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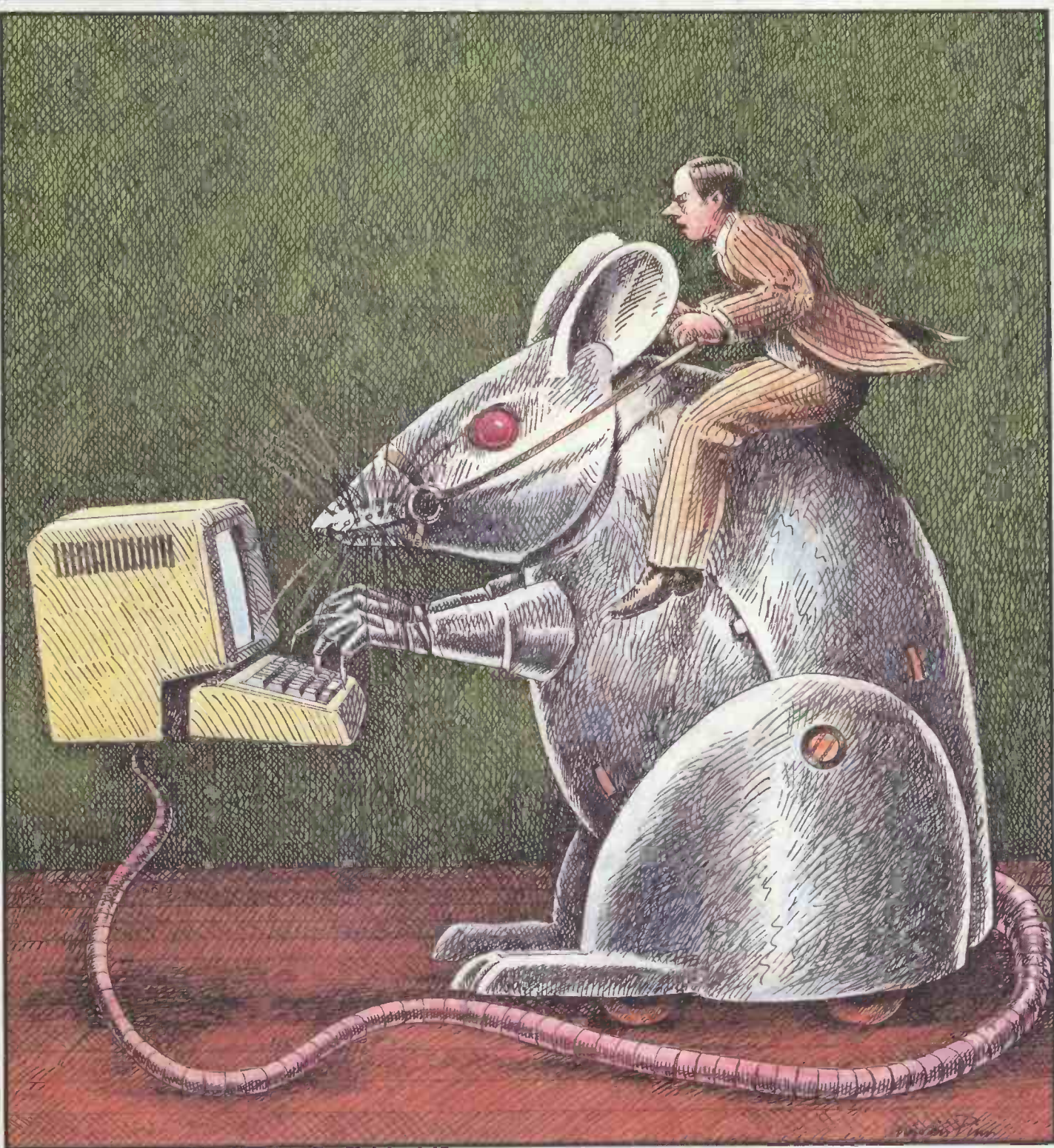
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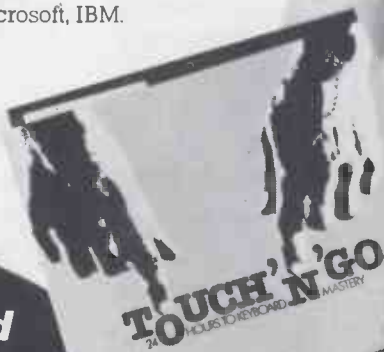
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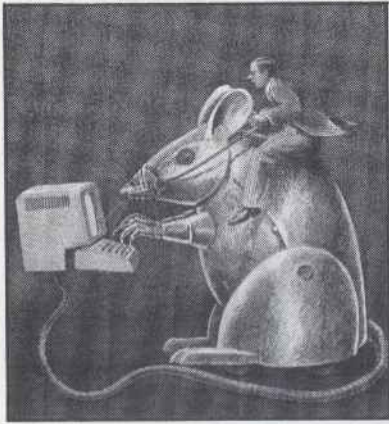


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PCW

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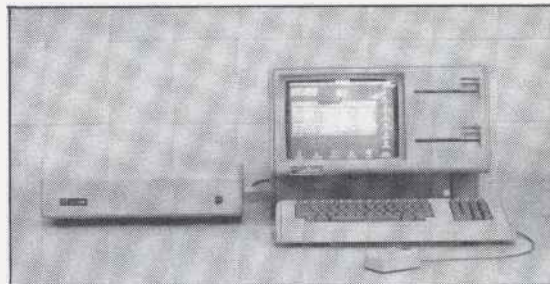
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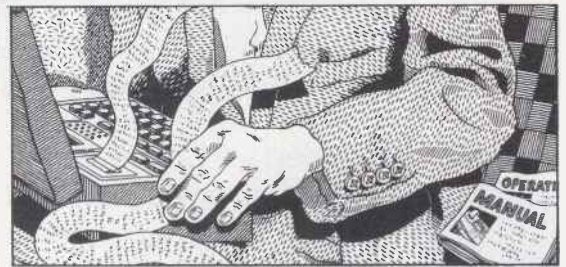
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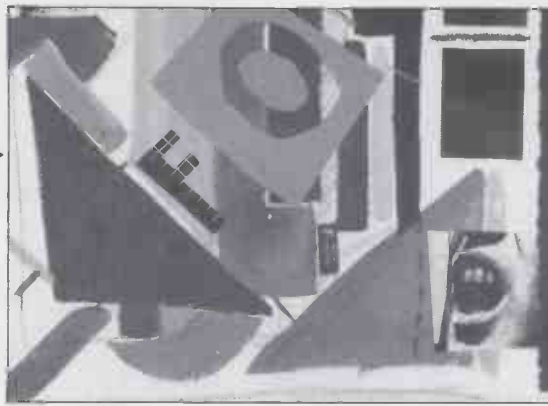
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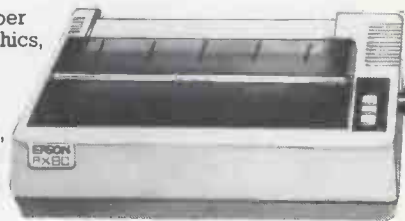


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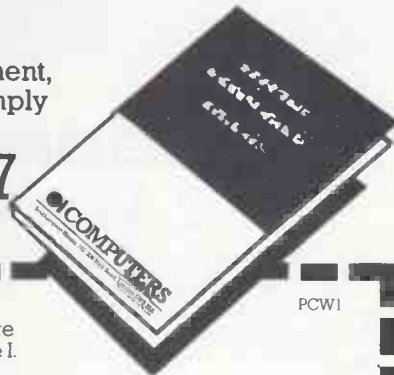
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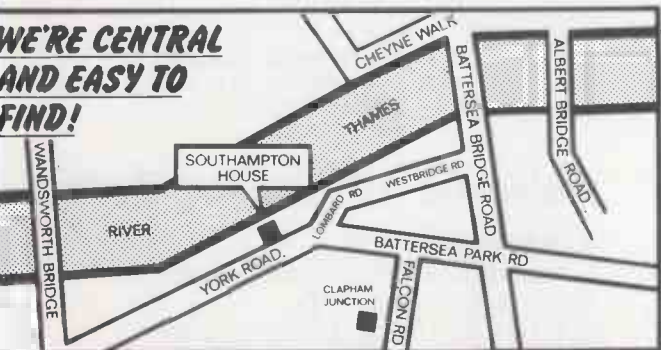
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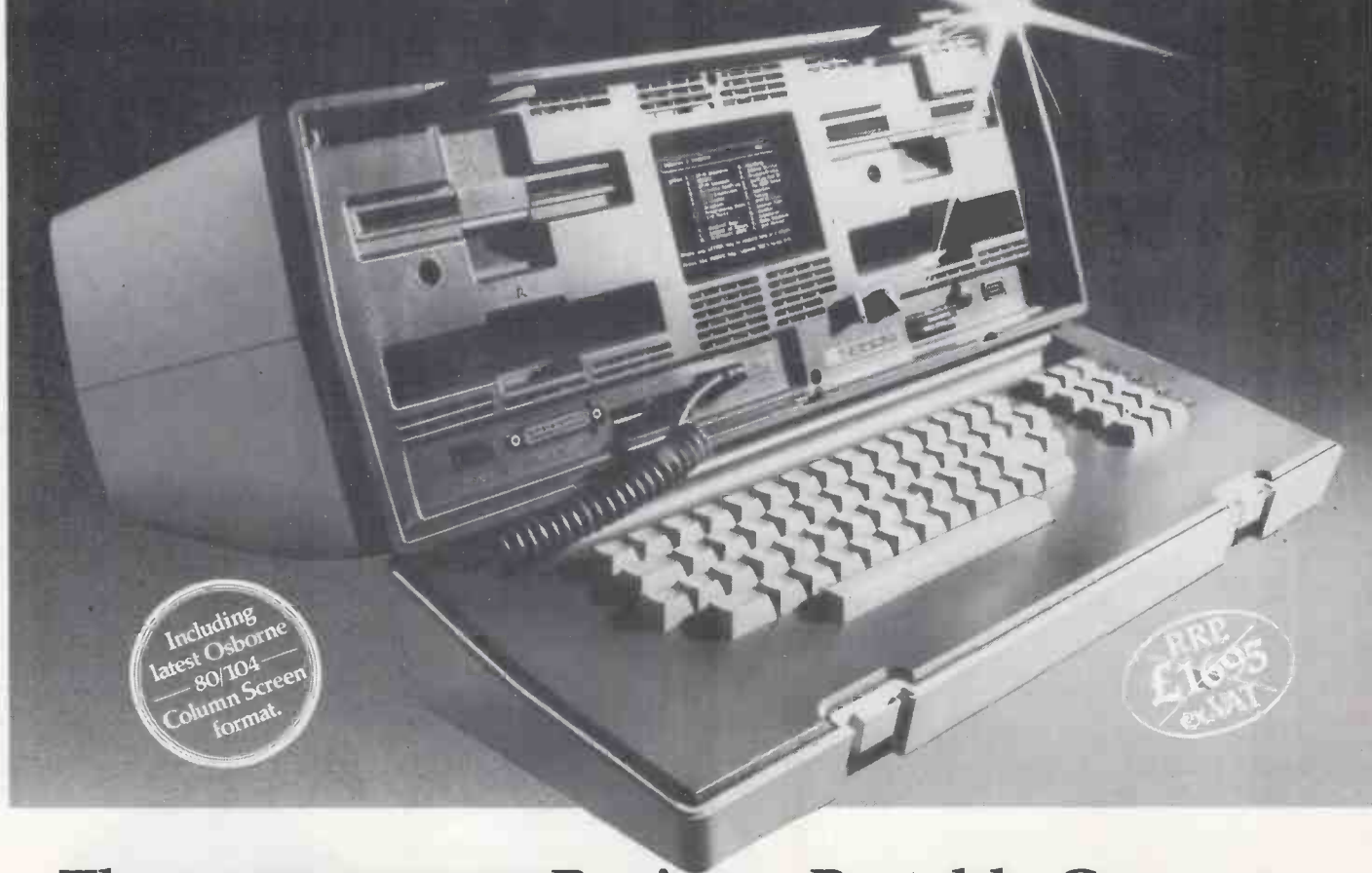
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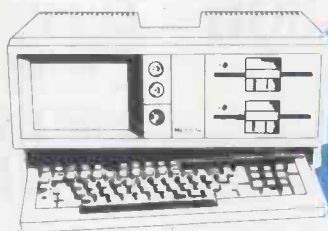
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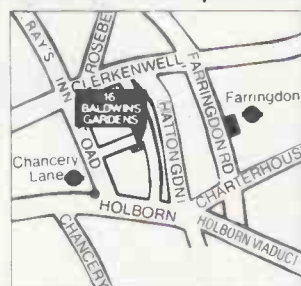
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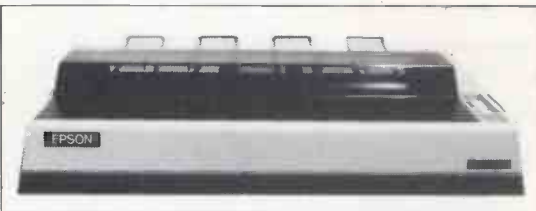
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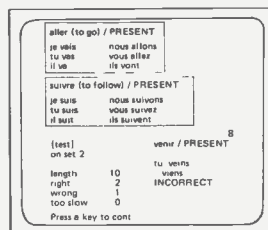
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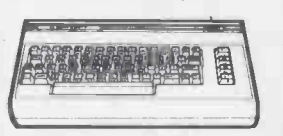
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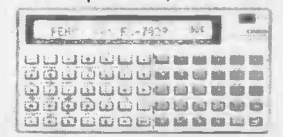
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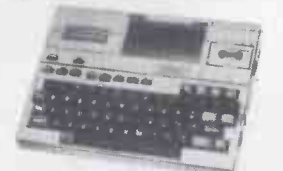
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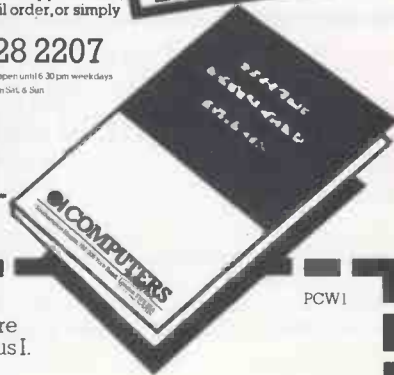
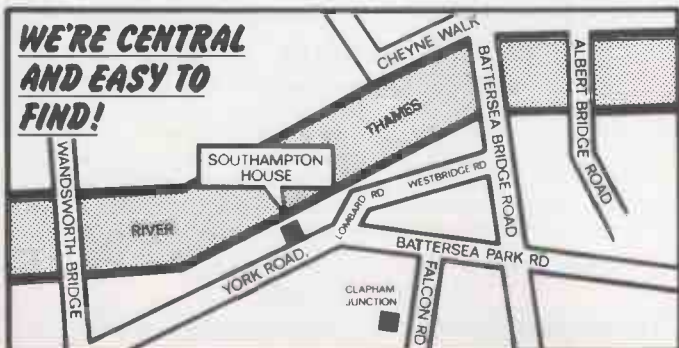
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ACCOUNT	DEBIT	CREDIT
1 Sales £11		60070
2 Sales £11		49071
3 Discount Sales & Inv	3000	
4 Purchases 102	31400	
5 Purchases 27		37150
6 Discounts Sales & Inv		5000
7		700
14 Assets	6430	
15 Assets	1700	
16 Assets & Res	1825	
17 Assets & Res	625	
18		1020
19		211
20		780
21		613
22		800
23		150
24		150
25		150
26		150
27		150
28		150
29		150
30		150
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TOTALS	114800	114800

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2 Sales £11		49071
3 Discount Sales & Inv	3000	
4 Purchases 102	31400	
5 Purchases 27		37150
6 Discounts Sales & Inv		5000
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TOTALS	114800	114800

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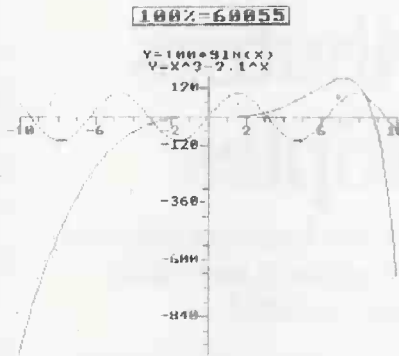
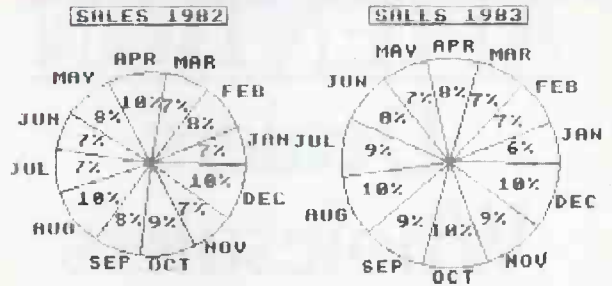


