.

Buffer Board	32.50	2.60	35.10
Mother board	9.50	0.76	10.26
Mini Motherboard....	2.90	0.23	3.13
Vero frame	29.50	2.36	31.86

NASBUS
The 77 way Nasbus has the following advantages:

1. Uses standard Veroboard as a motherboard and Standard 0.1" single sided edge connectors for expansion cards. These components are readily and cheaply available.
2. The bus structure leaves 8 spare data lines and 4 spare address lines for future use of 16 bit processors.
3. The power lines are regulated, on board regulators are therefore not needed which obviates the necessity for fan assisted cooling
4. All cards use lower power, low noise shottky buffering which means the bus is quiet and does not need sophistication like active termination or interleaved ground planes.
5. Expansion boards are standard 8" x 8" vero DIP boards which are economic and give a good useable area.

MEMORY
The memory expansion board can carry 16 dynamic RAM chips, these can be either 4K bit or 16K bit chips and the board is offered with 8, 16 or 32K bytes of RAM. The 16K board can be expanded to 32K by plugging in 8 more 4116 chips.
The memory expansion board also has room for 4 2708 UVEPROMS each of 1K bytes and a lot of pre-programmed systems software is available to fit these sockets.

Nett	Nett	VAT	Total
8K RAM board kit	85.00	6.80	91.80
16K RAM board kit	140.00	11.20	151.20
32K RAN board kit	200.00	16.00	216.00
Set 8x 4116	70.00	5.60	75.60
Additional 2708	10.50	0.84	11.34

INPUT/OUTPUT
For people wanting to use more peripherals than the standard kit allows for, Nascom are producing an 1/O board which can carry a counter timer chip and a number of PIO's and UARTS.
This will be available in March.

I/O board	35.00	2.80	37.80
CTC	8.00	0.64	8.64
UART	5.50	0.44	5.94
PIO	8.00	0.64	8.64

BASIC
To allow high level language programming Nascom have produced a 2K Tiny basic and a 3K Super Tiny Basic in 2 or 3 2708 EPROMS respectively. Also available is an 8K Microsoft precision floating point basic in 8 2708's which will be available in June on a single 64K bit ROM to fit the EPROM board.

Tiny Basic	25.00	2.00	27.00
Super tiny Basic	35.00	2.80	37.80
8K Basic (8 x 2708)	100.00	8.00	108.00
8K Basic (ROM)	40.00	3.20	43.20

EPROM BOARD
Available in June this board will carry 8 x 2708 UVEPROMS and the 64K bit ROM containing basic. The board can also be used for burning in 2708 UVEPROMS.

EPROM BOARD	40.00	3.20	43.20

GRAPHICS BOARD
Allows high resolution graphics on your Nascom 1. Contains 4K of RAM.

GRAPHICS BOARD	95.00	7.60	102.60

MONITOR
Nascom have written a new monitor, T4 the most powerful yet available for this machine it contains many desirable features not found on any other monitor. T4 comes in 2 x 2708 to plug into the main Nascom 1 board.

	Nett	VAT	Total
Nasbug T4	25.00	2.00	27.00

ASSEMBLER
A powerful editor assembler zeap 15 available to run under Nasbug on tape.

Zeap (tape)	30.00	2.40	32.40

M5
This is a new computer language, designed to use the minimum amount of memory and thus work on a basic Nascom 1 Kit.
Features
- Reverse polish notation
- Multiply, Divide, Add, Subtract, Increment and Decrement by one.
- Integers up to 64K.
- Variables A to Z
- Loops and jumps
- Editor
- Error messages
- String handling

M5 is supplied on tape with an instruction manual packed with examples and a hex dump of the language.
We have priced M5 so all Nascom owners can afford it.

	9.26	0.74	10.00

(M5 is supplied free on all Nascom purchases over the value of £150).

THE FUTURE
In the near future a mini-floppy disk system will be available with either single or double drive. These will probably offer in excess of ½ a megabyte and 1 megabyte respectively at prices that will allow even thet to have a large data base. To take full advantage of the business and scientific uses opened up by disks Nascom intend to release several high level languages. Looking further forwards Nascom Is a developing product, and the fact that many thousands are now in use will ensure that the latest in computer technology will be available at a competitive price.

FREE Gift Pack

with all **Nascom I** purchases over £150.
Contains:
A copy of M5, pad of 100 Microdigital coding forms, 10 CI5 cassettes, keyboard bleep kit, UHF modulator and keyboard ribbon cable.

Total Value nearly £30.00

A6

NASCOM 2 NEW AT MICRODIGITAL

Following the success of its NASCOM-1 Microcomputer which was launched nearly 18 months ago, Nascom Microcomputers Limited has introduced the NASCOM-2.

In no way is the NASCOM-2 a replacement for the NASCOM-1. Over the 18 month period, it has become obvious that there is a marketplace for the NASCOM-1 for the forseeable future. However, there is also a large market for an upgrade version which will have more of a computing bias. From this specification you will see that many of the additions necessary on the NASCOM-1 are integral in the NASCOM-2.

MICROPROCESSOR

Z80A. 8 bit CPU. This will run at 4 MHz but is selectable between 1/2/4 MHz. This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.
The software library for the Z80, with its base around the 8080, has rapidly expanded with the increasing use of its more powerful instruction set.

HARDWARE

12" x 8" Card
All bus lines are to the Nasbus specification.
All bus lines are fully buffered.
PSU +12v, +5v, -12v, -5v.

MEMORY

On-board, addressable memory:
2K Monitor — Nas-Sys I (2K ROM)
1K Video RAM (MK 4118)
1K Work space/User RAM (MK 4118)
8K Microsoft Basic (MK3600 ROM)
8K Static RAM/2708 EPROM

INTERFACE KEYBOARD

New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.

T.V.

The 1v peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.

I/O

On-board UART (Int. 6402) which provides serial handling for the on-board cassette interface or the RS2 32/20mA teletype interface.
The casette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the Nascom —
The RS232 and 20mA connector will interface directly into any standard teletype.
The Input and Output sides of the UART are independently switchable between any of the options—
i.e. It is possible to house input on the cassette and output on the printer.

PIO

There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2 x 8 bit ports with complete handshake controls.

ON-BOARD DECODING

The NASCOM-2 makes extensive use of ROMS for on-board control decoding. This reduces the chip count and allows easy changes for specialised industrial use of the board.
Link options are on-board to allow the Reset control to be reassigned to an address other than zero.

CHARACTER GENERATORS

The 1K video RAM drives a 2K ROM character generator providing the standard ASCII character set with some additions, 128 characters in all. There is a second 2K ROM socket for an on-board graphics package which is software selectable. Gives another 128 characters.

The PCB is, of course, of industrial standard, through hole plated, masked and screen printed.

DOCUMENTATION

Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

	Nett	VAT	Total
Nascom-2 in kit form	295.00	23.60	**318.60**

RING FOR A DELIVERY DATE

NASCOM NAS-SYS I MONITOR

For use with the Nascom 2 and its new keyboard, a completely new monitor has been designed. It incorporates all the features of the Nasbug 2K Monitor (T4) with many additional functions.
The most obvious enhancement is the use of a blinking non-destructive cursor with on-screen editing facilities using the left, right, up and down arrow keys. A routine is provided which gives the user a pointer to an edited line of text, input via the screen and keyboard, allowing user programs to exploit this powerful feature.
The method of calling routines has been modified and rationalised so that, in most cases, users need only a two byte RST operation. It also allows the monitor to be changed and improved at a later date without needing to re-allocate jump addresses.
Although primarily designed for use with the new keyboard, all features can be used with the current Nascom I keyboard by using combinations of keys. As with Nasbug T4, ASCII terminals are fully supported via the serial interface and can be switched on and off using the X and N commands.
Users can add their own I/O drivers via the Nas-sys I/O driver table to support other devices.
The 22 commands supported are:

A — hexadecimal Arithmetic
B — set Breakpoint
C — Copy
E — Executie
G — Generate
H — Operate as half duplex ASCII termina
I — Intelligent copy
J — Execute at FFA (to start Basic etc.)
K — set keyboard options
L — Load from tape
M — Modify store
N — return to Normal mode
O — Output to PIO port
Q — (Query) input from port
R — Read tape
S — Single step
T — Tabulate
U — activate User I/O routines
V — verify tape
W — write tape
X — set external device options
Z — execute at FFD
(warm start for Basic)

A total of 42 user accessible RST operations are provided including character input/output, system reset, relative sub-routine call, input a line, position cursor etc.

NASCOM 2 EXPANDED KEYBOARD

Ten new keys have been added, as follows:

(a) Graphics — when used in conjunction with Nas-sys simplifies generation of graphics characters from the keyboard.
(b) control — to generate control characters.
(c) — cursor control keys for use with Nas-sys.
(d) LF to allow input of additional useful characters.
CH, LF, CH to allow.
(e) Shift — an additional shift key has been added on the left-hand side of keyboard — particularly useful for typing in Basic or other high level language programs.