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4			Oct.	Nov.	
5			£	£	
6	INCOME				
7	Sales				
8			11786	10944	
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10	Purchases				
11			500	500	
12	Advertising				
13			1596	1596	
14	Director's salary				
15			2216	2216	
16	Rent				
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Dragon 32k or 64k	●	●	●	●	●			●	●	●	●
VIC 20 (16k +)	●	●	●	●				●	●		
Sinclair ZX81 (16k +)	●										
Grundy Newbrain	●		●								
Sharp M280A	●	●	●	●				●	●		
Sharp M280K	●	●	●	●				●	●		
Sharp M280E	●	●	●	●				●	●		
BBC Micro model A or B 32k	●	●	●	●	●	●	●	●	●	●	●
Atari 400/800	●										
Torch	●	●	●	●	●	●	●	●	●	●	●
Epson HX-20	●	●	●	●							
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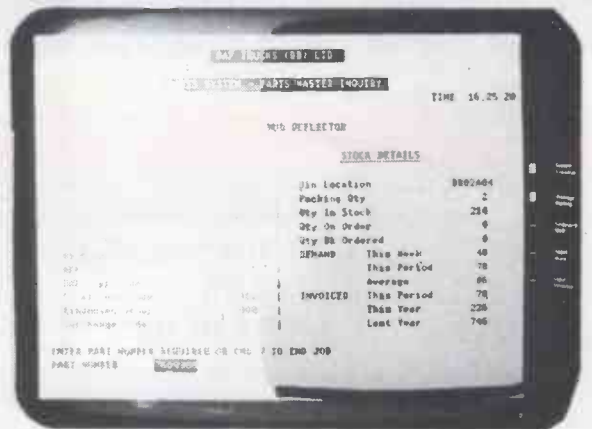
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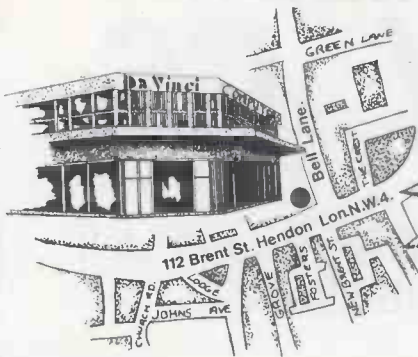
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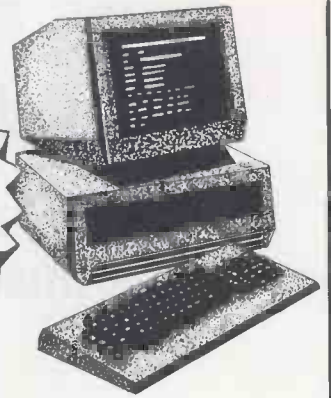
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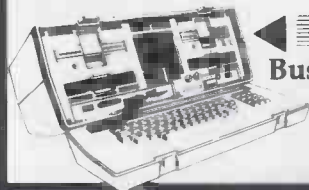
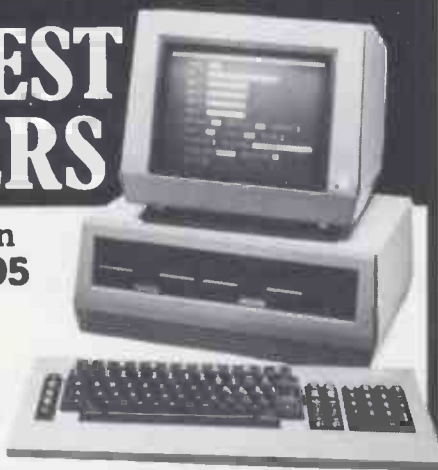
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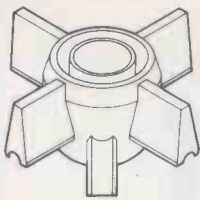
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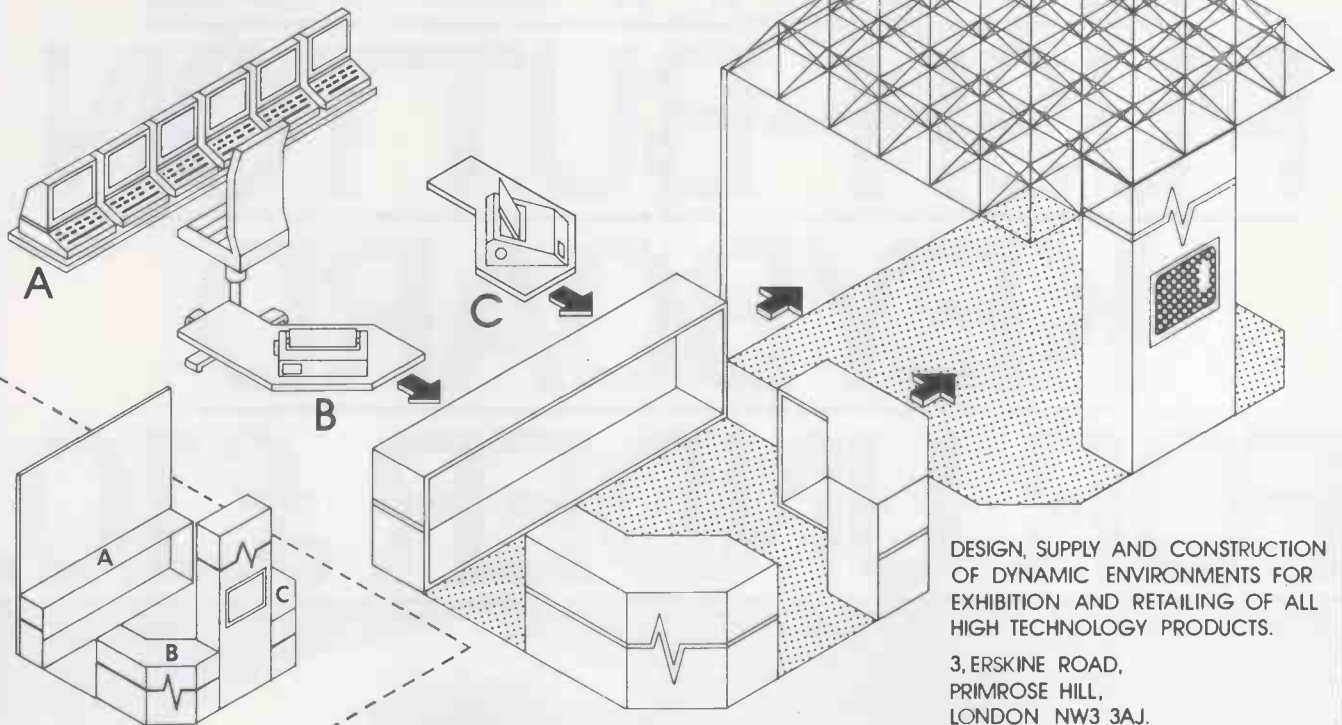
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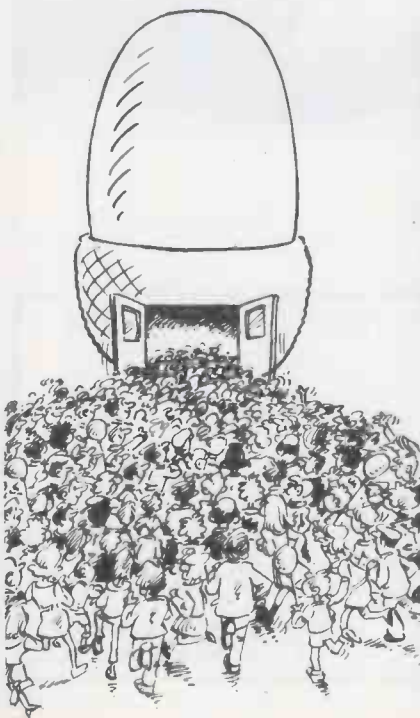
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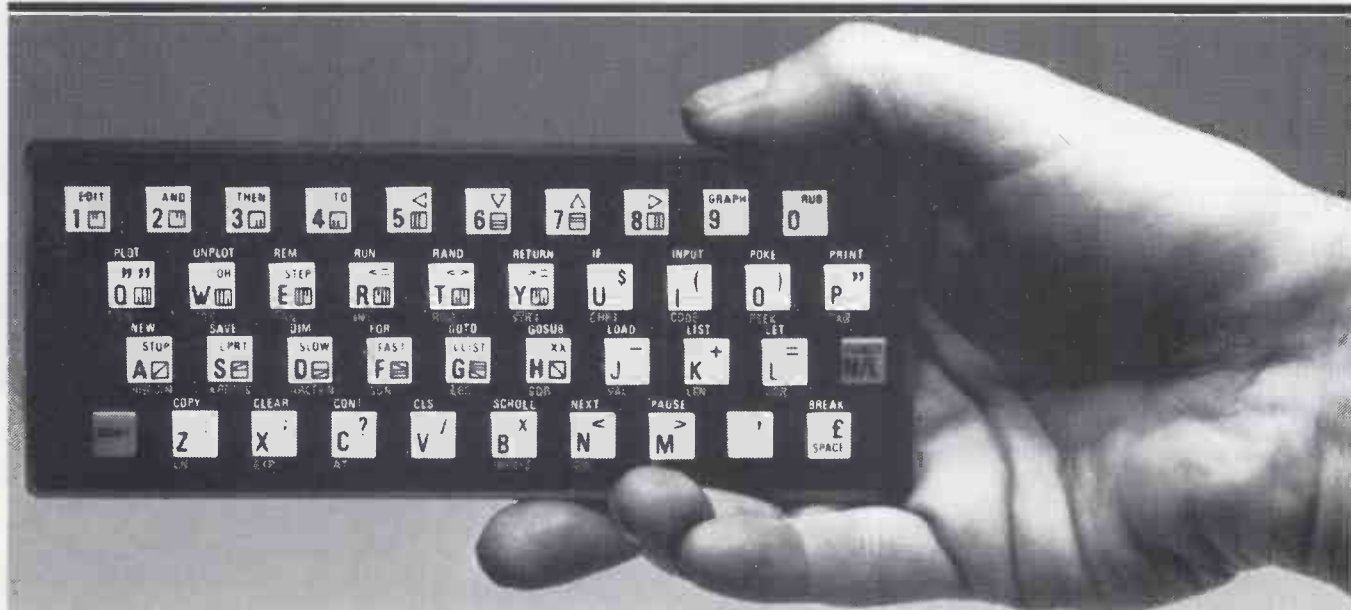
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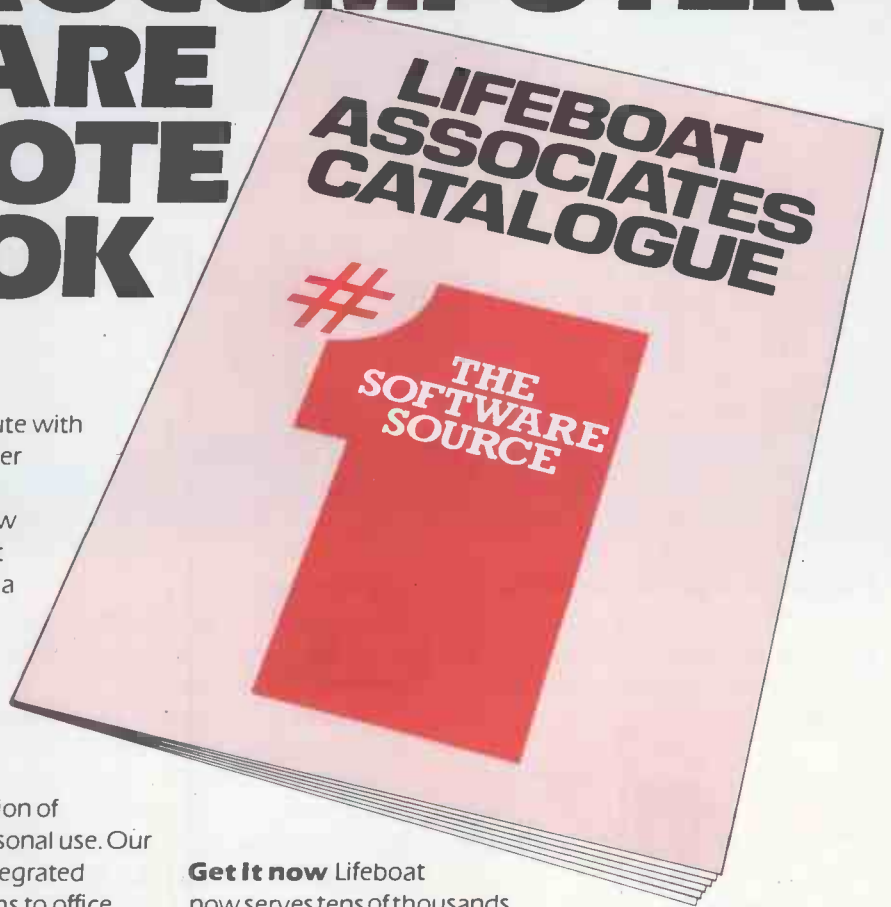
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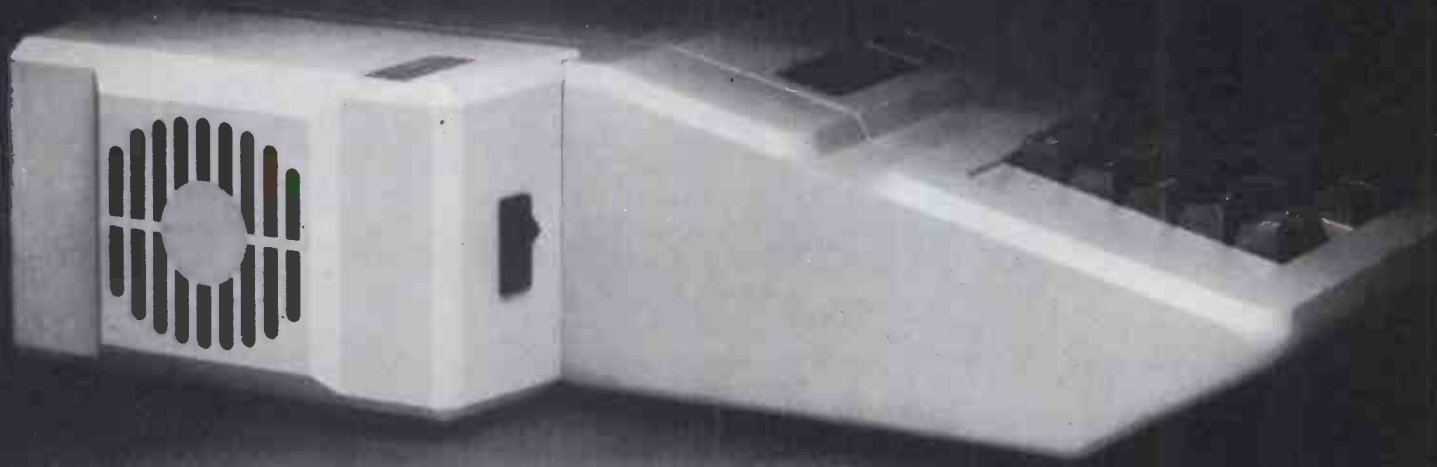
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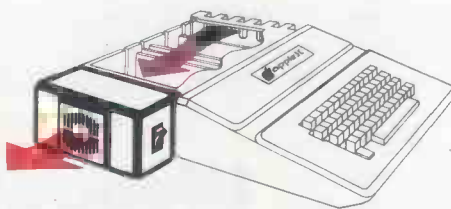


By connecting the Apple II power input through the SYSTEM SAVER, power is controlled in two ways: 1) Dangerous voltage spikes are clipped off at a safe 130 Volts RMS/175 Volts dc level. 2) High frequency noise is smoothed out before reaching the Apple II. A PI type filter attenuates common mode noise signals by a minimum of 30 dB from 600 khz to 20 mhz, with a maximum attenuation of 50 dB.

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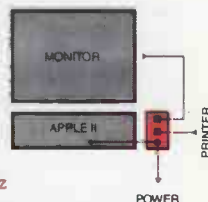
Today's advanced peripheral cards generate more heat. In addition, the cards block any natural air flow through the Apple II creating high temperature conditions that substantially reduce the life of the cards and the computer itself.



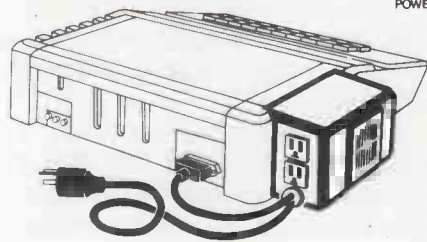
SYSTEM SAVER provides correct cooling. An efficient, quiet fan draws fresh air across the mother board, over the power supply and out the side ventilation slots.

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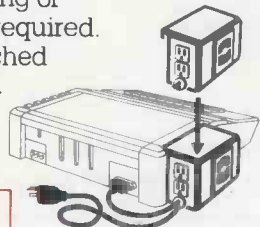
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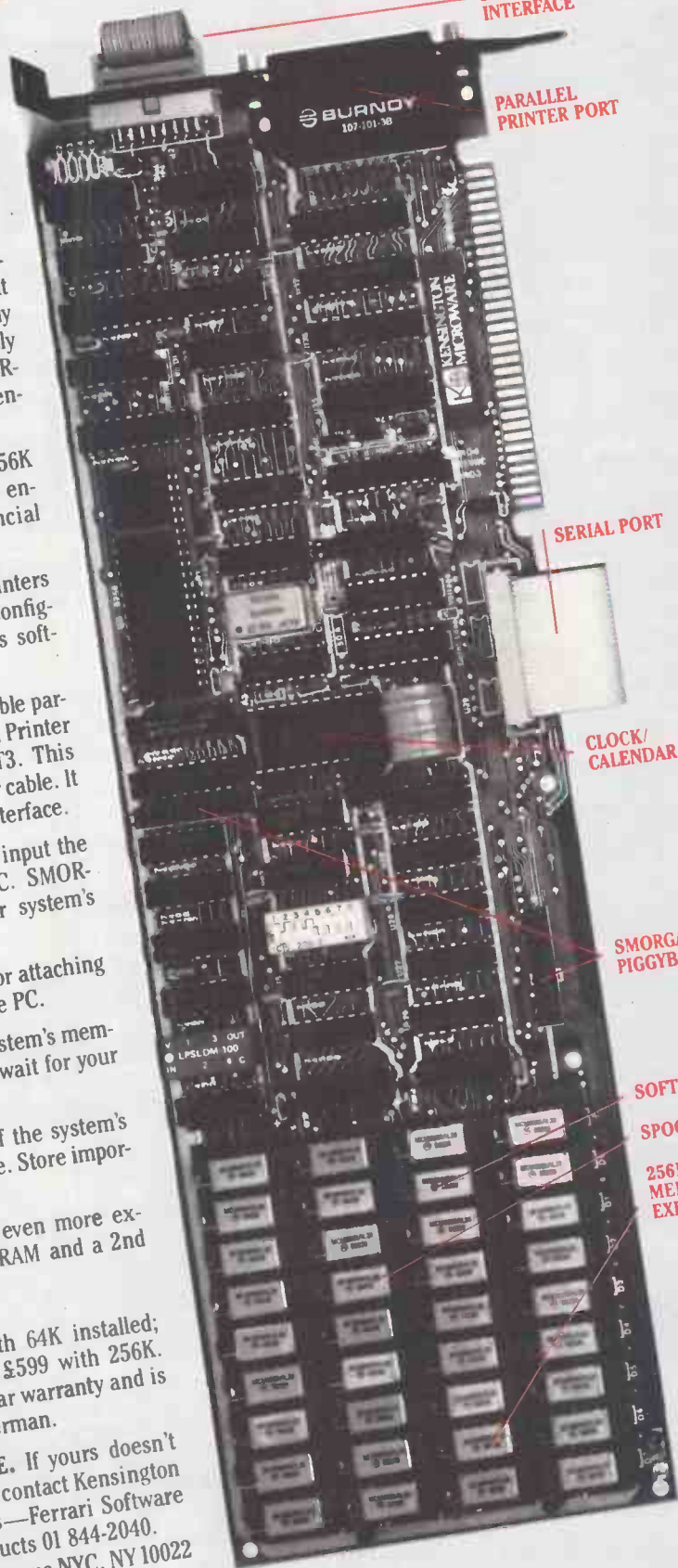
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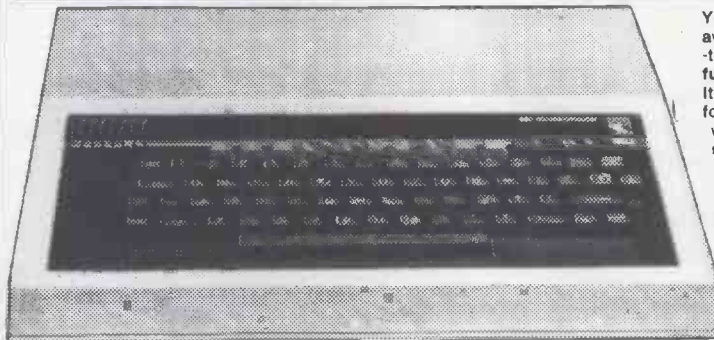
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Spectrum Price

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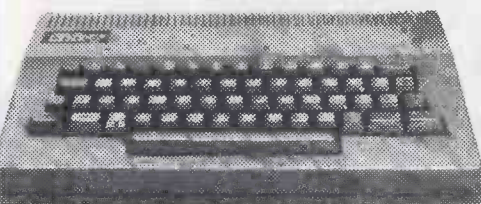
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Text screen 2 Lines
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Cassette Lead Incl

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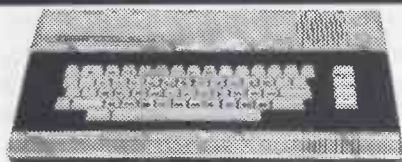
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DISCOUNT - Teach yourself LYNX BASIC £6.95

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Cassette Lead..... Included

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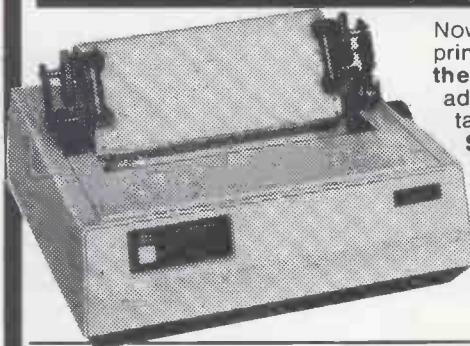
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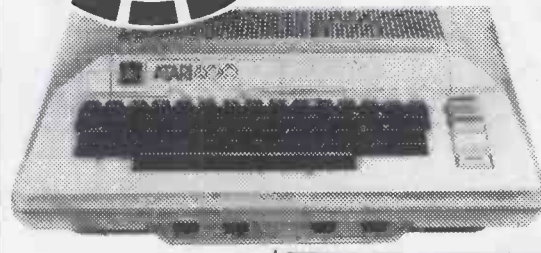
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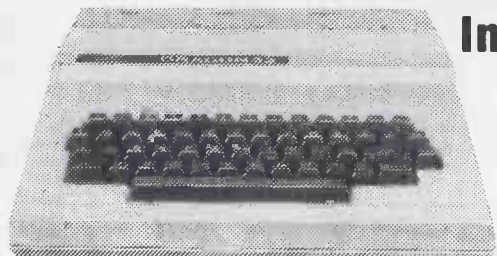
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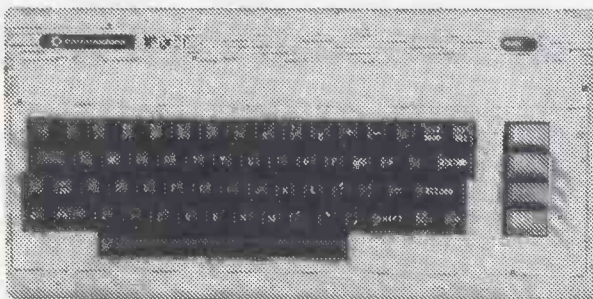
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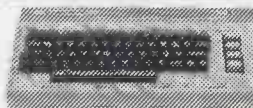
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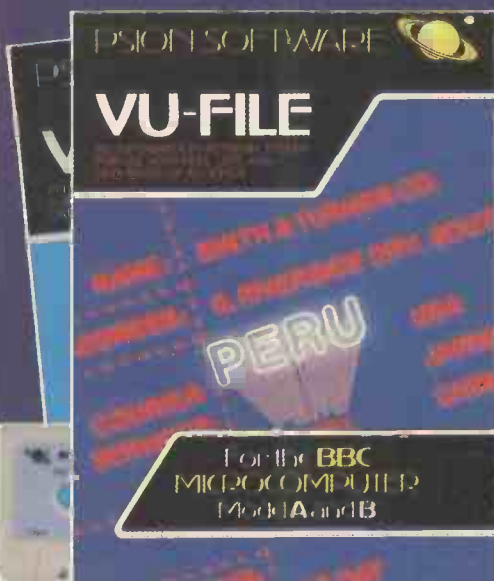
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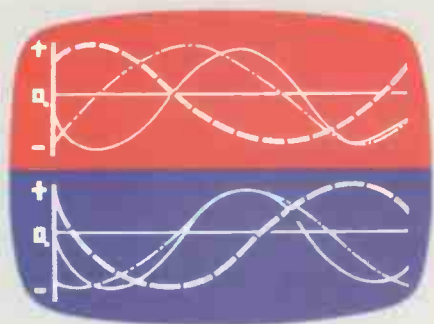
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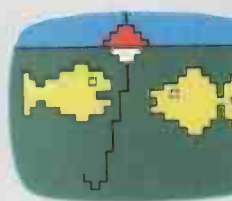
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For those that do,



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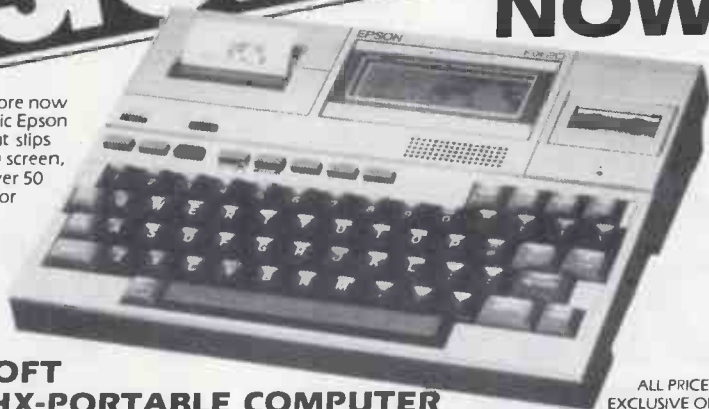
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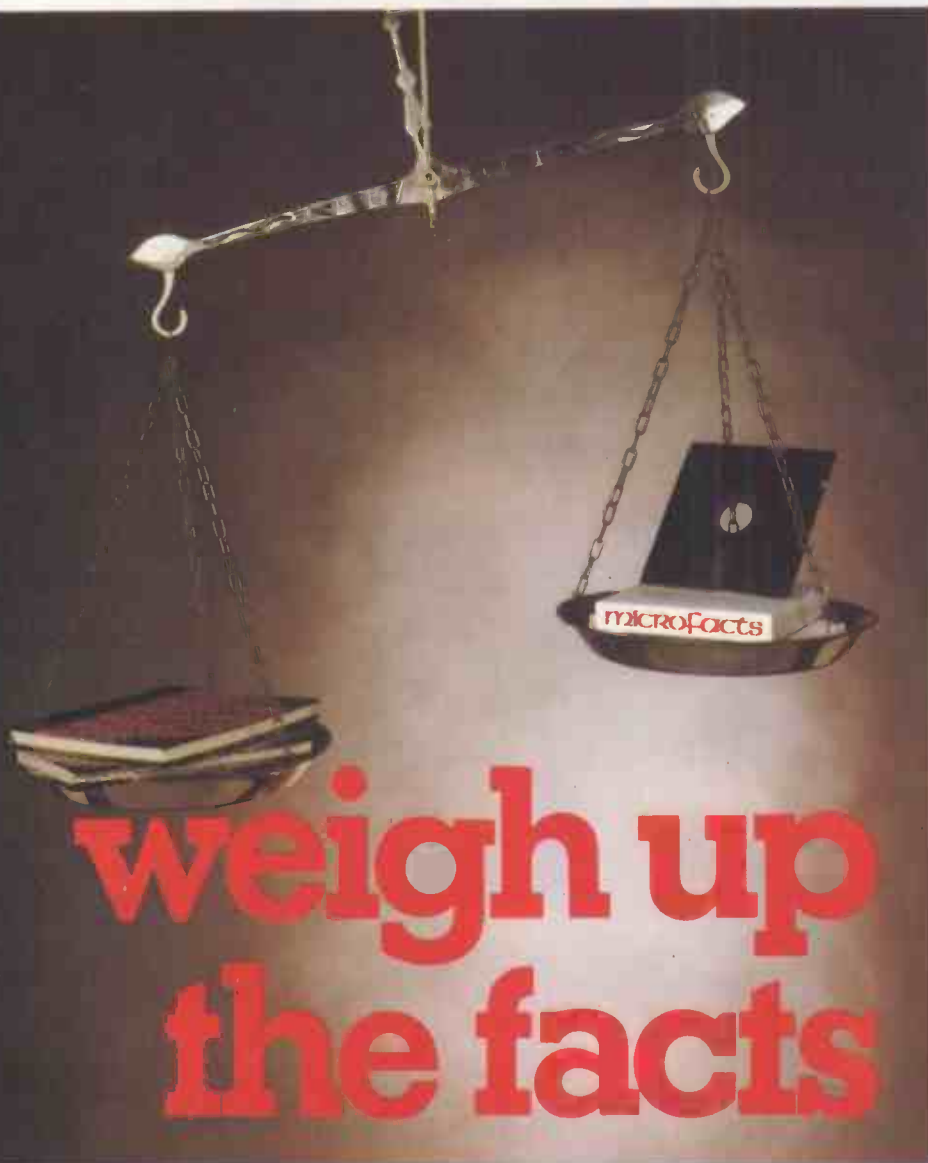
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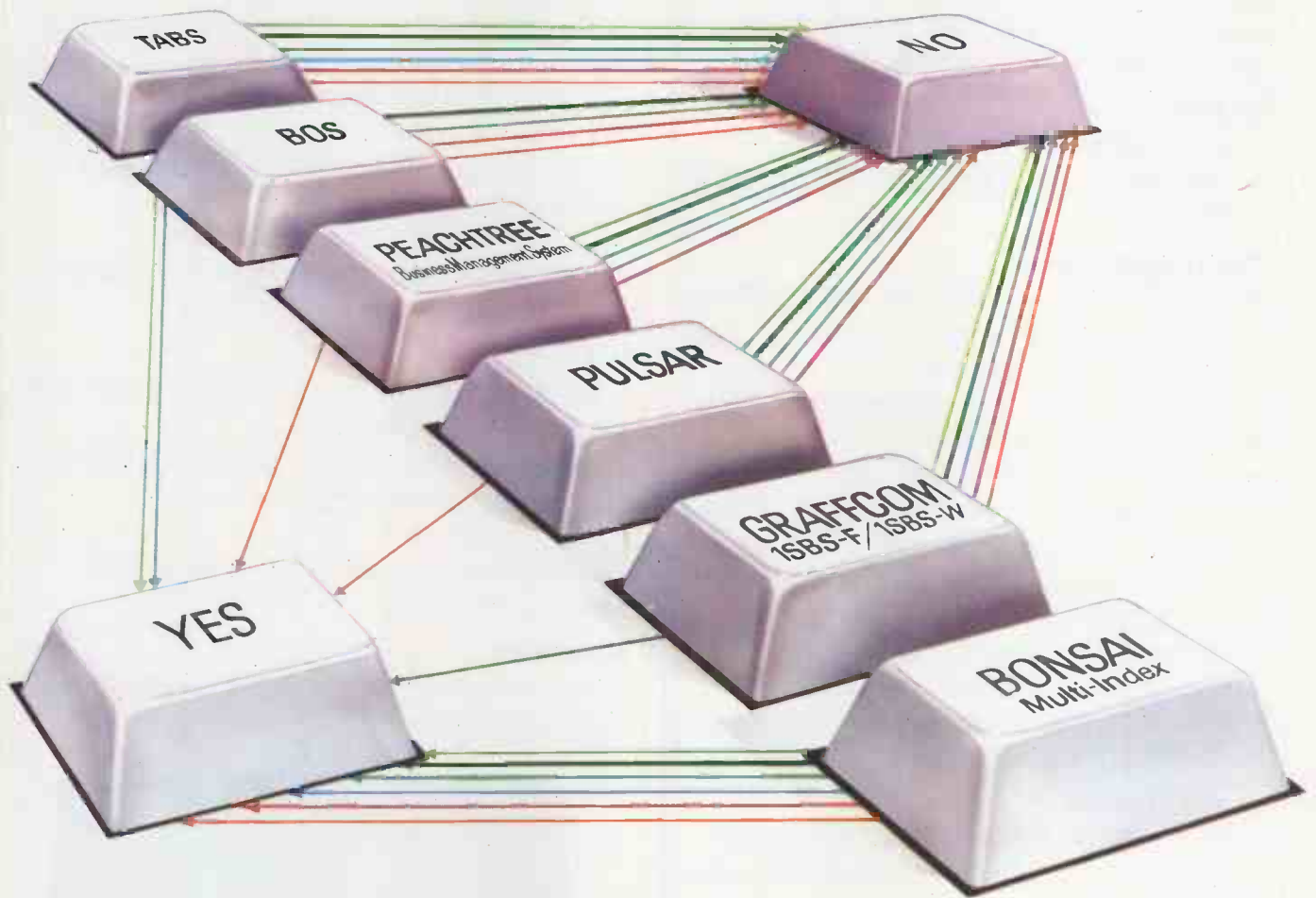


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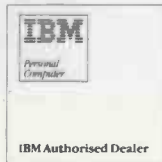
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- 24K bytes of ROM;
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THE SCREEN DISPLAY

- 40 or 80 characters to the line – without affecting the 28K bytes of RAM at your disposal;
- 24 or 30 lines to the screen;
- well-formed characters, with true descenders;
- a full European character set;
- normal or reverse video, high resolution graphics on screen of controllable size, 256, 320, 512 or 640 horizontal resolution by 250 vertical lines;
- a facility to set up a “page” of up to 255 lines, with the screen acting as a “window” to display it;
- ability to maintain several such pages simultaneously, and to switch rapidly between them;
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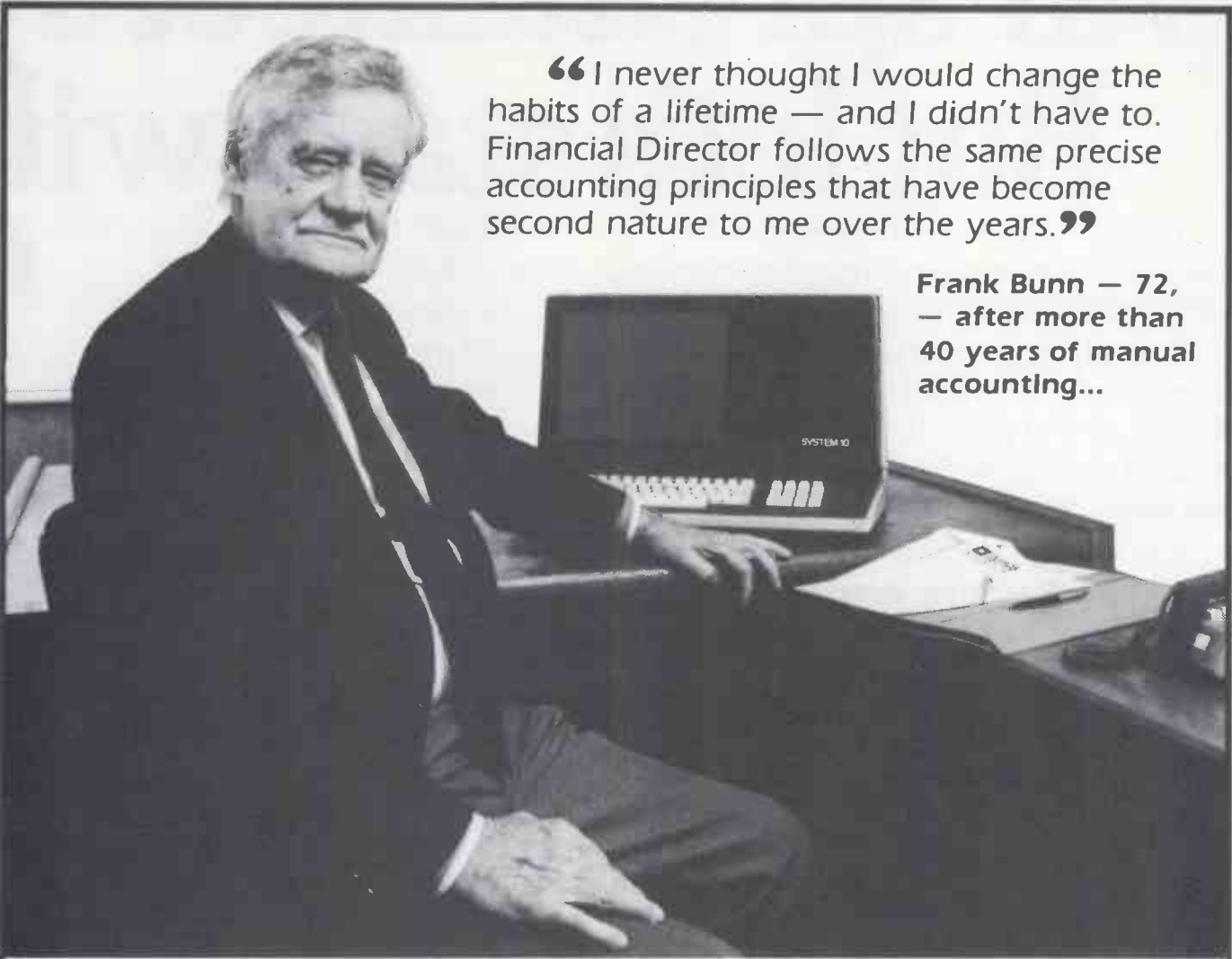
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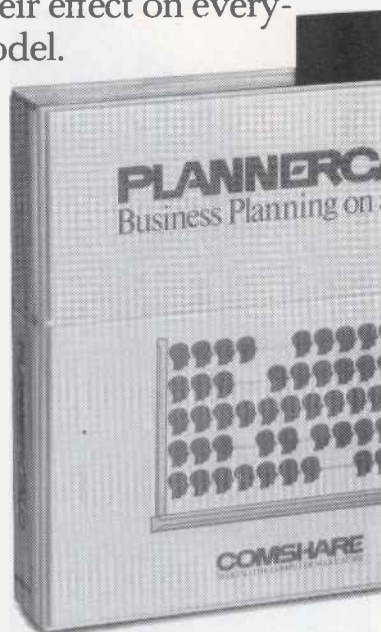
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Whether you use a micro for playing games, running a business or just learning about computers, the software you buy and use will make or break your relationship with your machine.

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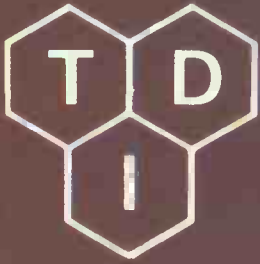
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CPM is available. What more to say except that Digital Research now give their blessing to SAGE with their CPM68K system. This comes complete with a 'C' compiler and will allow UNIX software to be compiled and run under the CPM environment.

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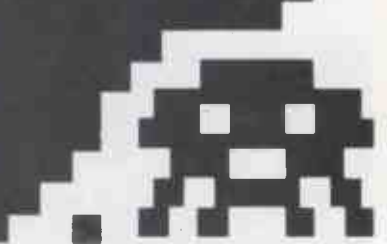
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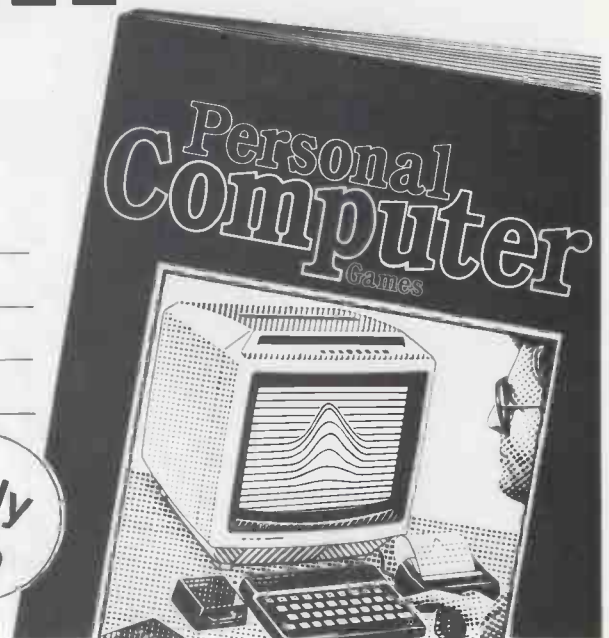
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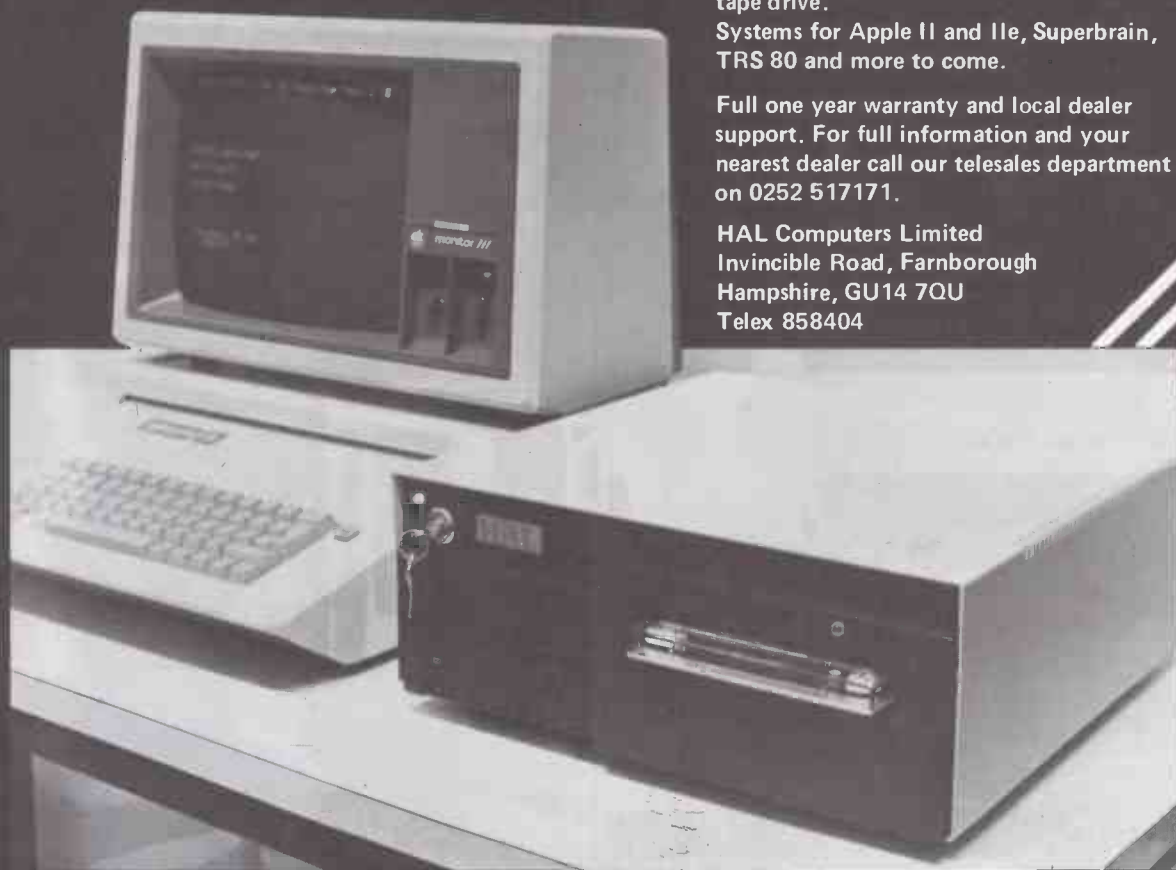
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PASCAL MT - SPP	Digital Research	173
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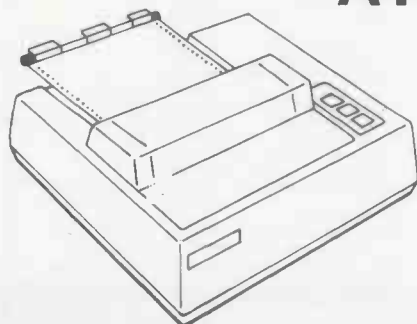
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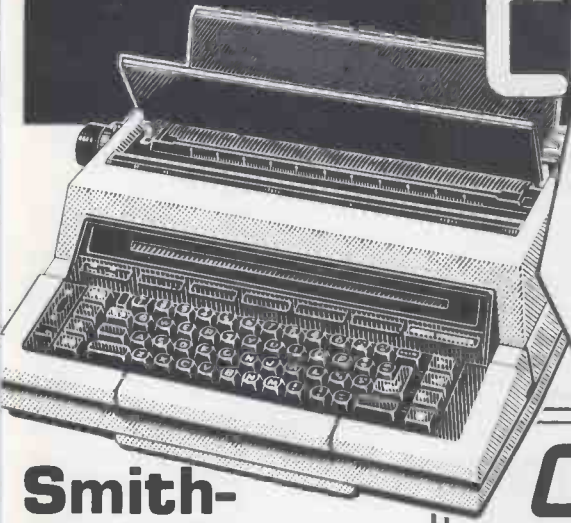
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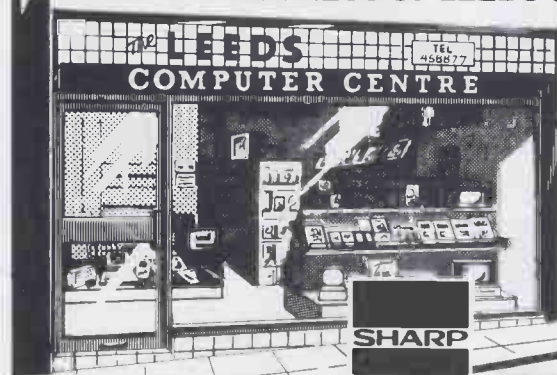
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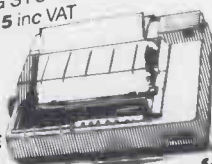
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Another may win every brownie point in the book on games. But with programming difficulties that make your brain ache (let alone your finger tips)...

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Owning one means that when you want to do something new, you won't have to throw away

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It means that once started, you can progress to be an experienced programmer. From fantastic games, to professional program applications.

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PROGRAMMABLE

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128 programmable characters with programmable screen for text and display. Plus 128 pre-set graphics on the keyboard.

4 programmable function keys in each shift plus auto-repeat on all 63 keys.

And to help cure any of your programming bugs - Colour Genie has a full, powerful editing facility!

MEMORABLE

On 16K RAM, virtually 90% is available for you to use. Rising to a staggering 95% with the 32K RAM option. That indicates design efficiency and some very experienced programming.

It's not RAM size that counts - it's the usable RAM that matters!

ADAPTABLE

Screen text display is a full 40 across x 24 down. In this mode you can build highly complex graphics. Using the highest screen resolution of 320 x 192 with both text and graphics.

With up to 16 colours on screen (8 colours and 8 hues), get the shapes to 'move' over the screen with a 3D effect. Or you can use full-screen high graphics resolution at 160 across x 96 down in 4 colours with background colour. In both modes you have the facility of 128 pre-programmed graphic 'building blocks' plus 128 more that you can create yourself.

Colour Genie

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COMPOSABLE

Outstanding facility with 3 sound generation channels. Independent or simultaneous with a full range of 8 octaves on each channel to give the synthesized sound of instruments such as drums, flute and harpsichord. A bomb, a car or a bird!

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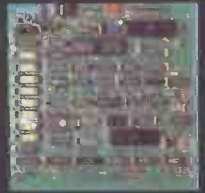