As with the current Nascom keyboard, the switch mechanisms are contact-less, high reliability professional standard units for long trouble free life.

NASCOM 8K BASIC

Nascom 8K Basic is based on the Microsoft 8K Basic which has become the de facto industry standard. It, therefore, offers a high degree of compatibility with other systems, and programs published in magazines and books should run under Nascom 8K Basic with little or no modification.
It offers a full range of string handling and arithmetic functions and handles numbers in the range 1.70141E38 to 2.9387E-38. It also supports use of the PIO using the INP, OUT and WAIT commands.
NASCOM BASIC operates with Nasbug T2, Nasbug T4 and the new Nas-Sys monitor. It is supplied as either 8 x 2708 EPROMS or 1 x MK 3600 64K bit ROM.
The most obvious feature, when used with Nas-Sys, are the extensive line editing features which make data or program entry and modification very simple — allowing insertion, modification or deletion of single or multiple characters.
In order to allow for flexible screen formatting, a cursor positioning command (SCREEN), and a clear screen command (CLS) have been incorporated. Also, by setting parameters, input can be undertaken on a character by character basis so that forms can be simply created and edited on the screen.
Backspace and delete functions are retained, and characters are input on a character by character basis when supporting a terminal on the serial interface. The width of a printed line can be set by the WIDTH command, and the serial interface turned on and off under program control so that a printer can be attached and supported with no additional software or interface hardware.
Normally the LIST command scrolls five lines at a time, then waits for a character to be typed before scrolling another five lines (or aborting if escape is typed). However, the number of lines scrolled can be set by the LINES command to any number allowing a complete LIST to be generated on a printer without pausing, or to scroll through a program at a faster (or slower) rate.
Program saving and loading uses the monitor's tape read and write routines, providing block checking and information about the success and progress of the operation on the screen. Program file names are displayed when read too.
Arrays can be read or written to tape, and the Nascom routines incorporate a 16 bit sumcheck to verify the accuracy of data read.
System modifications and machine code routines have been made easier by the inclusion of the routines DEEK and DOKE, routines which read or write 16 bit integers.
The Nascom graphics option is supported by the routines SET (X, Y) and RESET (X, Y) — which light up or erase point X, Y on a 96 x 48 point grid, and the function POINT (X, Y) which returns the value 1 if the point X, Y is lit up, or zero if it is not.
The comprehensive modifications and extensions to the original Basic provide both the Nascom 1 and the Nascom 2 with probably the most powerful 8K Basic available on any personal computer system today.

8K Basic Summary

Commands:

NEW	LIST	CONT	MINOTOR	RUN
CLEAR	NULL	SCREEN	LINES	WIDTH

Program Statements:

DEF	DOKE	IF . . THEN		FOR
DIM	END	ON . . . GOTO	LET	NEXT
GOSUB	GOTO	RETURN	OUT	POKE
REM	ON . . . GOSUB		STOP	
WAIT				SET
				RESET
PRINT	DATA	INPUT	READ CLS	RESTORE

Operators:

↑	↖	+	*	/
			NOT	AND
>	=	>=	<>	<

Functions:

ABS	ATN	LOG	SIN	PEEK
INP	INT	SGN	TAN	SPC
POS	RND	USRn	COS	DEEK
SQR	TRAB	EXP	FRE	POINT
ASC	CHR$	FRE	STRS	RIGHTS
LEFT$	LEN	MID$	VAL	

Cassette Input/Output Functions:
CSAVE (Array or program) CLOAD (Array or program)