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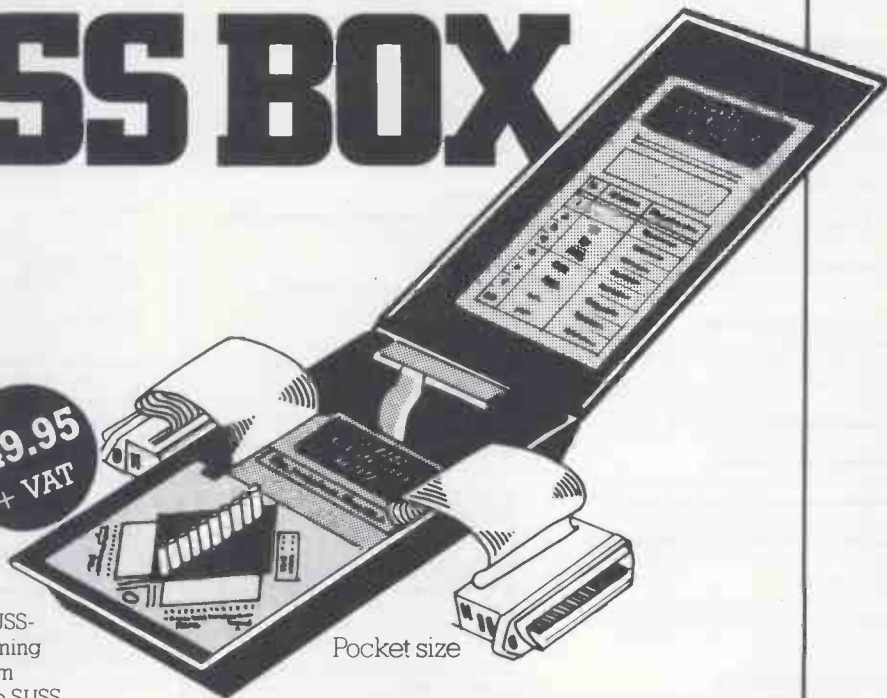
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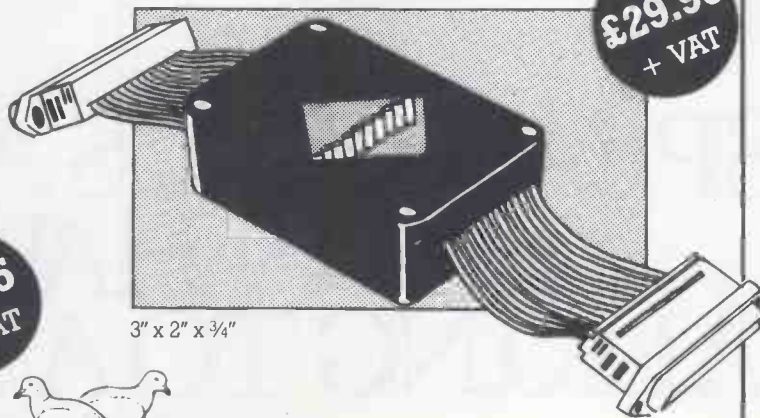
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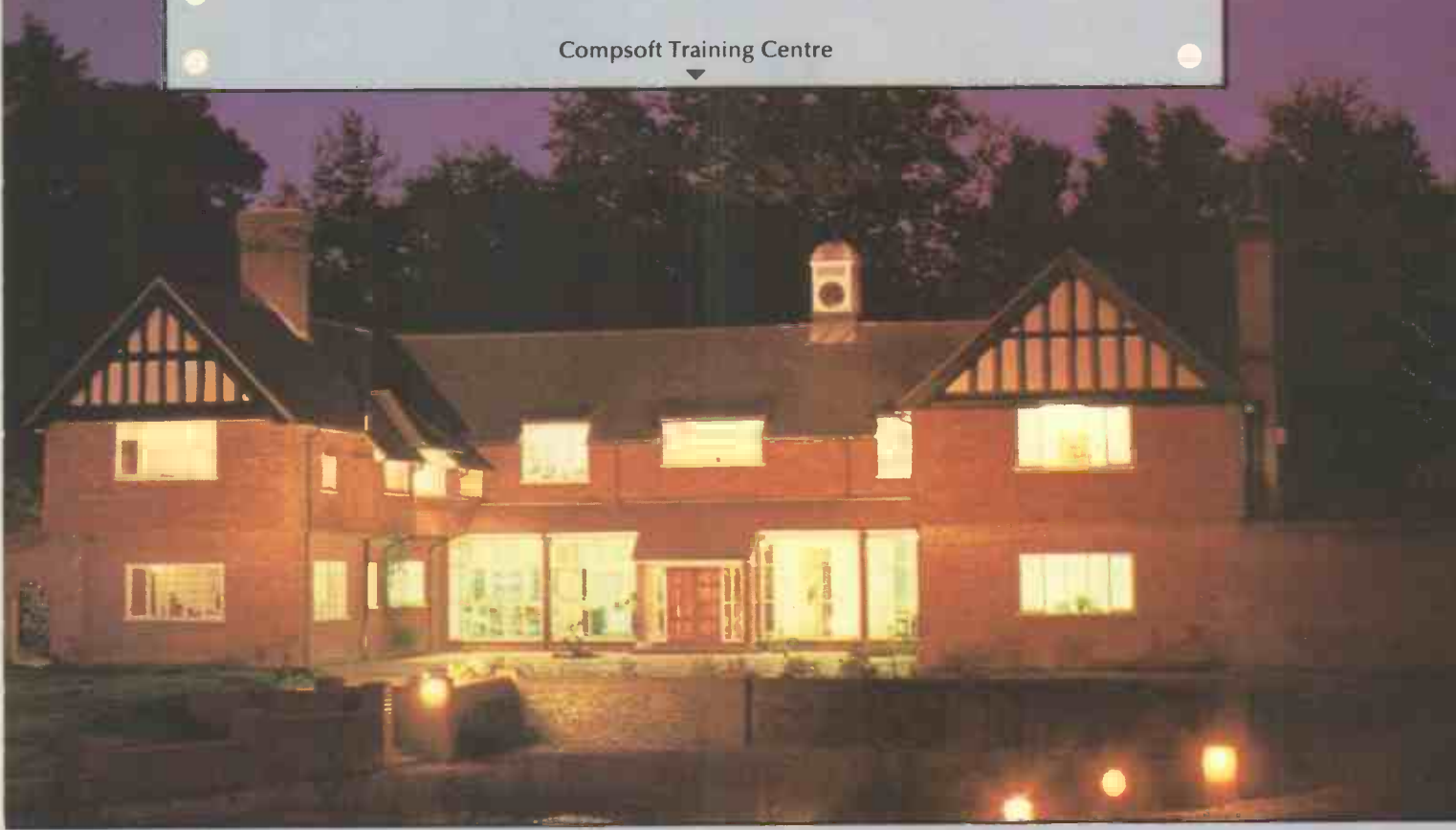
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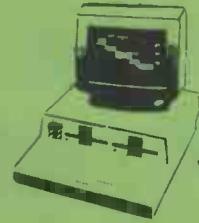
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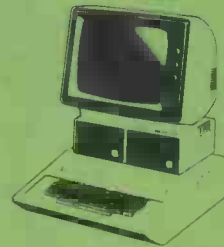
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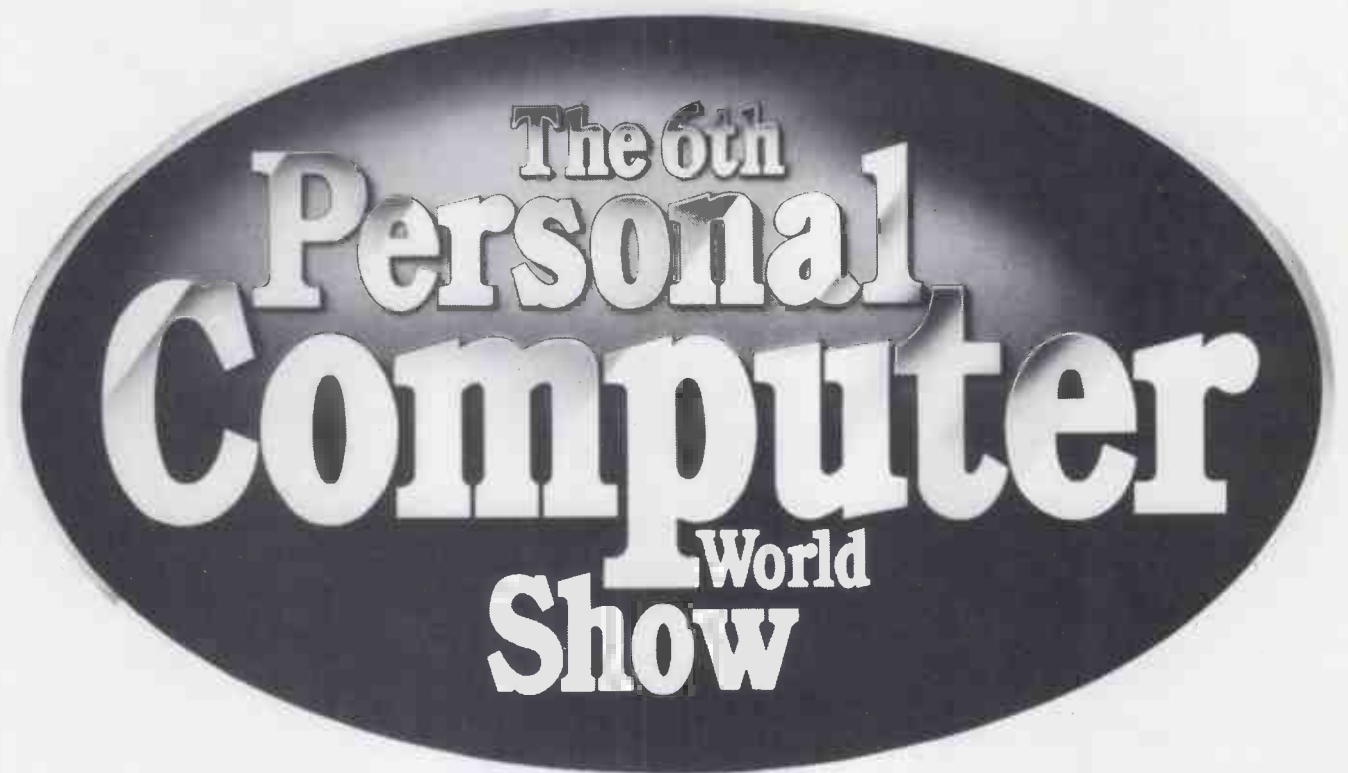
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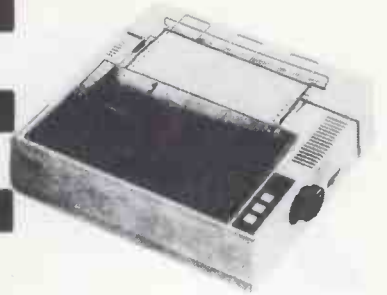
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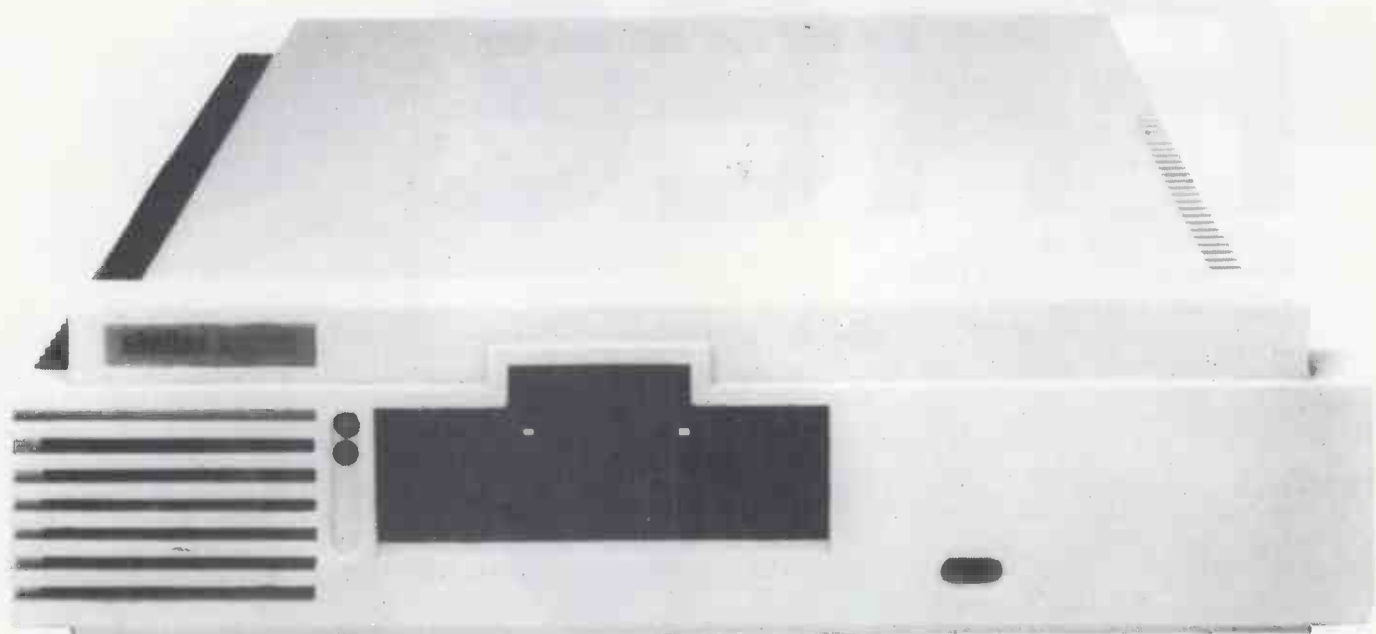
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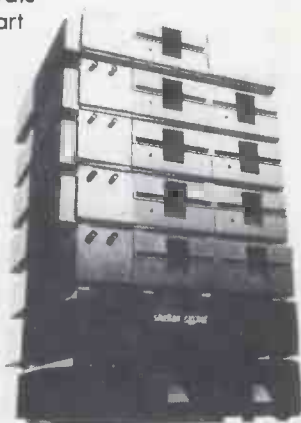
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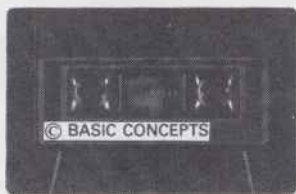
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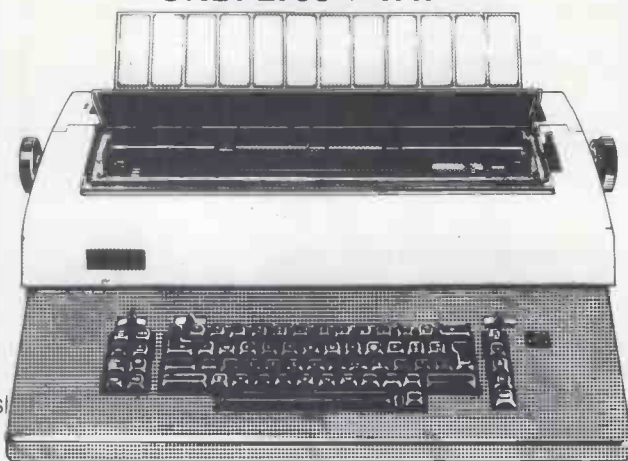
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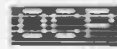
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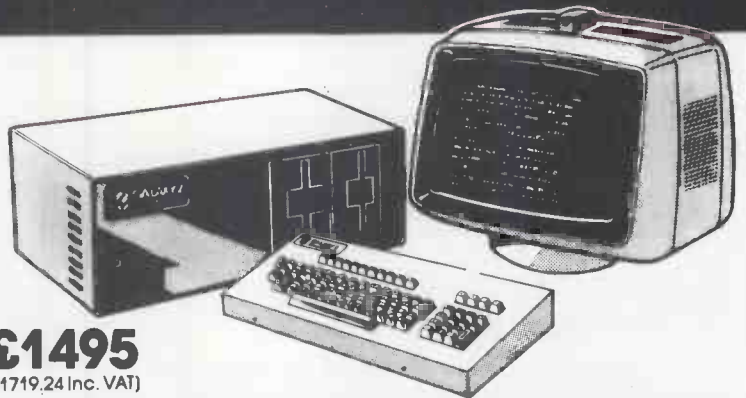
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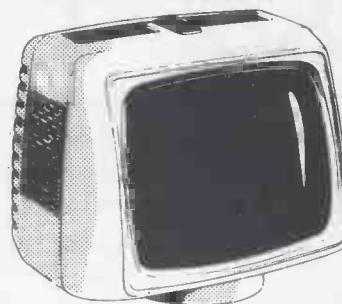
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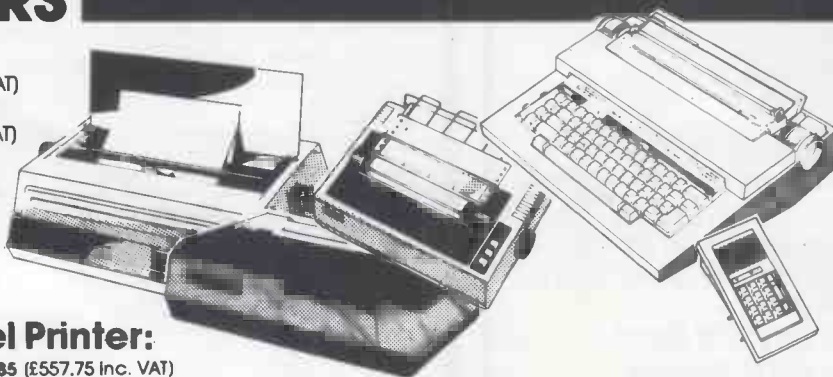
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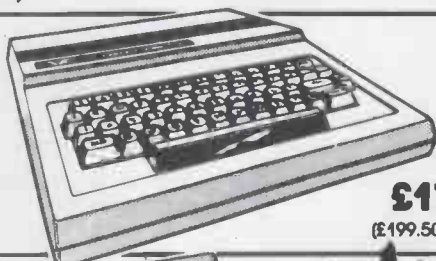
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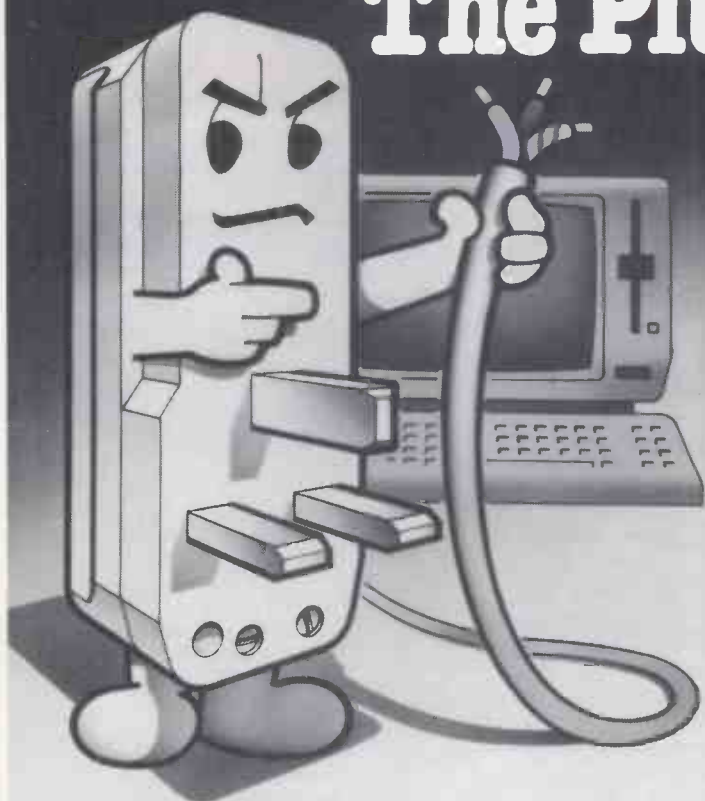
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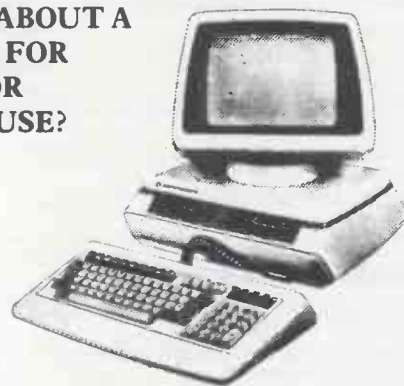
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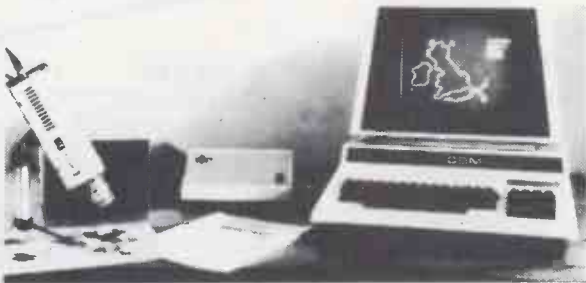
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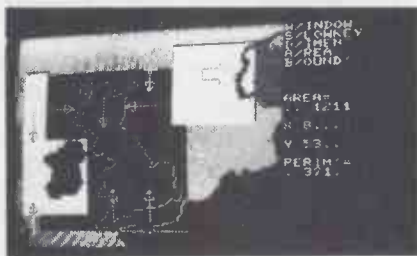


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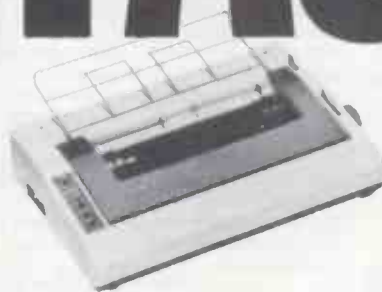
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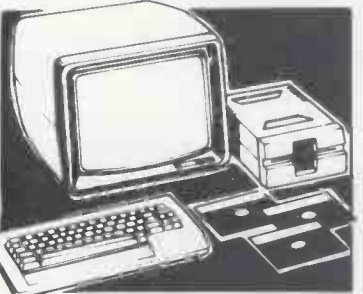


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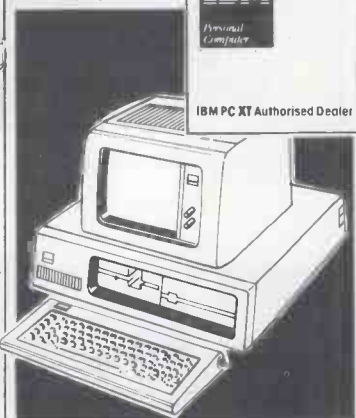
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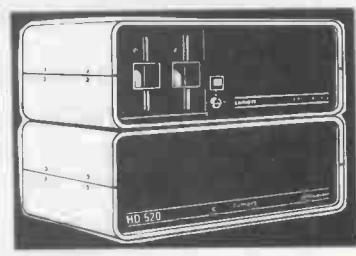
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Buy the world's best selling portable business computer from any Byteshop and we'll give you a massive £100 discount off the price of the Personal Pearl Database/FM Software Package. The Osborne 1 is the personal small computer system that is housed in a durable but lightweight 'snap together' case. Features embrace 64K RAM, dual floppy disk drives and we also throw in 100 sheets of paper so that you can start work straight away! The price also includes the following comprehensive business software programmes:
 • SUPERCALC for electronic spreadsheets.
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 NB. The voucher on the corner of this magazine must be presented at time of purchase to ensure a £100 discount off the price of the Personal Pearl Software Package. Offer valid until 31st July, 1983.

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 PERSONAL PEARL Pearl Data Base/FM 185.00
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 WORDSTAR Micropro Wordprocessing Package* Also available with Mailmerge and Spellstar... 295.00
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• Some items may be subject to a dollar surcharge if the dollar exchange rate changes more than 5 cents. Prices will be adjusted in line with the rate prevailing at the time of purchase.
 • Prices subject to change without notice E.&O.E. and are valid for the cover date life of this magazine (July 83)
 • Whilst we carry a vast range of stock, we cannot guarantee that every advertised item will be available in each shop.
 • All goods are new and include factory warranties.
 • No refunds on opened software.
 • Orders from Government Depts., Colleges & BFPD addresses welcome for orders above £25.
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 • Detailed prices available on request.



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You wouldn't go to a lawyer for medical advice, or take your tax problems to a doctor. It's just as illogical to talk computers to anyone but a computer expert.
 Every Byteshop is a specialist computer store. In it you will find nothing but computers and computer people. There is nothing else to distract you. Every Byteshop can show you the very latest personal computer systems and provide solutions to both specific and specialist requirements. Word processing, production control, accounts financial planning and data bases are just a few of the most popular applications.
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 NG1 6LF. Tel: 0602 40576

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 Tel: 021-622 7149

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 The Byteshop, 11 Gateway House,
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 M1 2GH. Tel: 061-236 4737

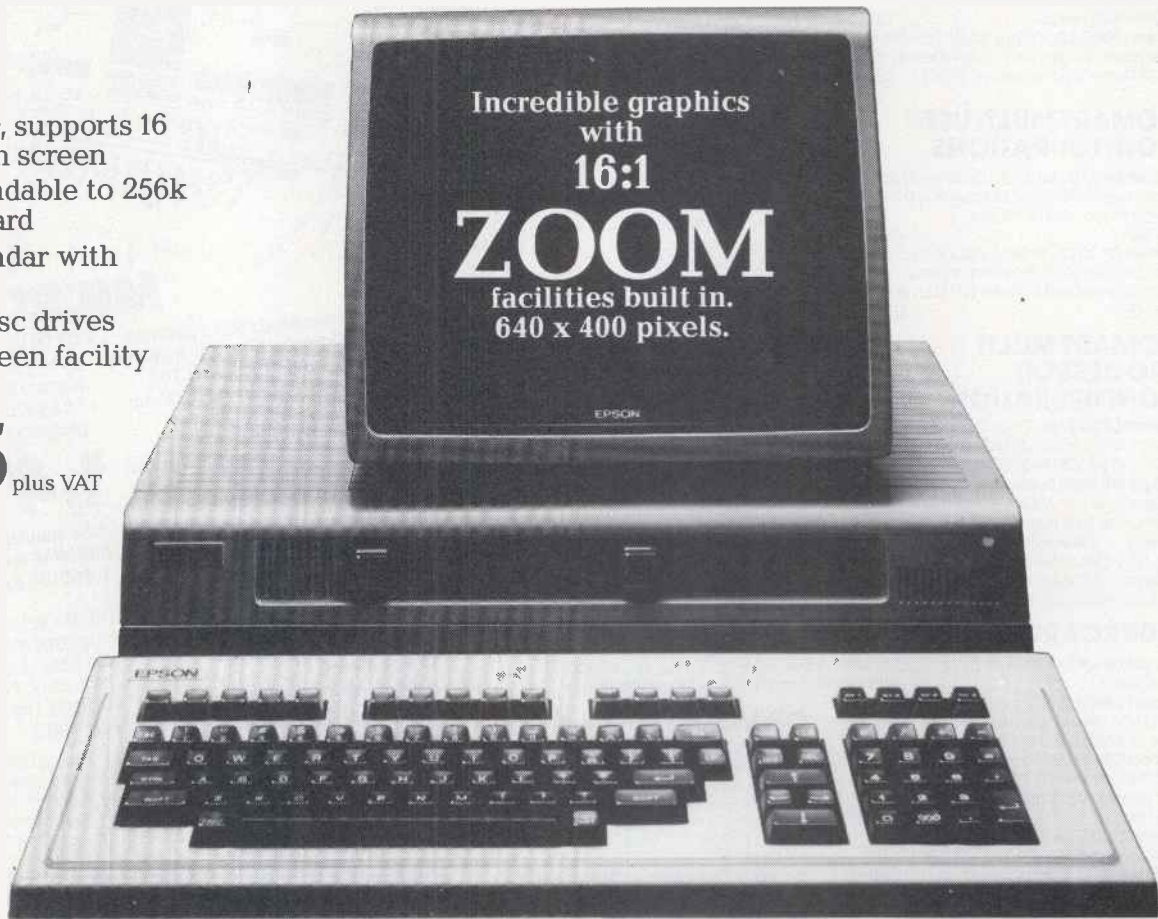
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Card index	Estate Agents
Databases	Authoring
Mailing	Time Tabling
Reports	OTHER LANGUAGES
BUSINESS	TCL Pascal
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+ VAT

As a stand alone portable or linked to your CP/M based computer, the HX-20 takes computing a step further. Unlimited horizons on a limited budget.

Transams portable computer centre offers a wide choice of portable equipment and software. The HX-20 has taken pride of place. Software now available includes:-

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A computer small enough to fit into a briefcase yet with a full size typewriter keyboard, LCD virtual screen, printer and microcassette facility actually built in. High speed serial communication with other computers plus the Epson reliability - a world beater.

CODE		PRICE
HX20UA	Portable Micro Unit with Operating Manual Vinyl Case	£402.00 £9.00
HX20MC-SA	Microcassette Drive	£75.00
HX20EU-SA	Expansion Unit	£80.00
H00BR-JA	Bar Code Reader	£82.00
HX20RC-SA	ROM Cartridge	£45.00
H00AAU	Spare Mains Adapter	£8.50
SHX700	Sendata Acoustic Coupler	£220.00
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CAB 705	Acoustic Coupler Cable	£15.00
CAB 714	Terminal Printer Cable	£15.00
CAB 716	Local Network Cable HX20/HX20	£15.00
CAB 717	Serial Interface Cable	£15.00
THX01	Parallel Interface Unit	£85.00
H00RP	Paper Rolls (5)	£2.60
H00CR-RA	Printer Ribbons	£2.20
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New from Transam, the software (in ROM) allows your HX-20 to interface with any computer and act as a terminal to transmit and receive with 'off line' editing. Full screen editor for text preparation.

Plug in ROM and documentation **£45.00** plus VAT.
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Construction Costs Profile

A - Materials (24%)
B - Overhead (33%)
C - Land (27%)



The new TI Professional Computer. If you want the business edge, it's the answer.



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helps you make better business decisions based on better information. With the performance and reliability you expect from TI.

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SPECIFICATIONS

System Unit

16-bit, 8088 microprocessor
64K byte RAM, expandable to 256K bytes
4K byte graphics display memory
5-slot expansion bus

Keyboard

Specially designed low profile
Popular typewriter layout
97 keys, including 12 function keys
Separate numeric keypad and cursor control clusters
Tactile response, for quick positive entry
Upper- and lower-case letters

Display Units

12-inch monochrome (green phosphor) or
13-inch full-colour, 25 lines x 80 columns
High resolution, 720 x 300 pixels

Mass Storage

Built-in 320K byte diskette standard
Additional internal storage of 320K byte
diskette, or 5 or 10 Mbyte Winchester disks
optional

Communications Options

TTY, 3780
3270 SNA stand-alone
3270 BSC and SNA cluster

Operating Systems

MS™ -DOS, Digital Research™ CP/M-86®,
and Concurrent CP/M-86™ UCSD p-System™

Languages

BASIC, COBOL, FORTRAN, Pascal

Applications Software

Over 100 programs available from the most
popular software vendors such as Microsoft,
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Lifeboat and others

Printers

150-cps TI 850 Series for most applications

FOOTNOTES: MS-DOS is a trademark of Microsoft Corporation. CP/M-86 and Concurrent CP/M-86 are trademarks of Digital Research Inc. UCSD p-system is a trademark of the Regents of the University of California

Let  **PHILIPS** put a word in
for your business (or thousands of words)

The P2000 word processing system

... lets even one finger typists turn out secretary-perfect letters. Time after time after time.

And it costs from under
£2000 complete with
letter quality printer!

The P2000 system brings word processing power within the reach of practically any small business. Accountants, small contractors, solicitors, sole traders. In fact anyone who needs to put out letters, quotations, invoices, etc. quickly, neatly and accurately.

No more hasty alterations giving your letters that 'amateur' look. No more frantic retyping when you realise you need to make a change just before last mail collection. You can change text, correct errors, add or delete words or paragraphs, all at the touch of a few keys.

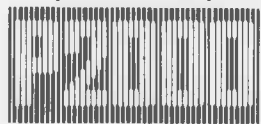
If you want more than one original it's no problem. You can even send the same letter to all your mail list, each individually titled. You'll soon find that the P2000 pays for itself in time saved, not to mention what it does for your business image.

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And all underwritten by the Philips' reputation for quality and reliability. It's simply for everyone.



Philips Micro-Computer



Simply for everyone.

**TO FIND OUT HOW
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Technical

Screen	: 12" non-reflective green screen. 24 lines of 80 characters.
Keyboard	: Full typewriter style. Numeric/ function keypad.
CPU	: Z80 2.5 MHz. 48K RAM.
Disks	: Two built-in 140K mini-floppy drives as standard. : Optional two drive expansion chassis.
ROM	: Programs loaded by inserting 16K ROM modules.
Printer	: Philips P2121 daisy wheel printer, 25 cps.
Basic WP package (under £2000)	: Computer with 48K RAM. Two floppy drives. Word processing ROM. P2121 daisy wheel printer.

pd MICRO
DESIGN

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includes £600 of free equipment

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includes £700 of free equipment

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includes £1100 of free equipment

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	M83A £535	Purchases	£195	Supercalc	£150
	M84A £949	Payroll	£195	Multi-Plan	£159
OLIVETTI JP-101		Stock Control	£195	Wordstar	£295
£320		Invoicing	£195	Select	£295
5 other matrix printer ranges available		Data Analysis	£195	Mailmerge	£95
SMITH-C TP1 £415				Dbase 2	£395
EL2000 £619					

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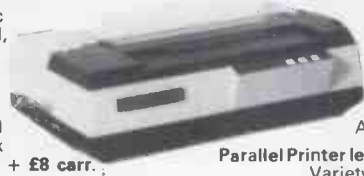
MICROVITEC 1431 14" Colour Monitor £249 + £8 carr.
 MICROVITEC 2031 20" Colour Monitor £319 + £8 carr.
 KAGA 12" Colour Monitor RGB £255 + £8 carr.
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 Variety of interfaces, ribbons in stock
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RX80 100CPS 80col
 Tractor Feed £298

FX80 160CPS 80col
 F & T Feed £389

MX100 F/T3 £425
 (£8 carr./printer)

Full Specifications on request

DISC DRIVES FOR THE FORTH COMPUTER

5 1/4" Teac FD55 Slim Line Mechanisms
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 Bare: £135. Cased: £155
 2 x FD55A 40 track SSD 500kbytes unformatted.
 Cased + psu £350
 FD55E 80 track SSD 500kbytes unformatted.
 Bare: £180. Cased: £205
 2 x FD55E 80 track SSD 1 Mbyte unformatted.
 Cased + psu £475
 5 1/4" Mitsubishi M4853 Slim Line mechanism
 80 track DSD 1 Mbyte unformatted.
 Bare: £225. Cased: £245
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Other parts for FORTH COMPUTER available.
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The complete micro processor development system for Engineers and Hobbyists. You can develop programs, debug, verify and commit to EPROMS or use in host computer by using softy as a romulator. Powerful editing facilities permit bytes, blocks of bytes changed, deleted or inserted and memory contents can be observed on ordinary TV. Accepts most +5v EPROMs. Softy II complete with PSU, TV Lead and Romulator lead £169.

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10 way	90p	85p	120p
20 way	145p	125p	195p
26 way	175p	150p	240p
34 way	200p	160p	320p
40 way	220p	190p	340p
50 way	235p	200p	390p

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24" Ribbon Cable with Headers

	14 pin	16 pin	24 pin	40 pin
Single End	145p	165p	240p	380p
Double End	210p	230p	345p	540p

	20 pin	26 pin	34 pin	40 pin
Ribbon Cable with Sockets	160p	200p	280p	300p
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AMPHENOL CONNS

36 way plug Centronics Parallel Solder £5.25	IDC £4.95
36 way socket Centronics Parallel Solder £5.50	IDC £5.20
24 way plug IEEE Solder £5.00	IDC £4.75
24 way Solder Plug (IEEE type)	500p
24 way Solder Socket	500p
24 way IDC Plug	485p

RIBBON CABLE

	(Grey/meter)
10 way	40p
16 way	60p
20 way	85p
26 way	120p
34 way	160p
40 way	180p
50 way	200p
64 way	280p

D CONNECTORS

No. of Ways

	80p	105p	160p	250p
Solder	80p	105p	160p	250p
Angled	150p	210p	250p	365p

	105p	160p	200p	355p
Solder	105p	160p	200p	355p
Angled	165p	215p	290p	440p
Hoods	90p	85p	90p	100p

IDC 25 way plug 385p Socket 450p

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14 pin	275p	40 pin	£6
16 pin	£3		

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(25 way D)

24" Single end Male	£5
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24" Female-Female	£10
24" Male-Male	£9.50
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	Solder	IDC	Type
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16 pin	50p	140p	
24 pin	100p	200p	
40 pin	200p	225p	

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DIN 41617	PLUG	SKT
21 way	160p	165p
31 way	170p	170p

DIN 41612

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2x32 way Ang. Pin	275p	320p
3x32 way St. Pin	260p	300p
3x32 way Ang. Pin	375p	350p
IDC Connector	-	475p
A+B	-	525p
A+C	-	525p
2x32 way U Connector	£15	

(please specify a+b or a+c)

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	0.1" 0.156
2x18 way	140p
2x22 way	190p
2x23 way	175p
2x25 way	225p
2x28 way	190p
1x43 way	260p
2x43 way	395p
1x77 way	600p
5100 Conn.	600p

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24 pin	£5.75
28 pin	£8.00
40 pin	£9.75
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10 way	140p

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2732	350p
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4116-2	80p
4164-2	450p
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4702B	750p
COM 8116	700p
MC 14411	675p

CPU's

1802CE	650p
2650A	£12
6502	350p
6502A	500p
6800	225p
6802	225p
68802	700p
6809	650p
68809	£12
6809E	£12
8035	350p
8039	300p
8080A	250p
8085A	450p
INS8060	£11
TMS9980	£20
8086A	£22
8748	£18

COMPONENTS

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Z80	290p
Z80A	320p
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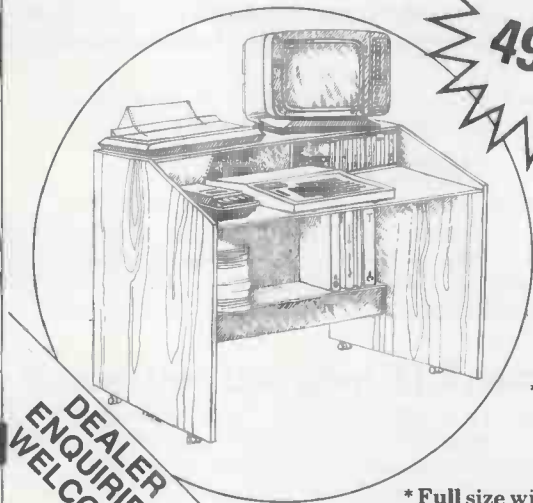
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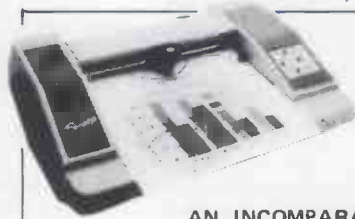
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Amongst the many thousands who could benefit from ACCELERATOR II are users of Visicalc, DB Master, Micro Modeller, Multiplan Tabs, and Systematics.

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In November 1982, PCW published a bumper round up of all the Benchmark Timings since PCW began. The Olivetti M20 came out top of the 'league' with an average Benchmark timing of 11.5. Running the same Benchmark test programs,

the Apple II Plus with Accelerator II averages a timing of 8.58 — that's an incredible 25% faster than the Olivetti M20.

We have reproduced some of PCW's findings, incorporating Benchmark Timings for the Apple II Plus with Accelerator II.

Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
Apple II Plus with Accelerator II	0.3	2.4	4.5	5.0	5.5	8.2	12.9	2.98	8.6
Olivetti M20	1.3	4.0	8.1	8.5	9.6	17.4	26.7	1.6	11.5
IBM Personal Computer	1.5	5.2	12.1	12.6	13.6	23.5	37.4	3.5	17.6
Osborne 01	1.4	4.4	11.7	11.6	12.3	21.9	34.9	6.1	19.9
Intertec Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	5.6	21.9
Apple III	1.7	7.2	13.5	14.5	16.0	27.0	42.5	7.5	24.7
ACT Sirius I	2.0	7.4	17.0	17.5	19.8	35.4	55.9	4.3	24.8
Xerox 820	1.7	5.5	15.5	15.1	16.2	28.9	46.1	8.0	26.1
Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	10.7	30.4
Commodore CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	11.9	34.3

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Private Eye

Some time last year, a deal was concluded between a computer maker and a shop, which is now attracting the attention of the police.

It involved the maker setting up a 'front' for mail order purposes, because it didn't want its dealers to know that it was indulging in mail order.

In order not to upset the police, I'll keep the story anonymous. As I am not God, however, I cannot be sure whether people are telling me the truth. I can, therefore, only present the story with the facts that have been made known to me.

First of all, the computer company was in difficulty. It had signed big deals with retail chains, promising to deliver computers (which it had not yet made) too cheaply: that is, at a price which would not have provided it with more than pennies in profit.

The company itself was in debt, and the bank — presented with this deal as evidence of its bright future — had become so alarmed that it began taking steps to wind up the company. So the company, which from now on we will give the name R Souls, began looking for a deal which was obviously much more profitable.

But you can't do that, after having just told a major chain like W H Greenon that you can only supply them with 1000 computers (when they wanted 10,000.) If you do, it will come back and demand that you supply the requested number, and do not divert its products directly into the postbags of customers.

So R Souls decided to disguise the operation. The idea was to set up an associated company which would print the advertising

under its own name.

To do this, it needed a handy fool who would set up N D Fule Ltd — a dealer — and advertise his shop and also offer mail order computers and software. Then, if W H Greenon were to complain, R Souls would be able to throw up its little hands in despair, and say: 'It's awful, isn't it, but what can we do?'

The reason that R Souls needed a fool for this was simple. To make its profits, mail order people have to accept machines at a very high price — so if they cost £100, they have to pay £95 (or more). They have to be too dim to see that — as a dealer — he could get them at dealer price — and if R Souls refused to give him a dealer price direct, he could get machines through friendly arrangements with other dealers.

Look at the arithmetic. R Souls pays for the advertising, and prints N D Fule's address. A hundred people write in and pay £100 each, and a mere 15 people walk in through the door, and buy them off the shelf. (That makes 115 computers.)

But N D Fule then rings up R Souls, and plaintively says: 'The response has been awful; I've only sold 20. Oh, and I'll need 95 machines for my shop, at £60.' (That, oddly enough, also makes 115 computers.)

He then flogs the machines to his hundred mail order customers at the high-profit rate, when his shop only had 15 customers through the door. Instead of making 100 times £5 (plus the retail of 15 times £40) he makes a thumping lot more.

This simple dodge doesn't appear to have occurred to the chief of R Souls, nor to the N D Fule man. They signed a deal, which I've seen,

setting all that out in terms obviously designed only to make lawyers rich.

Of course, the deal didn't work. Primarily (I think) it didn't work because the wretched factory at R Souls was not making any machines. That is to say, it was making them by the hundred, all bar one small chip which the chip maker had neglected to inform it was not quite ready — and didn't work. So the computer didn't work.

At this point, R Souls set up a subsidiary, which we will call Flybynight Systems, and gave this new company the rights to make the Soul computer. Then it raised enormous City finance, and told N D Fule that his contract was no longer valid because he hadn't stuck by the contract. And anyway, his contract wasn't with Flybynight, was it?

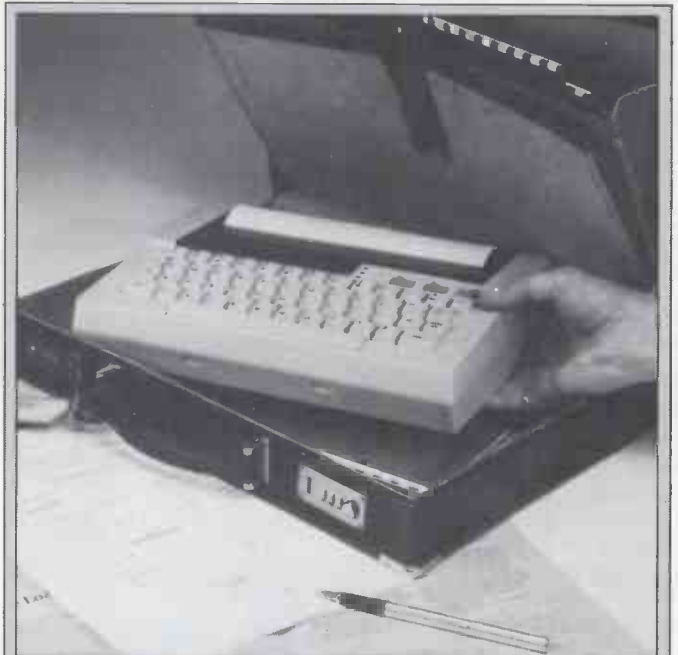
The way in which he had broken his contract is interesting.

He had been told to put all mail order money in a special 'escrow' account in R Souls' bank, and to send out products direct to mail order buyers.

But the bank, (I think, quite reasonably) felt — since it was just about to wind up the company for its indebtedness — opening a new account was just not on. So N D Fule couldn't pay it into its joint account so, obviously he was breaking the contract.

At that point, fiction has obviously entered the scene. It gets worse from here on.

According to R Souls, there had never been a mail order deal. That is, it was revoked before it was signed. It continued to pay for N D Fule's advertising, and check the artwork for the advertisements, but there was nothing R Souls could do about the fact that he was offering mail order. He was a dealer after all — except he had to pay cash with order



Unlike most portable micros you may meet, this Texas model 709 has a full width printer. Unlike most computers, however, this model 709 has no data processing power. Eventually, says Texas Instruments, it is proposed to provide 'solid state software' (that is, plug-in cartridges) to make it do some of the things that a computer could do — such as automatically dial up a computer and provide the user's log-on sequence. At £800, I should jolly well hope so, too.



For people who don't like reaching behind their computers to unplug the printer before connecting the modem, or putting the daisy-wheel on, or whatever, the T-switch (T for Transfer) from Inmac costs £135 for a two device switch, £175 for four, or £215 for six devices. Other configurations to suit every taste: details on Runcorn (09285) 64321.

because he wasn't creditworthy.

He swears he sent the £9700 he received to R Souls (as Flybynight strangely renamed itself). It says he sent no money, but did pay cash for his retail sales. He denies this — claiming his deal said he didn't have to pay in advance of getting machines. He sent the mail order cash. He couldn't send the retail cash, because he was going bust. It says he wasn't entitled to machines in advance, because there had never been any deal. And it says that it will lose £20,000 because of it, refunding customers their money or supplying machines and software.

At the end of the day, one good thing has emerged: one customer, brighter than the rest, refused to accept R Souls' assurances that N D Fule was not its agent, and threatened to sue them jointly — and was given his product ('without prejudice'). Shortly after, out of the goodness of its heart, R Souls decided to supply the machines and software to anybody who could prove they had sent money to N D Fule.

Fortunately, I don't have to make up my mind whether any of the three bumbling twits involved was actually a crook.

But the law says that you can't take money for goods you can't supply, whether you do it on purpose, or by accident. And so at least one man out of three bumbling twits is very likely to spend a few months in prison 'on

remand' waiting to be tried for fraud, and possibly a few years serving a sentence. Somehow, that spoils the joke.

I wish the police joy of it. For any customers of mail order computer firms who have had similar experiences, the lesson is simple; it isn't: Don't buy mail order — because most people who do have no other choice. It is: Do not accept the assurances from supplier and dealer that 'you have to sue the other one'. Threaten to sue them jointly; this will magically change the supplier's attitude from 'get lost, sucker,' to 'you poor, poor dear, you really deserve a machine to console you, and here is one, out of the goodness of our hearts.'

Make sure you get the full warranty, in writing.

Brainy deal

The Newbrain portable micro is about to change the meaning of the word 'cheap' on systems using CP/M as the operating system.

By August, the plan is to supply a Newbrain with CP/M, with a single 200 kbyte floppy disk, display monitor and printer for £700 or less. The printer will probably be the cheap Oki model.

This package will be upgradable to a 96 kbyte system with twin floppy disks of 800 kbyte each, plus monitor and printer, for £1200.

To go with this new system, Newbrain's parent company

Grundy has signed a software contract with Peachtree: Peachtree has implemented virtually the entire product range on the Newbrain.

That will be marketed along with the Newbrain CP/M system — the extra 64 kbyte expansion module.

Anybody needing a CP/M system this month should ignore this announcement — because you won't be able to get one for a little while.

Production has already begun, but order backlogs and other prior bulk commitments will take a fairly sizeable chunk of time. Expect to see computers in high street stores in August.

Grundy has also done an interesting deal on maintenance: it has signed a contract with the Thorn EMI subsidiary, Software Science.

This means that the dealers and Grundy will act as brokers for the Software Science maintenance facilities on a nationwide basis — there are ten branches around the country. This deal will not just cover the Newbrain itself, but expansion modules and peripherals, too.

At first, the new expansion system is expected to be clumsy-looking. As an interim measure, Newbrain will provide a metal case racking unit with built-in, heavy duty

power supply (able to drive the whole lot). Eventually the company will design and develop a packaged unit for desk-top work. The Newbrain itself can always be unplugged from the system, and carried home.

Details from dealers.

Going cheap

Scanty details of the Advance 86 — to be launched shortly by Dixons — indicate a frightening change in the price structure of 16-bit micros.

For £400, including VAT, this machine (without disks) will provide an 8086 processor (that is, the proper 16-bit chip of which the 8088 in the Sirius and IBM machines is the little brother), plus 128 kbytes of internal memory.

Owing to the 8086, it runs at around 40 per cent faster than the IBM micro, but the builders say it will be almost totally compatible.

The system will apparently have colour display, the MS-DOS operating system, an IBM standard tape cassette interface, and a detachable keyboard.

I'm told it will take IBM personal computer cards, including the standard £200 IBM disk controller card. And



Sending data down a phone line to a computer involves rather more than the modem to connect your own processor to the phone: there is the small matter of persuading the receiving computer that what is coming down makes sense.

Specialist in computer communications, Albetros, has produced a package called Semaphore, which takes into account all the file handling eccentricities of either computer.

That is, as long as the computers fall into the categories for which it has a list of eccentricities: namely any CP/M or CP/M-86 system; or any MS-DOS computer; or Digital Equipment's minis; Data General's Eclipses; or Prime and IBM minis and mainframes.

Cost of the software on diskette starts at £125. Details on (0256) 57551.

when the computer is fitted with diskette drives, they will read IBM PC-DOS diskettes.

The price of a complete system isn't easy to work out from that information, so I've been told to quote a price of £1425 for a complete system with one five megabyte hard disk, one 329 kbytes floppy drive, and the operating software.

Bill Gates, head of Microsoft, says that his big test of whether a computer is compatible with IBM's personal computer is: 'Will it run Flight Simulator?' (a game which displays an immensely complex screen of aircraft controls and outside scenery) — and further says that the Advance 86 will, indeed, do so. He has been working closely with the designers, getting MS-DOS running properly.

At this stage of the project, details like 'How many are going to be made?' and 'When will they be available in Dixons shops?' are unanswerable. But the news is obviously worth passing on to your own dealer next time he tries to sell you an ordinary American eight-bit system with ordinary CP/M for around £2000.

Anyone going down?

You will have noticed that the price of ZX81s, Commodore VICs, Texas Instruments 99/4As and ZX Spectrums are all down.

The ZX81 has come down to £40, the Spectrum to £100 (£130 for the bigger version with 48 kbytes of memory); the VIC 20 is approx £85, and the Texas machine £100 — without the trimmings.

It's interesting to try to work out why; but before looking at that, there is something else that is even more interesting. That is: spot the odd ones out.

The obvious one, the BBC Micro, hardly need explaining. Acorn can sell every BBC Micro it can build, and Acorn's dealers are frantic to get hold of add-ons like games, joysticks, disk interfaces, second processors, or just anything at all. And when the Electron starts appearing in September, things

will not get any easier with the BBC Micro, because there are enormous differences, and because nobody who can afford the one will be satisfied with the other.

It isn't the Dragon, either.

That and the Lynx both sell in the £200 price range, and all the price-drop machines are well below that level.

No, the interesting omission is the Commodore 64.

The 64 still costs £300 in this country. Astonishingly, it costs around \$300 in America.

Once, there was a tradition that gave us lots of prices like this in the UK, but these days an imbalance as big as all that cannot last. It is a warning that it will soon change.

As things stand today, the 64 looks (on paper at least) like a computer roughly equivalent to the BBC Micro. It is £100 cheaper, but needs a special tape recorder, and has a noticeably inferior Basic which can be upgraded to something at least comparable by plugging in a special purpose cartridge.

This cartridge, Simons Basic, is spoken of very highly inside Commodore, but less so by programmers with whom I have discussed it. A matter of taste, perhaps, but in any event, not a clear advantage over the BBC Micro, and nothing like the publicity that the BBC can generate to back it, while it does make the two prices very similar.

So, expect Commodore to cut the price of the 64. When, I wouldn't like to say.

Probably around August, and possibly not by a straight price cut — something more like the VIC move.

The VIC's price cut has been engineered by supplying the special tape recorder, the 'Teach Yourself Basic' programming course, and four games, all for £140.

On the 64, anything could happen for a package deal. It might be software and tape, it might be a special disk, or it might even be a colour monitor thrown in free. Whatever it is, the effective price of a 64 will be down to £200 long before Christmas.

Now: as to why the prices fell, the answer is easy. They were too high.

The VIC has been selling for a lot less in America than the UK, for months. So has the Texas machine.



For those of you who felt ignorant and uninformed when I referred to CP/M hard disk systems for £4000 that didn't have printer or software, gaze enraptured at the Cifer Cub. It is a 'low-cost winchester-equipped micro priced at only £3395', with five megabytes.

You don't even get CP/M Plus: just a nice, ordinary version 2.2. Details on (0225) 706361.

Commodore had planned to sell 10,000 VICs per month, and the only reason the actual figure was 7000 was that the factory in Germany couldn't make them that fast, and so there wasn't any point in reducing the price, except to eat into the Spectrum market — and since Sinclair couldn't make enough Spectrums either, nobody cut any prices.

But the high UK computer prices made Japanese and American inventors look greedily at the market here. The Humdinger was just the first of many machines prepared for export to Europe; others will appear over the next few months — Panavision, Mattel Aquarius, Sord M5, and so on.

So Sinclair boss Nigel Searle was persuaded to lower the Spectrum price to discourage the importers, and VIC and Texas had to keep in step.

Then, the unforeseen factor arose, W H Smith, with 20,000 black ZX81s in its warehouse (so people say) did a little arithmetic. A Spectrum with 16 kbytes costs £99. But a ZX81 with an add-on 16k costs £80.

Panic. Cut the price of the ZX81 by £10.

Smith's own version of the story is that they decided to lower the price a week earlier than Sinclair 'so that customers could benefit over the May Day bank holiday' — an idea which struck me as absurd. The big 'Sale' signs

go up *after* the holiday, not before, as any Christmas student knows.

Behind the times

British micro builder Casu after years of near invisibility to the average UK buyer — except those inside British Telecom (who bought most of the production) — has stepped into stage centre with the daring innovation of a five-inch diskette.

Anybody who wants to explain the company's strategy, please do so.

At a time when IBM is selling a system worth £2300 for over £3000, Casu has released a system with the same chip, same operating systems, a bit more memory (and a lot more disk) for £4000 including printer.

At a time when everybody else is starting to decide which three-inch diameter diskette to use, Casu is stubbornly sticking to the eight-inch diameter standard — it has announced upgrades for all its old Z80, MP/M micros, now also available with winchester disks of 20 or 40 megabytes.