PERSONAL COMPUTER WORLD BENCHMARK TESTS

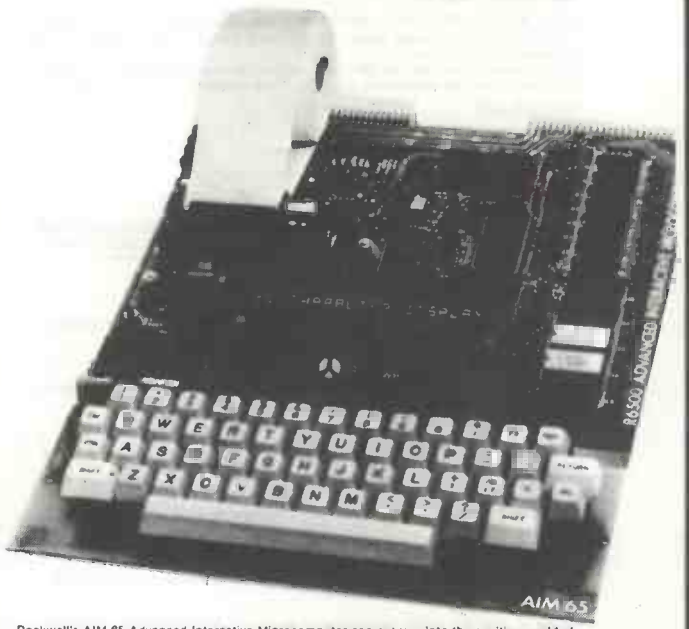
	APPLE II INTEGER B	NASCOM 2	RM. 3802 8K ZAPPLE	PET
BM 1	1.5	1.1	1.4	1.7
BM 2	3.2	5.4	6.5	9.9
BM 3	7.3	11.1	13.2	18.4
BM 4	7.2	11.6	13.9	20.4
BM 5	8.9	12.6	15.0	21.7
BM 6	18.6	19.3	22.3	32.5
BM 7	28.2	27.6	31.6	50.9
BM 8		5.2	6.2	12.3

Rockwell

AIM 65

AT MICRODIGITAL

The Head-Start in Computers



Rockwell's AIM 65 Advanced Interactive Microcomputer can get you into the exciting world of microcomputers a lot easier and at a lower cost than you may have thought possible. And you'll be working with the 6500 family, the advanced state-of-the-art NMOS system that's an everincreasing favorite for new commercial and hobbyist applications.

As a learning aid, AIM 65 gives you an assembled, versatile microcomputer system with a fullsize keyboard, 20-character display and, uniquely, a thermal printer. An on-board Advanced Interactive Monitor program provides extensive control and program development functions. And our AIM 65 User's Manual will help you along each step of the way.

You'll master fundamentals rapidly. Then you'll appreciate the fact that unlike the computer "toys" on the market, AIM 65 offers flexibility and expandability you would expect to find in a sophisticated microcomputer development system.

THERMAL PRINTER GIVES YOU HARD COPY — FAST AND QUIET.
AIM 65's 20-column Thermal Printer prints on low-cost, thermal roll paper at a fast 120 lines per minute. It produces all of the standard 64 ASCII characters with a crisp-printing five-by-seven dot matrix. AIM 65's on-board printer is a unique feature for a low-cost computer.

EXTENDED ALPHANUMERIC DISPLAY IS BUILT FOR UNDERSTANDING, NOT DECIPHERING.
AIM 65 comes with a 20-character true Alphanumeric Display. Information is displayed with bright, magnified 16-segment font monolithic characters. It's both unambiguous and easily readable.

FULL-SIZE KEYBOARD IS DESIGNED FOR HUMANS, NOT ELVES.
AIM 65's terminal-style keyboard frees you from the hassles of fumbling around with a tiny calculator-type keypad. And its 54 keys provide 70 different alphabetic, numeric, control and special functions.

ON-BOARD ADVANCED INTERACTIVE MONITOR GETS YOUR PROGRAMS UP AND RUNNING.
The ROM-resident AIM 65 Advanced Interactive Monitor Program provides a comprehensive set of easy-to-use, single-keystroke commands for debugging your programs, and offers features normally available only in larger, expensive microcomputer development systems. And with the AIM 65 Monitor, there's no guesswork involved; the Monitor gives a self-explanatory prompt when it needs information and it will generate a meaningful error message if an error has occurred.

The AIM 65 Monitor includes commands to

- Enter and edit programs directly — no "opcode" memorization
- List programs on Printer or TTY
- Display/alter registers and memory
- Set breakpoints, trace and debug program execution
- Control the Thermal Printer
- Transfer information to/from attached Cassette Recorders or TTY
- Execute programs in on-board or external RAM, ROM or PROM memory
- Interface the optional AIM 65 Assembler and BASIC Interpreter

AIM 65'S ADVANCED R6500 NMOS ARCHITECTURE.
The R6502 Central Processing Unit is the heart of the AIM 65. It provides demonstrated speed and simplicity, plus 65K addressability and the power of a 56-command, minicomputer-like instruction set.

The R6532 RAM-Input/Output-Timer (RIOT) combination device is used by the AIM 65 Monitor for scratchpad memory and Keyboard operations.

Two R6522 Versatile Interface Adapter (VIA) devices are provided. One device supports AIM 65's Thermal Printer and the TTY and Cassette Interfaces, the other supports two user-dedicated 8-line I/O ports, plus an 8-bit serial I/O port and access to two 16-bit interval timer/event counters, on the module's Application Connector.