It must leave Apple, Osborne and Sirius absolutely quaking in their boots at what we clever UK computer people are going to do next. Why, Casu has sold nearly 3000 systems (since 1976), whereas by the end of this

year, IBM will be making a mere 12,000 PCs per week.

I wouldn't mind, really I wouldn't, even with the bee I have in my bonnet about wanting to see a strong British computer industry, if the people who do this sort of thing (and that includes 'quality' micro builders like Pericom, Sintrom and Rair) weren't so obviously pleased with the wizardry of their growth.

Casu sent me 28 pages of information on these poor-man's minicomputers, ending up with a three page soliloquy on the subject of their 'planned growth' from a garage in 1976, with a turnover rising to £5m last year.

In the motorbike industry, this would be phenomenal. In the computer business, comparison with another micro company that was in a garage in 1976 shows just what an opportunity we are all missing.

Just in case you didn't know from the financial press, Apple is in the Fortune 500 — the list of the 500 biggest US companies, as compiled by the magazine Fortune, each year.

It's all right for you. You don't have to go to press conferences while important executives from ICL harangue you about how IBM has got it all wrong by failing to design a multi-user micro, and how Apple has taken a very silly risk by trying to launch Lisa. I do.

Tardy Tandy

Were it not for one little detail, I would have been planning to spend \$800 as soon as I reached America for the National Computer Conference (that was at the beginning of May, in Los Angeles) on a Tandy model M100.

The M100 is a portable computer which knocks spots off the Epson HX-20. It has a similarly nice, typewriter style keyboard, is very much the same size, and weighs around the same.

But the Tandy machine (built by Japanese firm Kyocera) has a display which is almost twice the size of the Epson. And it has text processing software by Microsoft, based on that company's new

Multi Tool word processor (silly name isn't it? Nobody explained British slang to them, you see).

The \$800 system gives only 8 kbytes of memory: up to 32 kbytes can be added.

The drawback is actually one of its biggest advantages: a built-in modem. In America, this allows the computer to be plugged into a phone, to transmit text to any other computer with a standard 300 bits per second 'answer' modem. In Britain, it is so much useless silicon, because our CCITT standard modems can't understand a note that American Bell standard modems can whistle.

This idiotic lack of common standards mean that I'll just have to wait until the UK half of Tandy gets its act together with the British Telecom people, and develops, then gets approved, a UK type modem.

The processor inside this marvel is a special CMOS silicon which uses almost no power at all — but which behaves like an Intel 8085, which is a CP/M family processor. Unlike most portable computers, however, this one also has CMOS process in its memory and other chips. So it really can do a lot of work from four pen cell batteries.

And where things like Osborne, Kaypro, Compaq and so on will fit under most airline seats (but not the window seats, nor the aisle seats of DC9 type aircraft, because I've tried), this one will sit on your lap, and let you get on with your work.

I wish I thought Tandy UK would have it out before Christmas.

Expensive claims

A computer called the Kaypro II, designed to be an 'improved' version of the portable Osborne 1 but to sell for the same price, has been launched in the UK by a new company called CK Computers.

Unfortunately, the new company has neglected to take the important step of making the price in the UK the same as Osborne's UK price.

The man behind the deal is Michael Kilmartin, who was

previously famous in the business because he set up DRG as a rival to ACT, importing the Victor (which is the Sirius 1 in a different colour box) as a rival to the Sirius.

He is repeating a claim I've heard a lot in America, to the effect that the Kaypro (because it has a bigger display screen than the five-inch Osborne screen) is outselling the Osborne.

Like the Osborne, the Kaypro II is a good, standard CP/M workhorse, and I might leave it there, if the 'outsell' claim hadn't been made several times, quite publicly.

I may be biased by my fondness for the Osborne, but there are several reasons why I find this particular claim unconvincing.

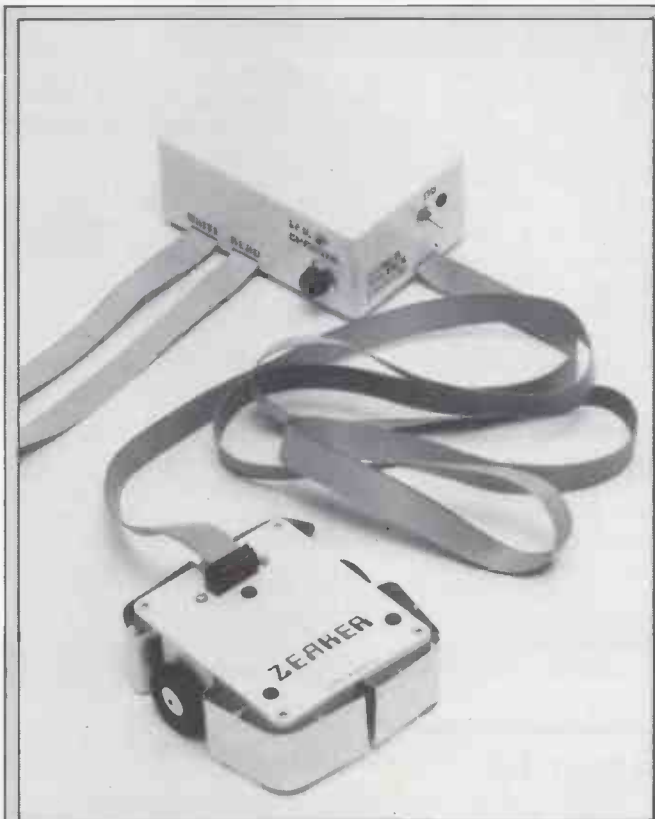
First, the maker of the Kaypro II, a company called Non-Linear Systems, is known to have been looking

for a buyer for its computer business, which is something of a sideline.

Second, a very big dealer in Los Angeles, Jade, assures me that it is doing a great deal of Kaypro business, but not more than Osborne business — despite the fact (it says) that it knows more about fixing the machine than Non-Linear Systems does.

In the words of one senior Jade executive at the recent West Coast Faire: 'The machine was designed by an outside circuit design consultant, and Non-Linear Systems has a very rudimentary idea of what can go wrong with it.'

Third, the machine carries the same Microsoft MBasic interpreter as the Osborne. According to Microsoft head, Bill Gates, information available to him doesn't appear to support the Kaypro II claim. I presume it pays

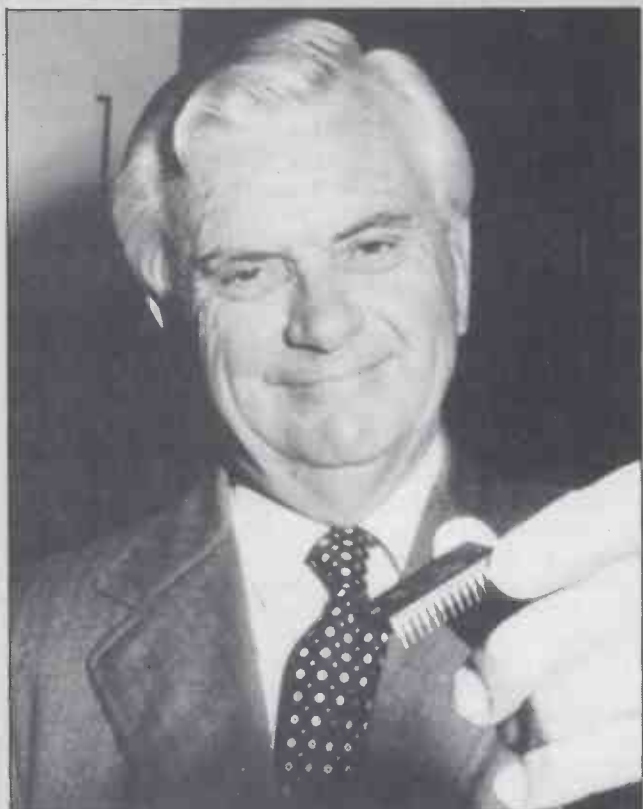


The Logo turtle, made famous by a television programme on Seymour Papert (the South African inventor of the language Logo) is a bit on the costly side for many children. And children are the prime targets of Logo as a teaching language.

Colne Roberts has released this Zeaker Micro-Turtle, at £52 (plus VAT) for the kit, or £69.50 (plus VAT) ready-built. Any computer with a bi-directional, eight-bit port (often called 'parallel') can drive it, as can the Spectrum or ZX81 (for which Colne has special interfaces).

Under it is a retractable pen; its two wheels are separately controllable, and software supplied with it will enable it to learn its way around an area, dodging obstacles. But you don't get Logo with it.

Details on 01-892 8197.



This picture of BBC TV man Kenneth Kendall was sent by Acorn to illustrate the fact that it has used his voice as the basis of its voice synthesiser chip.

This is very silly of it. Everybody who saw the BBC programme in which this chip spoke for the first time will recall that it sounded like a damaged recording of a four-foot jews-harp being buzzed by a timbermill bark-stripper, through a helicopter-mounted carbon microphone, down a faulty telephone line.

Even the programme presenter, Mike McNaught Davis, proudly and triumphantly asked by his assistant to guess whose voice it was, could not be persuaded to agree that it sounded human, never mind like Kenneth Kendall. Maybe it was meant to be his voice after getting the illustrated chip stuck in his throat.

him the correct royalties.

All of which is, perhaps, quite irrelevant compared to the fact that the machine seems nice, has a clear display, a good keyboard, and is portable with a good bundle of software including Perfect Writer, Filer, Calc, Speller and others.

Integrity

Long ago, when I was a little lad, and wanted my mother to buy a book which we couldn't afford, she took me to the local public library and suggested I borrow the thing for as long as it took to read.

My puritan nature was revolted. If everybody could get books from libraries without paying, what would happen to the book shops? And without bookshops, what would happen to books? Was the magic world of reading

going to collapse overnight?

When I grew up and started working in the publishing world (I'm sorry, the nostalgia has to go on, just a little more), I found myself either working for 'controlled circulation' papers which were given away free, and paid for by advertising, or on high quality newspapers, which were only partly paid for by advertising.

And whenever I went to interview a software producer, he would always have ready for me a file of useful information about his company, including Xerox copies of press reports. On his desk would be a single copy of at least one newspaper like *Electronics Weekly* or *Microscope* or *The Economist*, and attached to that newspaper would be a piece of paper with ten or twenty names on it. People who had read it would cross

their names off, and pass it on.

Some of these software producers sell complex programs, like database managers. Some of them are good, some of them are too clever for me, and some of them are useless to man or beast — though there is no way of finding this out until you've used them for a week or two, filled them with information, and found that it won't come out again.

One such producer of software, a very good friend indeed, recently accused a local bunch of children of 'stealing' software because the five of them clubbed their pocket money together to buy a program they couldn't otherwise afford.

This man is perfectly rational. He would never dream of trying to close down public libraries in order to boost authors' fees, nor would he imagine that closing down libraries would have any such effect. Yet he is firmly convinced that if he can only find a way to make software uncopyable, everybody who 'steals' software will instantly go into the nearest shop and buy the programs they have borrowed.

His latest idea is to make sure that every computer has a serial number, and that software sold to me will only run on my computer. This would prevent me from lending it to my friends.

Quite apart from the problem of what happens

when (in two years' time) we are all on local networks getting our software from the central disk, and linking our networks (in five years' time) to each other via 64000 bits per second data lines, I can think of only one program that would have been sold in large numbers if only one person could use it, and that is VisiCalc.

And all the best-selling programs I know are *completely* copyable. Yes, there are three copies in existence for every one sold, but there are three times as many sold as the rival program can claim.

There is a lesson to be learned there. It has to do with 'pigs in pokes' and it has to do with advertising by word of mouth. But you need not expect to see the lesson learned by most software producers — they are too close to the problem.

My good friend was once reduced to an almost frothing rage by my careless mention of the fact that one of his programs could be easily duplicated by following the instructions in his manual. I didn't even repeat the instructions.

I have even sold copies of his program by lending it to friends (copies, of course) to try out. He actually tells a lovely story of a programmer who wanted him to publish a program and insisted on having a binding contract that it would be published before



The reason the word 'easy' is displayed in two-inch high letters is that the operator is partly blind. The ViewScan system uses the Epson micro and a little camera to expand the word from paper, or from the computer.

It isn't a giveaway but there is a special £500 discount to mark the launch of the computer based system.

Details on (0602) 814673.



Looking like a glass elbow over a map, the Versawriter connects to the IBM micro as a way of feeding drawings into the computer memory. It costs £200, and is available from Pete & Pam on (0706) 212321.

even saying what sort of program it was. He actually gives away a very useful version of one of his programs, in the hope that you may like it enough to come back and buy the full version.

But talk about software libraries, and you will have to survive without his excellent companionship for weeks.

In general, I have learned that you should not expect sense from a smoker about health, or logic from the IBA about contraception, or a warm welcome from Digital Equipment if you're a friend of mine.

It is a year since ex-software publisher Julian Allason told an excited world that tape duplicating 'has destroyed the computer games software business' rather than admit that his Petsoft programs were all out of date — and yet games software writers, even of totally copyable Spectrum tapes, are earning £35,000 at the age of 17 and getting invited to dinner with Margaret Thatcher.

These are facts.

But don't discuss them with software publishers. They won't understand.

Fruitful promises

The UK importer of the Sirius, ACT, has announced that it is building a new design of personal business computer.

The announcement came in the course of a financial deal which raised £6 million to pay for the development of the computer. It will be called the Apricot, will be broadly compatible with the IBM Personal Computer — but portable and more powerful — and is promised for this year.

Actually, the question of when it will be available is a matter of guesswork. In May, ACT executives admitted that they didn't yet know of working prototypes, but still said they would let software houses start work on 'pre-production models'. That began in June.

I don't doubt their sincerity, but I do doubt their judgement. I've seen more experienced hardware designers than ACT take more than a year from where they are now to the point where people could walk into shops and buy computers.

Look for your first Apricots in January.

Narcissistic tendencies

It is an old rule that when people tell you how amazingly cheap a system is, but don't actually quote a price, you can be sure it isn't cheap.

In the case of the Dutch Tulip micro, a beautiful yellow-coloured IBM-like system with the more powerful 8086 and 8087 (arithmetic) processors, knowing the price might be a letdown. It would

have to match up to this: 'For it is CompuData which has developed the Fourth Generation Microcomputer, going by the striking name of Tulip System I. Its introduction worldwide was carefully prepared to ensure maximum impact: with the advent of the Tulip System I, the fastest genuine 16-bit microcomputer is a fact.'

After that low-key, modest introduction, the style of the announcement warms up a bit, mentioning a 'truly unparalleled combination of advanced technological features', and climaxing triumphantly with 'The know-how that CompuData has gathered, and which many companies view with awe, constitutes the basis on which the future of CompuData, its dealers, and the European micro electronic industry will be built.'

The technical data sheet, which accompanied this awesome megalith of technological buzz-wordery, went on to detail a perfectly ordinary micro running perfectly ordinary programs like WordStar, SpellStar, dBase II, Multiplan and MailMerge (all optional).

Anyone who is interested, says CompuData, can obtain more information from them on 073-422045. I'm fairly sure I didn't get this one on April 1st.

The knowledge

Spend five minutes trying to explain local area networks to a taxi driver one day, and you will learn two things.

One, you cannot explain them to anybody who doesn't know what computers, disks, storage, printers, files, displays and data rates are already. And two, what you are trying to do is actually easier than installing one.

The news that American firm 3Com has successfully persuaded 25 retail stores to stock its line of EtherSeries add-ons for the IBM PC, shows what a lot that company has achieved in its short life.

It is easy enough to persuade a manager, who has ten colleagues, all wanting a three megabyte hard disk at around £800 each, that he really wants one 80 megabyte drive at £2500 and a few network connections. It is



This happy family photograph shows Epson distributors. The man to look out for is called Carl Tayfour, head of Informex — one of 11 Epson distributors dropped just before this meeting. (He isn't in the picture).

Epson's larger-than-life sales manager, John Patterson, explained the dropping of the eleven with the tactful comment: 'Let's be honest, we want distributors who are going to commit to us in the long term, and not just make a fast buck at someone else's expense.'

Epson subsequently let it be known it was taking legal action to get £100,000 which, it claims, Informex owes them.

I think Tayfour may have taken this somewhat to heart. He was last seen talking to lawyers about £500,000 he reckons Epson owes his company. 'We were one of its' biggest distributors. We made it what it is today in the UK,' he told the trade paper Microscope recently.

You see; now that the hardware side of this business is getting to be all boring old IBM look-alikes, the trade side is getting to be more fun than ever.

quite another to get him to buy the network.

The 3Com trick is a little box, with an IBM PC plug-in card, and a length of coax cable — TV cable by appearances. In the box are full instructions — the card costs £700 or so — and you can do it yourself.

Just in case the prices look a little too close, they also have a lovely range of networked software. There is Ethermail, where all the users in the artwork club can swap memos instantly, and there is a networking game, Etherman (no, nothing like Pac-man) and lots of other useful and envy-producing things.

Details on (415) 961 9602.

Autocode

Programmers who find it easy to write programs with dBase II or Cobol will probably dismiss Autocode as the sort of thing for weaklings who are afraid of cold baths.

It does most of the hard work of converting untrained

ideas into dBase II specifications and commands, or Cobol statements, and it costs £220.

Its inventors, working for a company called Stemmos, say it's the most powerful software of its kind — that kind being program generators — in the world. I suspect them of bias, but they claim 2000-plus customers, so far, and are reckoning to sell another 10,000 copies by the end of the year. So maybe the bias is justified.

Details on 01-740 9444.

Well researched homework

One side effect of the success of the BBC micro (over 100,000 sold in May) has been the growth of people using them in classroom networks. Most use the Acorn Econet, since it comes virtually built into the computer.

Now a way of linking Z80 based micros into Econets has

been launched by S J Research (of Cambridge, where else?) starting with the Research Machines 380Z — also used in many schools.

The most obvious use of the interface is to share 380Z disks. Typically, schools have only one 380Z but with reasonably large disks, whereas the more numerous BBC's disks are still more like hen's teeth than computer peripherals.

Price for software and hardware to do this is £500: to connect a Z80 system to an Acorn network, however, is rather cheaper at £153 (VAT extra).

Details on (0223) 69927.

Crossword Magic solutions

For all the crossword fanatics who read June *PCW*, here are the answers to the puzzle printed as part of the Crossword Magic Checkout (page 198).

Across	Down
1. Silent	1. Sun
8. Orbit	2. Lid
9. Lead	3. Nefarious
10. Own	4. Traitor
11. Be	5. Pi
13. Sagacious	6. Oak
15. Strap	7. Constant
16. Obligatory	9. Lease
18. Me	12. Oxo
19. Ant	14. Capital
22. Intent	17. Bumblebee
24. Tab	20. Reason
26. Story	21. Ko
28. Onus	23. Nun
29. Pseudo	25. Bap
32. Insane	27. Rip
34. Per	30. Or
37. Necromancer	31. Sensible
	33. Norm
39. Vile	34. Present
40. Egg	35. Broken
41. Ebullient	36. Best
43. Blessing	38. Mint
44. Tern	39. Vicious
45. Scene	42. Line
47. Use	46. No
48. Enter	

Catch 22

You have got the program running on your BBC micro, and you want to send it in to us. So you SAVE it on tape, and then you read our

instructions, which clearly state that we want a direct printout. But you can't afford the printer until we publish your program!

What you need is a friend with a BBC and a printer. Failing that, try Beebprint, a company in West Sussex set up by enthusiast Bob Sampson, who has a printer, and will charge you £2 or so per program up to 32 blocks long. He will even do a screen dump of whatever part of the program you want to have printed for 50p extra (if you include a line saying VDU2:CALL & DOO:VDU3 at the appropriate point).

Details on (0273) 833397.

Showtime

Last month we gave everyone the tiniest peek at what will be in store at the 6th *PCW* Show. For those who haven't yet heard, the Show is from 28 September to 2 October, but members of the public should remember that the first day is a trade day — nobody outside the computer business will be admitted — but there are still four other days to choose from...

Last year the Scrabble contest was run using just the Apple II. This year games mogul John Baldachin of Little Genius will be presenting the Scrabble program on the Spectrum, T199/4A and one other micro — so you can choose your favourite.

Entering the contest will be much like last year — you go along, fill in a card and wait to play. The four prizes will be presented at the end of the last day. All winners will receive a Chambers' Dictionary and the first three prize winners will also be awarded a different computer each — we don't know what they are yet because it's a secret.

It's quite a challenge, though — last year the computer was, in score terms, the undisputed winner, with 503 points. Bearing in mind that competitors will only have two minutes to move, this is pretty hard to beat. Dealers in the Show will be selling the program, which is not available from the Scrabble feature itself.

Regular readers of Tony Harrington's Chess column will no doubt be looking forward to the Chess tournament.



Take a 16-bit processor, 80k RAM (32k user) standard and expandable to 512k, a 3in 320k (formatted) Hitachi drive, built-in 66 col x 8 line LCD display, touch-sensitive 'mouse' plate, integral modem, two operating systems, MBasic and a selection of software in ROM capsules — all as standard in a machine expected to retail at around £3000. Add a 50cps letter-quality thermal-ribbon printer at £700 and a second disk drive at around £500. Now picture the whole system, including printer and single drive, weighing less than 15lbs, running on rechargeable batteries and fitting comfortably into a standard sized briefcase. You've got a Gavilan 'Mobile Computer', available in Britain from October (says Gavilan). The software is IBM compatible and is available in five languages to match the six different keyboards available. Dealers haven't been appointed as yet, but the number to ring for information is 01-353 8807.

Surya

Business Computers you can afford.



At last here's a range of true business computers at realistic prices. Sanyo desk top micros give you a choice of 8-bit, 64K RAM or 16-bit 128K RAM, expandable up to 512K. Sanyo's reputation for quality products, thoroughly pre-tested for reliability, is backed up by Logitek's experience and service.

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Logitek are the top distributor for Altos micros, and Peachtree software and the new Landmark multi-processor

micro complete the range with full compatibility of operating systems and applications software.

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Dealers - contact your Fox & Geller distributor for more details:

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QUICKCODE, dGRAPH, dUTIL and autoGRAPH are trademarks of Fox & Geller. dBASE II is a trademark of Ashton-Tate.



This will be the 4th European Microcomputer Chess Championship.

Many of last year's exhibitors will again be taking part, among them ACT, Acorn, Pete and Pam Computers, Peachtree Software, Sinclair, Atari, DEC, Computers, Microwriter and Sharp. New exhibitors will include Oric Products, Psion, Mattel (probably exhibiting its micro, the Aquarius) Micronet 800, and several more new and hitherto unheard-of companies who will no doubt be displaying interesting software, add ons, books and all known paraphernalia for your micro or the one you might just buy at the Show.

Don't forget that we've only listed a minority of the exhibitors — there will be many more to see. All in all, it looks like visitors to the PCW Show will find just about anything they could want for whatever micro they may have. See you there (if we're not hiding in the lounge again) . . .

Micronode launch

The UK office systems company Xionics has announced Micronode, a network of local area networks (LANs). Each Micronode processor can support between two and eight users sharing winchester, floppy and printer, the maximum number of linked Micronodes being unlimited for all practical purposes.

The LAN is via Xionics' own Xinet, and Micronodes are linked to each other by a public switched telephone network (PSTN). The main selling point of the system is the library of communication protocols which will enable it to talk to other machines including IBM, ICL and DEC mainframes, Viewdata and Telex Message Switches, together with selected word processors and micros. The IBM PC is scheduled to be the first. These protocols will allow a Micronode workstation to emulate whatever it happens to be plugged into — be it a humble word processor or an IBM mainframe.

The operating system that achieves these minor miracles is being kept a closely-guarded secret, and managing director

Mike Bevan wouldn't so much as tell me the name of his OS. The company will, we are assured, be making an announcement 'shortly'.

An entry level system costs under £10,000, for which you get a Micronode, software and two workstations. Details on 01-636 0105.

Surya

Golden opportunities

On 22 March, 1982, Telecom Gold was launched to market British Telecom's Dialcom Electronic Mail Service.

Telecom Gold — now in its second year — has become firmly and successfully established with some 175 client accounts, who together constitute a user population in excess of 2500 mailboxes.

The success of Telecom Gold to-date has been based primarily on the Mail service, the store-and-retrieve mailbox capability. This however, is only one of a number of services offered by Telecom Gold through its London-based computer timesharing service.

The Dialcom Electronic Mail software extends, in fact, to cover products for calendar/diary scheduling; notice/bulletin board; database management systems; phone messaging; forms design and processing and across user 'chat' facilities.

Most significant has been the development of software providing interworking capability from Mail to such British Telecom services as Telex, Telemessage and Radiopaging. All these interworking products are currently completing their trials and final market tests. Early commercial release of these additional interworking products is planned.

For further information, contact: Sales Administration, Telecom Gold Ltd, 42 Weston Street, London SE1, tel 01-403 6777.

Dragonalia

Come August those McCaffrey Dragon freaks among you will be able to buy a game of the Dragon civilization of Pern to play on your home computer.



Transtec Computers has just announced its new range of micros: the Krypton series. The standard micro is a 64k, Z80-based, CP/M machine with a memory-mapped 80-column display, user-definable characters and 17 fully programmable function keys. Options include CP/M Plus and USCD-p operating systems, floppy and hard disks and a choice of either a 128k or 256k RAM disk. The operating software supplied with the RAM disk is CP/M transparent and the disk is accessed as drive E. As an indication of its speed, MBasic loads in approximately 0.5 seconds. This, says Transtec, makes it ideal for storing overlay files, where the time taken to access floppies can be extremely irritating. The availability of Telemaintenance, a remote hardware and software diagnostics facility using an acoustic coupler, is being heavily stressed by the company. The basic machine costs £1695, and the RAM disk is £325 for 128k and £450 for 256k. Details on Dublin (0001) 718521.

Surya

Anne McCaffrey has just given games manufacturer Epyx the licence to market a game incorporating the two-stomached, firestone-eating, phosphane-breathing dragons. It will run on machines from Apple, Atari, Commodore, IBM and Tandy, and will cost \$29 or the UK equivalent.

The game is set on the feudal planet Pern, where the dragons and their human riders live, and which is subject to invasion by worm-hatching spores.

Anne admits that she doesn't have a world monopoly on dragons, only on firestone-eating, phosphane-breathing ones. She is extremely circumspect about to whom she grants licences, and the Epyx deal follows unsuccessful attempts to sign her dragons up by Atari and other games manufacturers. She feels very personally attached to her dragons and won't authorise any games which aren't in the true spirit of the Pern civilisation.

Ten million of Anne's Dragon books have now been sold. She awoke one morning

at a convention in Baltimore, Maryland and discovered she was a cult figure. People at the convention were singing dragon songs and wearing dragon costumes. Now there is a whole subculture of 'dragonalia'.

Anne has just finished a new dragon story 'Moreta, Dragon Lady of Pern', scheduled for launch in October.

Jane Bird



I would like to address this convention on: 'Anne McCaffrey, Myth or Legend?'



PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Len Warner (see 'Computer Answers' page). Address letters to: 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

What's in a name, sir?

Dear World,
I address you, as such as your editor, or at least the individual responsible for the letters page, seems to have taken to (very rudely) addressing correspondents solely by their surnames. While I appreciate that there are probably a lot of wallies who write to you, surely it is not too much to be polite to your correspondents if you are going to publish their letters and your replies? I have to say that I have detected more than a little arrogance and 'in-crowd' attitude creeping into your magazine of late. At risk of being thought over sensitive, may I suggest that this will probably not do very much for your circulation figures?

Yours faithfully
**Dr J B Brooke (or to you, my boy, Brooke),
Nottingham**

Humblest apologies! Grovel, grovel — Ed.

Bad example

Your office pedant, Steve Mann, done it on purpose, didn't he? You know, wot he wroat about us illiterates. (If in doubt GOTO page 183, May 1983 *PCW*.) It were good on him to rush to the defence of...

Excuse me, does the 'its' refer to the English language, the losing battle or the computer industry?

Let me rush over the five (or is it six?) cliches in the first paragraph because I see in the middle column 'at most, a couple of sheets or a cassette insert'. If the 'couple of sheets' is 'at most' can the 'cassette insert' also be at most? Isn't the one more 'at most' than the other?

Yes again my attention is

distracted by 'riddled with errors'. What a lovely picture — or perhaps 'riddle' here is not rhyming slang for 'leak'. I must consult the dictionary. *Riddle = question, etc, designed to test ingenuity.* It is doing that. *Riddle = coarse sieve; to sift.* Neither of those seems to fit. What's this? *Filled with holes.* That's better — he's talking about punched cards. No, wait a minute — *filled with faults.* So the document is filled with faults, with errors. (My dictionary has an entry for 'riddling', that is, puzzling: that's no lie.)

We are told that 'children can only learn by example'. Quick, someone, and tell the government that all this money they are spending on computers is not needed — we have the authority of *PCW* for that.

'This is the case...'; 'this is not the case...'; 'in most cases...': we have enough cases to overload a forklift truck or a court calendar. 'True' or 'false' gives that 'clarity of meaning' (tautology) that is 'the one factor of prime importance' (tautology again) that Mr Mann seeks.

I have lost count of the number of cliches and of that unpardonable offence, the ambiguous pronoun, seen in the sub-title and near the end where an 'it' is parted from its noun by fourteen words.

At first I thought Mr Mann was showing us by example what happens to a pedant compelled to read too many 'computer-related products'. (Those are the black lines on the coffee jar, I suppose.) Then I read the next article.

'Shirt Pocket Casio' sounded more intimate than user-friendly. 'At the top end of the portable computer' was as far as I read before I was attracted to the heading 'Documentation'. In that I read '... the normal flimsy affair...' is '... quite complete'. Is it complete or not? Mr Pountain presumably compared the

Japanese and English texts to be able to justify his 'better translated' accolade but what does he mean by 'translated on average'?

Is the 'sizeable pocket book' measured in metres or inches?

'It (presumably the small program library at the end) is quite readable' which is more than I can say for Mr Pountain's review. Then, as if he has been hypnotised by the manual (or paperback or program library), he writes '... is slightly stilted in prose style'.

Several of your contributors complain, with justification, about the quality of paperware supplied with hardware and software. A higher editorial standard in *PCW* might educate the industry. RIRO (or do you prefer GIGO?) applies to writers as much as to computers. Mr Mann's comments about the education of children are more pertinent to the industry than to schools. In theory schools have teachers to correct mistakes.

**H J M Langshaw BSc MIS-TC, Technical Author,
Dartford, Kent**

Oversight

I started reading with interest Mike Liardet's article on Microsoft's Multiplan (*PCW* April 1983) and was greatly surprised to find that there was no mention of one of the very first micros to adopt Multiplan, the Olivetti M20 (although using a different operating system). This is even more surprising when one recalls the fact that the M20 passed *PCW*'s benchmark tests with flying colours — evidence of this was produced by the *PCW* benchmarks' summary in the December issue, when the Olivetti M20 was top of the list out of 63 machines tested.

The M20 is also conspicuous in the absence of any reference to it, except when British Olivetti or an indepen-

dent dealer decides to place an advertisement in your otherwise very informative magazine. I wonder why!
Brian J Darmanin, Sliema, Malta.

*No discrimination intended here — although the M20 is enjoying a big ride on the back of the *PCW* benchmarks — Ed.*

Universal disappointment

I sympathise with B Kemp's letter 'Bad bugs bite back' (May 1983) concerning the trials and tribulations of Bug-Byte's 'Space-Warp'. I have this tape and am bitterly disappointed.

The graphics are almost non-existent; the space craft on the cover only appearing as a file at the end of the tape.

The space craft tends to fly wherever it wants, especially when flying at warp speeds.

Your score only appears on your destruction, a rare occurrence due to the limited number of foes. It can be very frustrating, flying about an empty universe! B Kemp should think himself lucky that he never received a working copy.

**Andrew Hardy, Bingley,
West Yorkshire**

Useful tip

I recently ordered the language 'Lisp' from Acornsoft for my BBC Model A. When it finally arrived I was most disappointed to find out that it apparently did not work. Upon further investigation I discovered that if the interpreter is loaded into a Model A machine, the text window set by the usual Acornsoft header page is not reset, and so, although the interpreter is working, the text window is so small as to disguise this fact.

The solution I employed was to alter line 120 on the second Lisp program to:
 120 PROC oscli ("LOAD IMAGE" + STR\$ — (imbot % *&100)):IF HIMEM< &7C00 THEN mode % = 7:GOTO 150.

I hope that this will be of some use to your readers.
G Philip, Bangor, Gwynedd

Reader's digest

We were interested to see the use of biotechnology in computing. In fact HCCS Associates (*PCW* April 1983, page 317) seems to have a really 'gutsy' machine with its 'Colon Genie'.

DCE Kennils, Biology Laboratory, Old Swan Technical College, Liverpool

TRS-80 forum

I have a TRS-80 colour and DMP 100 printer to which (all being well) I will add disk drives by the end of this year.

I am very pleased with the system and unlike your unfortunate reader Mr H J Leckie in the May 1983 issue, I am very satisfied with the service that I receive from my local branch here in Brussels. If I ask for something not in stock I normally have it within five to seven days. One example was that I asked for the printer on a Thursday evening around 6.30pm and I took delivery on the Saturday. The only thing it has fallen down on is getting me an assembler/editor pack as there are none in Belgium at the moment.

The thing that I find strange is that I have not seen any programs in your program section for the TRS-80 colour. No, I am not mistaken; I have just completed checking all the issues I have, so the question arises 'why?', as I find it a reasonably versatile low cost system which I use in numerous ways for my personal entertainment and self-education of programing as well as the primary function my business needs for reports, files, etc. Admittedly the process is a bit slow at the moment without disks, but it is certainly not stopping me.

I would be interested in hearing from other TRS-80 colour owners as I get the impression that it is a system

being left out in the cold in favour of bigger names such as Apple, ZX81, BBC micro etc.

I would also be interested in your comments as a leading computer publication.
W J Brown, Brussels.

See page 231 The Domain of the Djinn, but why don't you send PCW some TRS-80 programs? — Ed.

Future plans

Now that the Spectrum has come down in price, is Sinclair planning to launch another colour moving-keyboard computer? Could it possibly be a 16-bit IBM compatible? If so, my wallet is ready. Can you please find out?

CC Kuan, London

Over to you Sinclair — Ed

Tandy feedback

Mr Leckie (May 1983) asked if his problems with getting spares for a Tandy computer are normal. I have been in charge of a lot of Tandy computers which take a battering at the hands of school children and I have a love-hate relationship with Tandy. The good part is that if you have a serious problem, you know that Tandy will fix it quickly and at a reasonable cost. If it is an obscure fault that is difficult to find, then it seems to replace the whole motherboard for a reasonable price and save the expensive labour costs. Even one that went up in smoke, after the best part of a glass of coke had gone inside, came back the following week with an affordable bill. On the other hand the company charges the earth to fit a lower/case chip which costs a few pounds from an independent supplier, and its official memory expansion is based on the times when chips cost four times as much as at present.

Tandy seems to fall over backwards to protect its customers from themselves, and this is the root cause of its disclaimer on CPUs that have been opened by the user. It is also true that the UK company is out of step with the

USA head office. Parts that are not available over here can be obtained from the USA by return of post.

So, Mr Leckie, you can at least thank your lucky stars that you have a TRS-80 and that Tandy only lost your letter. I sent a BBC computer back and it lost the computer for weeks.

Derek Tomkins, Maidstone, Kent

Epson praise

Late last year after reading various reviews including one in *PCW*, I bought the Epson HX-20. I was very pleased with it and after writing the two programs which I wanted for the computer, I awaited eagerly the Epson programs and interface to a TV. (I remembered that the programming instructions in the manual mentioned various instructions to a TV monitor.)

As far as I can see, and having discussed the matter with Epson, the TV interface is nothing more than a figment of the company's imagination. I think the advertising authorities should be made aware of Epson's practice of advertising items which simply do not exist.

While waiting for the Epson programs, namely, 'Correspondent' and 'ECalc', I tested a program called 'Intext'. This is a text editor from Talbot Offset in Bournemouth. Unfortunately, I obtained an early version of this program and on using it with the expansion memory of the computer it caused all sorts of problems. I found that I could not even re-set the computer at one point and had to disconnect the battery to regain control of the computer. It also used only twenty columns of the Epson screen which made tabulating columns of figures very difficult. Also controls could be inserted to underline and centre, but I found these extremely difficult to use.

The program also had a welcome feature enabling the width and length of the paper to be set.

Having recently contacted Talbot Offset I was assured that the newer version of the program has been improved and that the controls are easier, but I have yet to try them.

At last I have obtained ECalc and Correspondent 20. These programs, I think, must rate as the biggest insult to the Epson name.

ECalc is a program written in Basic which endeavours to emulate VisiCalc. It is so slow as to be almost unusable. Its other faults are that the user has to be extremely careful as there is no way one can retract a miskey to an option. It is also sadly missing the feature @SUM [. . .]. In ECalc to obtain a list of additions into a cell one must define all the other cells. The program did request the printer controls, but only a maximum of eighty columns, thus not using the feature on some printers to print in excess of eighty columns. A page selected in excess of eighty columns is wrapped around, thus making reading difficult. However, as the program is written in Basic, it is very easy to correct this deficiency.

Going back to the matter of time taken on replication or recalculation: to copy the formula A4=A1+A2+A3 to columns B and C takes over a minute and in serious use replication can take between five and ten minutes! This makes nonsense of using a computer to do work which can be done faster by hand. Even though the Epson is smaller than say the PET or Apple, the capacity is almost the same with the expansion memory fitted and thus I can only attribute these deficiencies to a badly written program. (I appreciate that tape storage is slower than disk.)

Regarding Correspondent 20, this is the Epson text editor which uses a page, sixty lines by sixty columns. The screen operates similarly to a piece of paper in a typewriter. A bleep sound is heard indicating that the end of a line is approaching and the operator has to make the necessary adjustments to the text. The result is that while editing the text, all the adjustments previously made are non effective and then every line has to be checked, correcting where the words are split or where unwanted paragraphs have occurred because a sentence has been lengthened. If editing is this difficult, it could be advisable to use a portable typewriter

like the Brother. There is no centering or underlining facility and neither is there any right justification.

The version I had was on a ROM cartridge and, as the control to the RS232 was fixed, only by altering the program each time could I make my printer operate.

A pleasant feature of the Correspondent 20 is the way the keys are used to search and move within the screen, a directory is created at the beginning of the microcassette and all the filing of the texts is carried out automatically by the program. Unfortunately even this has a draw back in that the tape duly initialised with the directory must be inserted before even a letter entered into memory can be printed; if this is not done the text is lost.

All in all Epson has a good product but with little decent software to use its potential. I suppose I'll just have to wait for other people to write sensible and well thought out programs which work.

J G Feingold, Salford, Lancs

For more comments on ECalc see Mike Liardet's review on page 164 — Ed.

Short supply

I am writing to bring to the attention of your readers the current situation regarding the supply of software for my machine the Acorn Atom.

I ordered the cassettes advertised for Forth and Forth utilities from Acornsoft on 19 November, 1982. Here I am six months on, and no sign of the order being fulfilled. My letters to Acornsoft are answered promptly, but they always say the same thing that they are waiting for supplies.

Thinking that Acorn dealers would be able to help, I found on contacting several that there is a widespread problem in obtaining software and hardware, particularly hardware peripherals for the BBC machine.

My experience of this situation in other walks of life usually indicates that a company that cannot meet demand, and is unable to make improvements is in financial difficulty.

It occurs to me that as the

Atom is likely to be phased out, it may be deliberate policy to neglect software to encourage Atom owners to buy BBC machines.

It would be helpful to readers if you could get a statement from Acorn on its policy on software for past, current, and future machines. In my opinion, the companies that will survive in this business will be the ones who demonstrate their continuing support for their customers.
John Ferguson, Chelmsford, Essex

What's the score then Acorn? — Ed.

Communicating by sound

As originator (and now managing director) of Head-Line Communication — the company responsible for the 'Sound Training' packs, I was naturally very interested in the Steve Harris feature 'Learning by Ear' (May 1983).

But before commenting on your review of our 'WordStar' Sound Training product, I would like to clear up a possible misunderstanding. The retail cost of the Sound Training pack is not £23 as you reported but £33.50 plus VAT. All Sound Training products are in fact available from sole distributors, Newtech Publishing, 8 Camp Road, Farnborough, Hants.

So much for the 'commercial'. In the cause of making some interesting and often valid observations, your review suggests that our selection of 'help level zero' is too low and that it should have been possibly pitched at 'help level three' which would be rather more practical. While taking the point, I still believe that selecting 'zero' is correct for our planned training approach. I would, however, like to point out that the Sound Training pack which you kindly reviewed was, in fact, an 'original proof package'. Since then, the product has been considerably revamped and hopefully most of the comments of both reviewers and early users have been taken into consideration and amendments made.

The sales success of the Sound Training approach cer-

tainly confirms our basic belief that the interactive training method is not only different from all others, but is one which is increasingly meeting the needs of the first time or inexperienced user.

Hopefully PCW will be prepared to 'plug in your tape recorder, sit back and listen' to our latest product, the Sound Training 'MailMerge' pack. Here, I hope you will agree we have taken a rather imaginative approach to what is a somewhat complex and often intangible software product.

As Maggie Burton comments in the same issue, 'Audio courses are an easier option than reading a book', or as we would add, following the manual.

John Campbell, Managing Director, Head-Line Communication, Hereford

Legal defence

I was amazed to read the letter from Brian Hurley (Communications May 1983) where he goes on at great length about copyright infringement and the rights and wrongs of copying programs, then he admits to having no legal background, and no connection with the authors of the book in question. It seems quite obvious that he has no connection with the Sharp MZ-80K either, because some of the tips which prompted his irate letter simply do not do what they were intended to do — as Anthony Newgrosh got some of his addresses wrong. Surely if one is going to make such a stand for what is right, one should at least have a little knowledge on the subject to start with. Does Mr Hurley actually own an MZ-80K, or indeed any micro, or is he just one more person wanting to jump on the software piracy bandwagon.

If Mr Hurley really wants to know about software piracy, I'll show him how to get a listing of a commercially integrated accounts package in MBasic which would cost anything up to a thousand pounds; or how to make as many copies as he wants of those commercial MZ-80K tapes.

My point being that anyone can find out such tricks of the trade, but that doesn't mean

we are out to make money by copying other people's software. I say 'good luck' to the Anthony Newgroshs of the world; at least they get pleasure from their micros.

The information regarding PEEKs and POKEs on the MZ-80K can be found in numerous computer magazines dating back to the day the machine was first put on the market; or as your reply rightly pointed out by simple experimentation.

Come on Mr Hurley, stick to enjoying computing and leave legal matters to legal minds.

Peter Paton, Burnley, Lancs

PS... Computer jargon definition: Endless loop = an argument about software copyright.

Arcadian delights

Steve Mann expressed in 'Screenplay' (PCW May 1983) his disbelief that anybody could reach level 53 on 'Arcadia'. I would like to report that I have reached level 173, gaining a score of 199,292, with only five ships provided initially. I would also like to report the first recorded case of what I am sure will soon be a common complaint 'Arcadian wrist'.

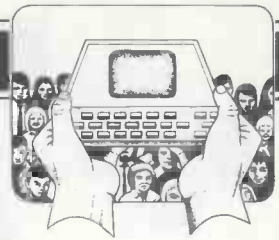
One point not explained by 'Imagine' in the documentation for the game, is the names of the various species of 'Atarian' attackers. To remedy this I would like to suggest the following names, which are now in common usage in this household. They are, in order of levels (level one first): Arrows, Bow-Ties, Round-Shouldered, Dancing Hurtles, Walking Sticks, Birds, Boxes, Eiffel Towers, Flower Pots, Octopuses, Singing Blacks, Boomerangs and Balloons.

Finally, I would just like to say what excellent value 'Arcadia' is; I would recommend it to anybody owning a Spectrum.

Ivan Mactaggart, Yeovil, Somerset



From its humble origins CTUK — Thanet has grown into a thriving success. Peter Kiff, its organiser, gives a synopsis of how and where it all began.



CTUK — bringing computer literacy to the whole community. It was only when we sat down and considered that aim that we realised what an enormous job it would be. We would surely fall short of our objective. Besides, we asked ourselves, what exactly was meant by computer literacy? Did it mean learning to program computers? Did it mean learning how computers work? Or was it rather finding out about the role of the computer in our fast-changing society? Probably it involved all of these and many more aspects beside. Then again, did the whole community want to be made computer literate? Would it not be possible for other organisations with more money, time and expertise than us to do the job more efficiently?

It was with some feelings of trepidation but lots of enthusiasm that we expressed our wish through the CTUK page of PCW to form CTUK — Thanet serving the island and its seaside towns of Margate, Ramsgate and Broadstairs. We received a few letters expressing interest in reply, not exactly an overwhelming response, but one was just what we were looking for. The local area librarian had spotted our announcement and had decided that computer literacy had a place in Thanet's libraries. Thus began a very fruitful partnership in which we have had every encouragement and lots of friendly co-operation from the library staff.

It was decided that we would hold meetings every Friday evening in Broadstairs Library, which is a fairly central venue for the Thanet community. We had the choice of

using the large entrance foyer or an upstairs exhibition room and decided upon the former, since this would mean that everyone entering or leaving the library had to walk past our computers.

Soon we had a group of people who were expressing an identifiable need, and posing questions such as: How can the computer help my business? How can the computer help my child's education? What can the computer do for me now that I'm retired? They wanted to learn more. At that time no adult education classes were available locally in either computer appreciation or programming. We realised that we had to run our own.

We began a ten week course in Basic; we kept it simple, we moved forward slowly, we always tried to link programming concepts with wider computer applications. We were helped once more by the library staff who provided another room for our courses while our other CTUK activities continued in the foyer.

We continued in this manner for the first 18 months of our operation. Towards the end of this period we realised that there was a need to change our mode of operation. Things were moving swiftly in the world of microcomputers. High Street stores were beginning to stock the machines; the merely curious could drop into the shops on a Saturday morning in between buying the groceries and ordering a lunchtime pint. The local Adult Education Centre began running programming courses. We found that our Friday evening sessions were being attended by the same people each week — mainly



'Computers in Education' day at Broadstairs' Library

youngsters who regarded our set-up as a club. It was always a pleasant beginning to the weekend but not what we had set out to do.

We mulled the problem over and discussed possibilities with the librarian. Eventually we decided, somewhat reluctantly, to abandon our weekly sessions and, instead, begin running all-day Saturday events about once every six weeks. Each of these was to be on a different theme. We felt now that our job was to demonstrate to people how micros could be useful in the home, at school and at work. Owing to the fact that we only needed to organise one session every six weeks, we could concentrate upon providing a really good display of equipment and software. Our thematic approach would give us an opportunity to explore various areas in some depth.

We decided upon 'Computers in Education' for our first Saturday session. It was the beginning of a new school year and the Department of Industry scheme was just being extended to primary schools. We gathered together appropriate hardware:

Research Machines 380zs, BBCs and Spectrums. We collected as much educational software as possible: The local bookshop put on a display of books. It looked impressive, but would anyone come? There were a few tense moments as we waited for the library doors to open. Then in they poured — teachers,

children and parents. From 9.30am until we closed the doors at 4pm, there was a constant flow of people. It was hectic but we coped and we dropped exhausted at the end of the day, tired but satisfied with our efforts.

Since then we have run sessions on 'Computers in the Home' and 'Computers for Small Businesses', both of them very successful in terms of numbers attending and, we hope, in getting the message across. Our next session will be an even grander affair. We are leaving our friends at the library temporarily because we need more space, and this the local technical college is providing. Our exhibition there will cover many different aspects of microcomputing. However, we shall be back at the library in September for another Education Day and then I think, since micros are getting cheaper every day, we shall need a 'what low-cost micros can do for you' kind of day, round about Christmas time.

I think we have learnt two important things from running CTUK — Thanet. Firstly, in the fast-moving world of computing one has to be prepared to change to suit the circumstances. Secondly, whatever your locality you need a CTUK centre.

Note: Peter Kiff, organiser of CTUK — Thanet has moved. He is now at Flint Cottage, 2 Ranelagh Grove, St Peter's-in-Thanet, Broadstairs, Kent CT10 2TE.