AIM 65 comes with two R2332 4K Read Only Memory (ROM) devices installed. These hold the Advanced Interface Monitor program. Spare sockets allow the user to expand on-board ROM up to 20K bytes. These sockets will accept user programs on R2332 ROMs or compatible PROMs, or can be used to install the optional AIM 65 Assembler and BASIC Interpreter ROM devices.

On-Board Read/Write RAM memory is available in 1K-byte and 4K-byte configurations.

AIM 65 HAS EXPANSION BUILT IN.
And to allow AIM 65 to grow the way you want it to, we've provided an Application Connector and an Expansion Connector. The Application Connector permits you to plug on a TTY (20 ma. current loop) and one or two standard audio cassette recorders. It also has the pinouts for the VIA's General-Purpose I/O ports. The Expansion Connector extends AIM 65's system bus — address, data and control — out to additional memory, or anything else you might attach.

And, BASIC high-level language programming is a built-in option.

AIM 65 Technical Overview

THERMAL PRINTER
Most desired feature on low-cost microcomputer systems . . .
- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quiet thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD
Provides compatibility with system terminals . . .
- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY
Provides legible and lengthy display . . .
- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES
Reliable, high performance NMOS technology . . .
- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple, but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program Memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY
- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES
Standard interface to low-cost peripherals . . .
- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM-RESIDENT ADVANCED INTERACTIVE MONITOR
Advanced features found only on larger systems . . .
- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERFACE MONITOR COMMANDS

Major Function Entry
(RESET Button)—Enter and initialize Monitor
ESC—Re-enter Monitor
E —Enter and initialize Text Editor
T —Re-enter Text Editor
N —Enter Assembler
5 —Enter and initialize BASIC Interpreter
6 —Re-enter BASIC Interpreter

Instruction Entry and Disassembly
I —Enter mnemonic instruction entry mode
K —Disassemble memory

Display/Alter Registers and Memory
' —Alter Program Counter to (address)
A —Alter Accumulator to (byte)
X —Alter X Register to (byte)
Y —Alter Y Register to (byte)
P —Alter Processor Status to (byte)
S —Alter Stack Pointer to (byte)
R —Display all registers
M —Displays four memory locations, starting at (address)
(SPACE)—Display next four memory locations
/ —Alter current memory location

Manipulate Breakpoints
—Clear all breakpoints
4 —Toggle breakpoint enable on/off
B —Set one to four breakpoint addresses
? —Display breakpoint addresses

Control Instruction/Trace
G —Execute user's program
Z —Toggle instruction trace mode on/off
V —Toggle register trace mode on/off
H —Trace Program Counter history

Control Peripheral Devices
L —Load object code into memory from peripheral I/O device
D —Dump object code to peripheral I/O device
1 —Toggle Tape 1 control on/off
2 —Toggle Tape 2 control on/off
3 —Verify tape checksum
CTRL PRINT—Toggle Printer on/off
LF —Line Feed
PRINT—Print Display contents

Call User-Defined Functions
F1 —Call User Function 1
F2 —Call User Function 2
F3 —Call User Function 3

Text Editor Commands
R —Read lines into text buffer from peripheral I/O device
I —Insert line into text buffer from Keyboard
K —Delete current line of text
(SPACE)—Display current line of text
L —List lines of text to peripheral I/O device
U —Move up one line
D —Move down one line
T —Go to top line of text
B —Go to bottom line of text
F —Find character string
C —Change character string
O —Quit Text Editor, return to Monitor

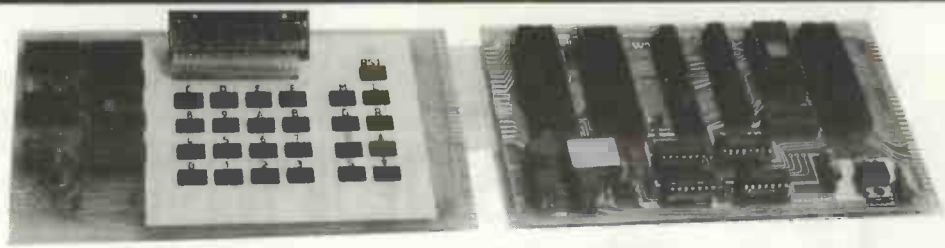
LOW COST PLUG-IN ROM OPTIONS
- 4K Assembler — symbolic, two-pass
- 8K BASIC Interpreter

POWER SUPPLY SPECIFICATIONS
- +5 VDC ± 5% regulated @ 2.0 amps (max)
- +24 VDC ± 15% unregulated @ 2.5 amps (peak) 0.5 amps (average)

	Nett	VAT	Total
AIM — 65 with 1K RAM	249.50	19.96	269.46
AIM — 65 with 4K RAM	315.00	25.20	340.20
8K Basic in ROM	70.00	5.60	75.60
4K Assembler in ROM	59.50	4.76	64.26

A8

ACORN



A professional MPU card – designed as a general purpose industrial controller based on the 6502 MPU, this card is complemented by a matching Eurocard hex keyboard and CUTS standard cassette interface, to create the new ACORN MICROCOMPUTER.

This compact stand-alone micro-computer is based on standard Eurocard modules, and employs the highly popular 6502 MPU (as used in Apple, Pet, Kim, etc). Throughout, the design philosophy has been to provide full expandability, versatility and economy. Take a look at the full specification, and see how Acorn meets your requirements.

Acorn technical specification
The Acorn consists of two single Eurocards:
1. MPU card; 6502 microprocessor; 512 x 8 ACORN monitor; 1K x 8 RAM; 16-way I/O with 128 bytes of RAM; 1 MHz crystal; 5 V regulator, sockets for 2K EPROM and second RAM I/O chip.
2. Keyboard card; 25 click-keys (16 hex, 9 control); 8 digit, 7 segment display CUTS standard crystal controlled tape interface circuitry.

Compact, easy to use Acorn Monitor includes the following features:

- System program
- Set of sub-routines for use in programming
- Powerful de-bugging facility displays all internal registers
- Tape load and store routines

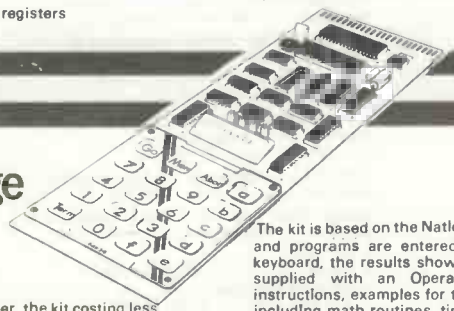
Acorn — with real expandability
The standard Acorn is fully expandable to 65K of memory, and the Acorn bus is available on the 64-way edge-connector. Whether you're a beginner in the field, an ambitious home computer buff, a development engineer, a teacher or a businessman, the Acorn and its family of modules will provide a practical solution in virtually every situation.

Acorn Operating Manual
With Acorn, you'll receive an operating manual that covers computing in full, from first principles of binary arithmetic, to efficient hex programming with the 6502 instruction set. The manual also includes a listing of the monitor programs and the instruction set, and other useful tabulations; plus a selection of 12 interesting and educative program samples.

Acorn MPU card with 1K RAM and keyboard card with cassette interface In kit form, with assembly instructions.

	Nett	VAT	Total
	65.00	5.20	70.26
Ready built	75.00	6.00	81.00

Science of Cambridge



MK 14 KIT

This is probably the cheapest complete home computer, the kit costing less than the retail price of the chips included in it. The specification is as follows:

1 Hexadecimal keyboard.
2 8 digit LED display.
3 512 x 8 PROM, containing monitor program and Interface instructions.
4 256 Bytes of RAM.
5 4 MHz crystal.
6 5 Volt stabiliser.
7 Single 6 Volt power supply requirement.
8 Space available for extra RAM and RAM I/O.

The kit is based on the National Semi-conductors SC/MP2 microprocessor and programs are entered in machine code through the hexadecimal keyboard, the results showing on the calculator type display. Each kit is supplied with an Operations Manual which contains operational instructions, examples for training applications, and numerous programs including math routines, timing general purpose sequencing, games, etc.

	Nett	VAT	Total
Science of Cambridge Mk 14 kit	39.95	3.20	43.15
Socket Set	3.60	0.29	3.89
256 x 4 extra RAM (2 required	2.95	0.24	3.19
INS 8154 RAM I/O	8.17	0.65	8.82
Power Supply	5.32	0.43	5.75
Cassette Interface	5.95	0.48	6.43
PROM Blower	9.95	0.80	10.75

NEWBEAR 77/68

This is a new concept for low cost computing. Each of these bags contain all the parts necessary to build a vital part of a microcomputer system. Each part is backed with the support necessary for such a complex project.

Bear Bag No 1 77-68 P.C.B., Components & Edge Connector.
This contains all the parts which fit on this low cost start to a large 6800 microcomputer system.

Nett	VAT	Total
45.00	3.60	48.60

Bear Bag No 2 77-68 LED's and Switches
This kit contains high lumance 0.2" LED'S and high reliability gold plated subminiature toggle switches suitable for low voltage low current contacts, to match Bearbag No 1.

14.95	1.20	16.15

Bear Bag No 4 77-68 5 u Rack Backplane
This card frame is not the cheapest way of mounting 77-68 p.c.b.'s but it is the recommended one. (The lowest cost alternative is to use a wooden box and plastic double glazing channel for guides).

27.70	2.22	29.92

Bear Bag No 5 77-68 4 K RAM P.C.B. and Components
This is the vital element for any computer. This design is fully buffered and address decoded. The 4K block can be positioned anywhere within the 64K memory allowable.

75.00	6.00	81.00

Bear Bag No 6 77-68 Mon 1 P.C.B. and Components
This board can support two V24/RS232C interfaces or 20 MA current loop (only one supplied) and a method of "bootstrapping" a kilo byte of operating system into protected memory. A listing of an operating system is supplied and Kansas City cassette or Paper tape is available. Beware to load the operating system a Kansas City cassette interface if required (see Bear Bag No 10) or a terminal with a paper tape reader.

50.70	4.06	54.76

Bear Bag No 9 Petitevid V.D.U. Kit Mk2
All the electronics for a VDU on a single 8" x 4" card! The latest Thompson CSF Super Chip does all the hard work and the result is a full scrolling VDU 64ch by 16 lines with full cursor control, software "home" and software of hardware clear screen. the interface is V24/RS232C switchable between 110 baud, 300 baud and 1200 baud.

85.00	6.80	91.80

Bear Bag No 10 Kansas City Cassette Interface.
This interface solves your bulk storage problem immediately. The method of use is quite simple. It sits in the V24/RS232C interface between your computer and VDU or Teletype and is switched in and out as appropriate when information is recorded from the computer or played back into it.

Nett	VAT	Total
18.95	1.52	20.47

Bear Bag No 12 77-68 V.D.U. Kit
This is a Direct memory accessed type of Visual Display Unit which gives a very fast writing speed. Its format is 40ch by 24 lines e.g. Teletext. Its output is composite video and it also has a keyboard interface which expects parallel 7 bit ASCII and strobe.

69.50	5.66	75.06

Bear Bag No 13 77-68 Mon 2 Kit.
This board can support "MIKBUG" (with a hardware single step). or "SWATBUG" on a 2708 Eprom. The V24/RS232C ports can be via one of the two 6821 PIA's or the ACIA port.

64.10	5.13	69.23

Bear Bag No 14 2708 Prom Programmer Kit (6800)
This is a low cost programmer which contains its own power supply and interfaces to a 6820 PIA. A novel approach has been adopted by supplying the necessary software in a 2708 and a short copying program to place it RAM. A low insertion force socket is provided.

35.00	2.80	37.80

Bear Bag No 15 Promverter. Mikbug to 2708
All the people who have suffered MIKBUG now have the chance to write their own operating system, plug it in the 2708/6830 converter and so replace (at last) MIKBUG.

8.50	0.68	9.18

Bear Bag No 16 77-68 Eprom Board (ROMA)
This board holds up to 8K bytes of 2708 Eproms or 16K bytes of Intel 2716. This bag does not contain the EPROMS.

29.50	2.36	31.86

Bear Bag No 17 77-68 Interface Board (P10)
This is a utility board which helps make 77-68 the most complete hobbyist system available, supplying a 6840 timer and enough 6820 I/O ports to keep your peripherals busy.

45.00	3.60	48.60

Bear Bag No 18 Cottis Blandford Cassette Interface.
This high speed cuts cassette interface was designed to be not only low cost but also Kansas City compatible, very few adjustments e.g. one! and up to 2400 baud or perhaps even 5000 baud.

17.25	1.38	18.63

Bear Bag No 21 Lower Case for Petitevid
A small modification to your "Petitevid" VDU kit can add lower case letters.

10.50	0.84	11.34

BOOKWORM

Mircroprocessors: from chips to systems.
R. Zaks — £7.95

Microprocessor interfacing techniques.

Microprocessor interfacing techniques.
R. Zaks — £7.95

Practical solid circuit design.
Olesky — £5.20

555 Timer applications source book. — £0.00

Understanding solid state electronics.
Texas instruments — £2.40

Modern operational circuit design.
Smith — £18.60

Microprocessor systems design.
Klingman — £14.00

Microcomputer design.
Martin — £12.00

Designing with TTL integrated circuits.
Texas instruments — £24.80

Fundamentals and applications of digital logic circuits — S. Libes — £6.36

Analysis and design of digital circuits.
P. Chirlian — £16.40

Linear IC principles, experiments, and projects
E. M. Noll — £7.16

Semiconductor circuit elements.
T. Towers and S. Libes — £5.56

TTL cookbook.
D. Lancaster — £7.50

CMOS cookbook.
D. Lancaster — £7.95

RTL cookbook.
D. Lancaster — £5.15

Active Filter cookbook.
D. Lancaster — £11.96

T. V. Typewriter cookbook.
D. Lancaster — £7.50

Cheap Video cookbook.
D. Lancaster — £5.10

Microcomputer problem solving using PASCAL — K. L. Bowles — £7.84

PASCAL User Manual and Report.
Jensen and Wirth — £6.52

An introduction to programming and problem solving with PASCAL..Schneider, Weingart and Perlman — £10.36

Programming in PASCAL.
P. Grogono — £7.50

PASCAL — An introduction to methodical programming — W. Findlay and D. A. Watt — T.B.A.

Best of BYTE vol. I — Helmers et al — £8.95

Best of Creative Computing vol. I
AHL et al — £6.95

Best of Creative Computing vol. 2
AHL et al — £6.95

Dr. Dobbs Journal of computer Calisthenics and Orthodonita vol. I.
J. C. Warren — £10.00

Scelbi-Byte Primer.
Helmers et al — £9.95

The Best of Micro.
Tripp et al — £6.95

The First West Coast Computer Faire proceedings — J. C. Warren — £9.56

The Second West Coast Computer Faire proceedings — J. C. Warren — £9.56

Program Design.
B. W. Liffic — £4.80

Simulation — B. W. Liffic — £4.80

Basex — P. Warne — £6.40

The BYTE book of computer music.
C. P. Morgan — £8.00

Superwumpus — J. Emmerichs — £4.80

Clarcia's Circuit Cellar.
S. Ciarcia — £6.40

Bar Code Loader — K. Budnick — £1.60

Tiny Assembler 6800 v3.1.
J. Emmerichs — £7.20

Tracer: A 6800 debugging program.
J. Hemenway — £4.80

MONDEB: An advanced 6800 Monitor-debugger — D. Peters — £4.00

RA6800ML: An M6800 Relocatable Macro-assembler — J. Hemenway — £20.00

LINK 68: An M6800 Linking loader.
J. Hemenway et al — £6.40

The 8080A Bugbook-Microcomputer, interfacing and programming.
P. R. Rony et al — £7.95

8080 machine language programming for beginners — R. Santore — £5.10

Scelbi "8080" software gourmet guide and cookbook — Scelbi computer consulting — £7.95

A step by step introduction to 8080 microprocessor systems.
D. L. Cohn and J. L. Melsa — £5.70

8080/8085 Software design.
C. A. Titus, P. R. Rony et al — £7.50

8080 Programming for logic design.
A. Osborne — £5.95

Practical microcomputer programming: The Intel 8080.
W. J. Weller et al — £17.56

Scelbi's 8080 standard monitor £9.95
Scelbi's 8080 standard editor £9.95
Scelbi's 8080 standard assembler £15.95
Scelbi computerconsultants.

'8080 Assembley language programming.
L. Leventhal — £7.95

An

'8080 Assembly language programming.
L. Leventhal —£7.95

An Editor/Assembler system for 8080/8085 based computers — W. J. Weller — £11.96

Scelbi 8080 Galaxy game.
Scelbi computer consultants — £7.95

8080 Programmers pocket guide.
Scelbi computer consultants — £1.95

8080 Hex code card — Scelbi — £1.95

8080 Octal code card — Scelbi — £1.96

Z-80 instruction handbook — Scelbi — £3.95

Practical microcomputer programming: the Z80 — W. J. Weller — £23.96

Sargon Z80 Chess Program.
D. and K. Spracklen — £9.50

The Z80 microcomputer handbook.
W. Barden — £6.95

A-80 Programming for logic design.
A. Osborne — £5.95

Z-80 Programming manual.
Mostek — £4.50

Nascom-1 Hardware notes — £1.50

Nascom-1 Programming manual — £1.50

Nascom-1 Seminar notes — £1.50

Sorcerer Technical manual — £T.B.A.

Sorcerer Technical manual — £8.95

Practical microcomputer programming: the M6800 — W. J. Weller et al — £17.56

Scelbi 6800 Gourmet guide.
Scelbi computer consultants — £7.95

Programming the 6800 microprocessor.
Bob Southern — £8.00

6800 Assembly language programming.
L. Leventhal — £7.95

Using the 6800 microprocessor.
E. Poe — £6.25

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