END

Computer Town UK! is a rapidly expanding network of computer literacy centres where members of the public are given free access to all sorts of computer equipment. This is courtesy of those willing to offer time/resources. You can find a Computer Town anywhere — they're often in libraries or schools. The aim is to make micros enjoyable and non-threatening, so axe-grinding of any sort is banned. Guidelines are available for those interested in starting up their own 'Towns. Write to: CTUK!, PCW, 62 Oxford Street, London W1A 2HG. Remember to enclose an A4 SAE for your reply. Please don't ring PCW for information as CTUK! is entirely a spare time activity.



BANKS' STATEMENT

ANY OLD JUNK?

Martin Banks rambles retrospectively on the ephemerality of computer hardware.

I woke up this morning and looked at my reflection in the mirror, counted the odd new wrinkle or two that had appeared since the last time I had been brave enough to attempt this feat, and asked myself a question: 'Is it all passing you by, Banksey boy?'

Having decided that it probably was (and I hope at this point that you are beginning to feel slightly sorry for me), I asked myself how this could be. The answer, I decided, was that although I could remember the great events in my life — many of the personal computers I had seen, played with and/or written about in my time as a journalist — there was in the end little tangible evidence of these events.

Unlike some of my compatriots, I never bothered to acquire specimens of these machines as and when they had appeared on the market. Now they are gone, lost to the ravages of time.

Of course some of those machines are better lost to time than attempting to reside here in the present world as working systems. But even they have had their place in the great scheme of things, if only because they were such excellent demonstrations of how personal computer systems should *not* be designed, built and sold. There are others that could have been successes if only all the factors had been right. If only, for example, the people with the finance a few short years ago could have had the vision and courage that they are starting to show today, now that there is a track record of success to demonstrate.

A further thought occurred to me as I gazed at the vision of loveliness in the mirror (look, I'm writing this, so I'll choose my own adjectives, even if they are pure sophistry). The thought was that, even in the short history of the personal computer, it has built up a tradition and a folklore that are, in their own way, as important and fundamental to the path of development of the industry and products, as Spotted Dick and Morris Danc-

'...if we lose sight of the tradition of the personal computer industry, we will be continually selling ourselves on the next technological gizmo...'

ing are to the way the English are now.

In a world of sanitated, greasy Yuk-burgers and two-dimensional French flies — sorry, fries —, Spotted Dick still seems remarkably real and wholesome,

something to be relied upon. It's probably what made the British great. Without it, we might just slide away forever into some fast food shop's chip pan to be processed, sanitated, re-processed and re-sanitated for ever.

In the same way, if we lose sight of the tradition of the personal computer industry, short in history though it may be, we will be continually selling ourselves on the next technological gizmo, purely because it *is* the next technological gizmo, and for no other reason: setting ourselves up to be processed, and re-processed, throwing away perfectly good products that actually serve our needs just because they have committed the final, cardinal sin. That sin, of course, is to become 'old' or obsolete.

What actually started off this train of thought occurred back in April. It was the London Computer Fair, a small show organised by the Association of London Computer Clubs. I went along to this affair, not to hunt out new and startling products, for I knew that such discoveries would be rare at such an event. No, instead I went to see if any old friends from the business were around, and to sniff the air among such a large collection of dedicated personal computer users.

I found some old friends to be sure, but I also met up with something else. This was a stand at the show taken by a company calling itself the Computer Junk Shop. At first I thought this was just another fun name for a company, but on investigation found that it was exactly what it stated, a company dedicated to selling old computer junk.

It was then that I thought 'here is history, and it's being knocked down at only a few pounds a time.'

To be fair, the stuff they actually had on the stand was not part of the essential folklore of the personal computer business. Some of it came close though, and it was all interesting. There were, for example, some old ICL 7500 series terminals going for around £40; there was even a Computer Automation mini-computer (definitely not part of the PC tradition) marked at £500, and an early Video Genie (definitely in as part of the tradition) on sale for £195.

There was nothing on the stand at the show that was earth-shattering or of immense historical importance, but there could have been. What if I had spotted an early Altair or Imsai on sale. Closer to home, what if there had been an old Scamp computer.

Hands up those who remember the Scamp? I suspect that there are probably quite a few of you out there, but many more will know nothing about the

machine. It was made by a company now long defunct (long at least in personal computer terms). The company was Bywood, the brainchild of the late, and lamented, John Miller Kirkpatrick. Today, the Scamp would be laughed at for masquerading as a computer, but with some better backing and some reasonable financial support, Kirkpatrick could have beaten Clive Sinclair at his own game!

He didn't of course, so perhaps it is no good crying over spilt milk, but Kirkpatrick and his Scamp computer have a place in the history of the personal computer business. I feel sure that many of the people presently working in the industry got their early experience on such a machine.

What is needed, therefore, is a museum, a place where all these artifacts of the business can be brought together for the interested to see and study. There are such museums elsewhere — for example, the Digital Equipment Corp has one in the USA — but there is nothing here, and we have contributed at least as much to the development of the

'Much more of what has appeared in the personal computer business should be saved for posterity.'

industry and its products as any one else.

There are, to be fair, some individual collections of such artifacts in this country. For example, journalist and writer Robin Bradbeer has one that he has assembled over the years — though, because it has come from his own pocket, or from what he could beg borrow or steal (in the nicest possible way, of course), it is far from complete in its coverage of the industry and its products.

Much more of what has appeared in the personal computer business should be saved for posterity, I feel. It should be kept together in one place where those that are interested in how the products and the industry developed can study the subjects at their leisure.

Ideally, of course, such a museum should be a national archive, though this perhaps is an unlikely hope. I know that the Science Museum carries some displays of this type, but these are far from complete, for the museum has to cover many other areas of science. Indeed, if Robin Bradbeer is to be believed (and why not?), a fair amount of what has been exhibited there has come from the man's own collection. (Perhaps we could start by saving Bradbeer for the nation!)

Failing that, it does seem to me that a



o Museum of Old Computers



magazine of some standing in the business — such as *Personal Computer World* — could easily be the benefactor of such a museum, especially if some college or university were to provide the important facility of a place to keep the exhibits.

But why, I hear a voice enquire, should we bother with what has gone before when there is so much currently happening on the scene that is new and exciting. Answer: precisely because there is all this new stuff. The pace of development in personal computers means that

some systems — especially those that take their time in actually appearing after their announcement — run the grave risk of being superseded. They are becoming obsolete before they ever appear on the market. They may never have a place to rest except in a museum!

This is certainly the case in the area of whizz-bang technology, where business machines have grown from 8-bit machines driving 4k of memory to 16-bit machines running 256k in about seven years, and where home computers have gone from having 1k to 48k in under

three years. In each case, the unit price has barely changed.

I'm not saying for one second that this development is in any way bad, but I do feel that when a home computer, offering 16-bit processing, 128k of memory and hi-res graphics on the TV, will probably appear with a price tag of under £150 by the end of this year, it is time to start keeping a sense of proportion. By charting what has been, both good and bad, we will be able to work out better whether, and how, such developments have any real value. **END**



T.J.'s Workshop

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish. PCW can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

BEEB'S SECRET COLOURS

Here is a simple program to display some of the numerous shades of colour which can be obtained using the BBC micro. Colours are mixed by drawing parallel lines close together; the distance between these lines being determined by the step size in line 50. All the effects are obtained using a two-

```

colour model! Mode 5
would enable up to four
colours to be mixed at
once.
10 MODE 0
20 FOR C=7 to 0
  STEP 1
30 FOR K=0 to 7
40 VDU
  19,0,C,0,0,19,1,K,0,0,0
50 FOR X%=0 TO 1280
  STEP 8
60 MOVE X%, 0
70 DRAW X%, 1023
80 NEXT X%
90 NEXT K
100 NEXT C
  Vin Riley
  
```

KEY SAVER

I am tired of seeing Basic programs designed solely to set up the function keys on the BBC micro, when there's a far simpler, faster and more efficient method to save the soft key buffer itself. The function keys should be set up as usual, then the command: *SAVE"FILENAME" BOO BFF should be entered. This will save Page OB of the memory, where the soft

key buffer is situated. The buffer can then be reloaded with: *LOAD This will not affect a program that is already in the memory, nor will it clear any variables. The buffer loads up to five times faster than an equivalent Basic program, an important factor for those of us not yet blessed with disk drives.

D Alderson

PET TAPE APPEND

A routine to APPEND sub-routines or to incorporate parts of other programs into a resident program is one of the most useful routines in any Toolkit — indeed one wonders how one ever managed without it. There are occasions, however, when a TAPE-APPEND can be very useful, eg, if your PET does not have a Toolkit-type ROM installed or, if like myself, you have decided to upgrade your Toolkit by installing a chip such as COMMAND-O, only to discover that the APPEND function will now only append from disk and not from tape.

There are at least two popular ways of APPENDING tape program files but they are both a little 'messy' in their own ways: (i) The Butterfield MERGE routine in which the sub-routine to be appended is converted first into an ASCII file and then read back as if they were being entered via the keyboard. As a MERGE routine this is fine but it does have the disadvantage that subroutines

have to undergo a conversion process first. (ii) Machine-code APPEND (such as detailed in Raeto West's *Programming the PET/CBM*) operates by loading machine code, then loading the program to be appended, then 'hoisting' it into high memory, then loading the 'main' program and finally 'appending' the first program by bringing it down from high memory to tag on to the tail of the main program. If one is working from disks, this is fine as access time is quick but in tape the process is very much slower and prone to error.

The routine to be developed here works in the way that you might expect it to work, ie, with a program already held in memory it is possible to APPEND another program straight on to the end of it as though one were using the Toolkit type APPEND. The routine is compact (some five or six lines of Basic) and can be entered in direct mode if necessary. To explain exactly how it works a little knowledge of tape headers is required.

When programs are

stored on tape, the program header has the structure as shown in Fig 1. Locations 635-636 in the first cassette buffer store the 'start' address for the load and this is usually 01 and 04 (=1025 decimal, ie, start of Basic program area). Locations 637-638 store the 'end' address for the load. It is possible to examine the header for any tape without loading the main program by typing OPEN 1 (or more fully, OPEN 1,1,0"PROGRAM NAME") and then examining the bytes in the monitor (SYS 4 and then M 027A-029A).

This tape-append routine works by opening the file of the sub-routine and recomputing new 'start' and 'addresses' for the load so that the sub-routine will tag onto the 'tail' of the resident program.

Explanation of the program:

Line 4 : As Basic programs end with three zero bytes, this routine works through the link pointers to ascertain the position of the middle zero byte. This is the 'start'

position of the new program.
 Line 5 : Requests the name of the sub-routine (in A\$), copies it into B\$. Note the three shifted spaces and three cursor lefts in the input string so that a null return will result in A\$ holding a *shifted* space (ASCII 160) and therefore not dropping into direct mode. If the tape to be appended is at a known position one can utilise this by pressing RETURN only.
 Line 6 : OPENS the tape header of the named (or next) tape-file and prints out (in reverse) APPENDING (PROGRAM NAME). The new 'end' address is computed and the low and high bytes of the new 'start' address are poked into position.
 Line 7 : The low and high bytes of the new 'end' address are POKEd into position and the end-of-Basic pointers updated so that the composite program can be saved if necessary.
 Lines 8-9 : Enters a ROM



SHARP LOWER CASE

One of the prices to be paid for the Sharp MZ-80K's excellent set of graphics characters, which makes some of the new generation games machines look stupid, is a hideously deformed set of lower case ASCII character codes. This can make such things as driving printers and communicating with other micros much more complicated than they need be. Fortunately, the MZ-80K is provided with an extra character set, the display code or graphics set. Although they are not in the same place, this set at least has the lower case letters in the right

order. Occasionally, you see enormous programs to convert from one character set to the other. These are completely unnecessary, as the MZ-80K monitor (SP-1002, I don't know about earlier versions) provides the conversion routines itself, 'ADCN' and 'DACN' at 0BB9H and 0BCEH respectively. Therefore, to convert Sharp ASCII to Standard ASCII, and vice versa, all that is necessary is to transfer and adjust.

This subroutine takes a Sharp ASCII lower case letter in the accumulator and converts it to a standard ASCII lower case letter in A:-
 CD B9 0B NONSTA:CALL 0BB9H ;Sharp ASCII — Display code

D6 20 SUB 20H ;Display code — Standard ASCII
 C9 RET

And this one take a Standard ASCII lower case letter in A and converts it to Sharp ASCII:-
 C6 20 STANON:ADD A,20H ;Standard ASCII — Display code

CD CE 0B CALL 0BCEH ; Display code — Sharp ASCII
 C9 RET

A simple routine will be needed to check that the character being treated is — in actual fact — a lower case letter.
 Stephen Morris

KEY-IN

Following all the interest that seems to have been generated by possible uses of the user defined keys on the BBC micro, here is a short program which can be saved and loaded in the normal way and does save a lot of time and frustration:-

10* TV 255
 20* KEY 0 OLD : M
 MODE 7 : M : N
 LIST : M

30* KEY 1 CLS : M RUN : M
 40* KEY 2 MODE 7 : M LIST

Obviously this can be changed and extended to suit any particular user's needs but all of the keys must be loaded on separate basic lines as the computer does not respond to colons when it is working in the operating system.

John Carey

routine to complete the load (the headers having been adjusted) and another routine to re-chain the program lines (versions for Basic4 and Basic2). If your version is only going to be used on one version of Basic, then one of these lines can be dispensed with. The CLR and END statements are important! Basic 1 (Old ROMs) should substitute SYS 62403: SYS 50227.

Notes:

- Line 3 is included so that the newly augmented program will skip the APPEND routine and go direct to line 10. It can be added later if you wish. If you include line 3 then activate the APPEND with RUN4.
- Your sub-routine should start at line 10, preferably with a REM. If you leave a line 10 REM in your APPEND program and later APPEND another line 10, the program will finish with two line 10 REMs. Deleting line 10

```
(a) CLR:A=1025:B=256:FORJ=1TO1E6:L=PEEK(A)+B*PEEK(A+1):A=L:IFL<>0THENE=L:NEXT
(b) OPEN 1 (or OPEN 1,1,0,"PROGRAM NAME") *NB tape must be positioned!
(c) N=PEEK(637)+B*PEEK(638)+E-1025:POKE635,EAND255:POKE636,E/B:POKE637,NAND255
(d) POKE638,N/B:POKE42,PEEK(637):POKE(637):POKE43,PEEK(638):SYS?????:SYS?????:CLR
The SYS calls are (Basic1)SYS62403:SYS50227: (Basic2) SYS62393:SYS50242
(Basic4)SYS62456:SYS46262
```

Fig 2

will delete the first of these leaving the (newly appended) line 10 in place.
 3 Your APPEND routine can be used as many times as you like to append further sub-routines. The responsibility is yours, however, to ensure that the numbers are in ascending order before the process is started.

To APPEND in direct mode is fairly easy but you must be exact! (a), (b), (c), (d) represent lines typed in direct mode assuming a program resident in memory: see Fig 2.

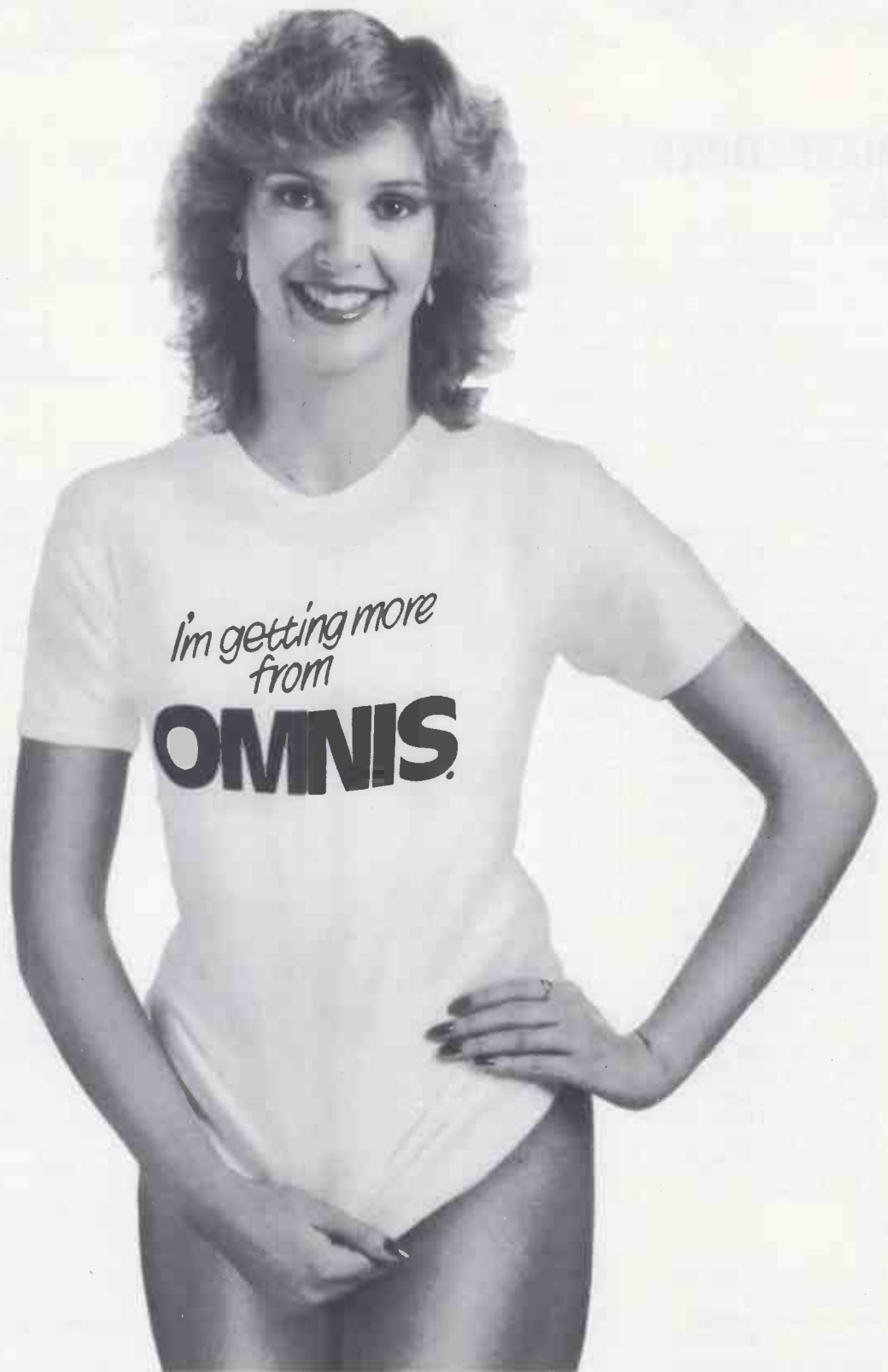
Disk APPENDS are documented in *Commodore Computing* (July 1982) p4 for Basic2; *Commodore Computing* (October 1982) p4 for Basic4.

M Hart

01	01	04	10	04	4E	41	4D	45	20	20	20
634		635 636		637 638		639 640		...			
Identif-ication no	Start Address	End Address	Name (16 characters long or name + space = \$20)								

Fig 1

```
3 GOTO10:REM NEW PROGRAM STARTS AT 10
4 A=1025:B=256:FORJ=1TO1E6:L=PEEK(A)+B*PEEK(A+1):
  A=L:IFL<>0THENE=L:NEXT
5 INPUT"APPEND NAME ████":A$:B$=A$:IFASC(A$)=160
  THENA$="":B$=""
6 OPEN1,1,0,A$:PRINT"APPENDING "B$:N=PEEK(637)
  +B*PEEK(638)+E-1025:POKE635,EAND255:POKE636,E/B
7 POKE637,NAND255:POKE638,N/B:POKE42,PEEK(637):
  POKE43,PEEK(638):IF PEEK(144)=46 THEN9
8 SYS62456:SYS46262:CLR:END:REM BASIC4
9 SYS62393:SYS50242:CLR:END:REM BASIC2
10 REM
11 REM*****
12 REM*
13 REM* VARIABLE LIST *
14 REM* ===== *
15 REM*
16 REM* A=LOW BYTE (BECOMES LINK) *
17 REM* B=HIGH BYTE MULTIPLIER *
18 REM* L=LINK ADDRESS *
19 REM* E=END OF RESIDENT PROGRAM *
20 REM* (BECOMES NEW START ADDRESS)*
21 REM*
22 REM* A$=NAME OF PROGRAM TO APPEND *
23 REM* B$=COPY OF A$ *
24 REM*
25 REM*
26 REM*
27 REM* LINE 8=LOAD & RECHAIN *
28 REM* (BASIC 4) *
29 REM*
30 REM* LINE 9=LOAD & RECHAIN *
31 REM* (BASIC 2) *
32 REM*
33 REM*****
```



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BETTER PET GRAPHICS

As a teacher of science, one of the major facilities which I require from a microcomputer is that of graph plotting. It is also most useful to be able to label and put scales on

graph axes.

This facility is most important, both in the context of simulated experiments (eg, simulation of the decay of radioactive isotopes), and in direct experimental applications. An example of the latter might be taking readings from a temperature probe

connected to the micro-computer via an A-D converter, and plotting the results in graphical form. (I feel sure that other microcomputer users can instance many important applications of graph plotting other than in science teaching.)

The science department at Earl Shilton College owns a PET 4016 computer. Other PET users will know that one of its major drawbacks is its limited graphics. The PET Basic provides only the TAB function for use in graphical displays. The usual solution to this problem is to plot the graph with the Y axis across the top of the screen and then plot the X axis and the graph points together, line by line, down the screen; an altogether unsatisfactory procedure (see Fig 3).

Labelling and putting scales on the axes is even more unsatisfactory. (Try it for the function above).

How much simpler this whole business would be if the PET was equipped with the PLOT and PRINT AT functions which are now available on some other, often less expensive, microcomputers.

Of course these facilities are available for the PET (as, too, are high-resolution graphics) at a price. However, one is loath to spend extra money, especially at a time when school funds are under considerable pressure.

After hearing of my dissatisfaction, Graeme, a former student of the college waiting to go to university, took two days to come up with two Basic routines which, when included in program, give the PET a full PLOT facility and a full PRINT AT facility. At the same time, the plotting density of the screen is doubled, ie, the 40 x 25 screen is converted to an 80 x 50 plotting area with full cursor mobility. The Basic versions of these

two routines are listed below.

PET double density plotting routine (Basic): The variables XX and YY hold the x and y co-ordinates respectively of the point to be plotted.

The co-ordinates (0,0) lie at the bottom left of the screen and the x and y co-ordinates must lie in the ranges of 0 to 79 and 0 to 49 respectively on a small-screen PET. If co-ordinates outside these ranges are supplied to the routine, it will simply return them to the main program without attempting to plot them.

Before the routine can be used in a program it must be initialised by performing a GOSUB to line 50090. This need only be done once, before the routine is used for the first time

The routine itself is accessed by setting up the XX and YY variables and executing a GOSUB to line 50000.

As a simple example, the program below plots a vertical line UP the screen from (5,0) to (5,49). (see Fig 4).

PET "PRINT AT" routine: A much more straightforward, but nevertheless useful little facility. This now returns to the normal screen size of 25 lines (0 to 24) and 40 columns (0 to 39) with (0,0) at the top left-hand corner; for example, this program prints EARL starting at line 20 column 12 (see Fig 5).

The only disadvantage of the PLOT routine is that being in Basic it is rather slow. Graeme soon became dissatisfied with this and within another two days had produced a machine-code version of the routine and a version in data statements.

Gerry Spalton and
Graeme Baird

```
10 REM THIS PROGRAM PLOTS A MEDIOCRE
  GRAPH
20 REM PLOTTING A GRAPH OF Y=2*X
30 FOR Y=0 TO 30
40 PRINT "  ";
50 NEXT Y
55 PRINT
60 FOR X=1 TO 15
70 PRINT TAB (0) "I" ; TAB (2*X-1) "*" ;
80 NEXT X
```

Fig 3

```
10 REM DOUBLE DENSITY PLOTTING
20 GOSUB 50090
30 XX=5
40 FOR YY = 0 TO 49
50 GOSUB 50000
60 NEXT YY
70 REM ** THE NEXT 13 LINES DO
  ALL THE WORK **

49999 STOP
50000 IF XX <0 OR XX>79 OR YY<0 OR YY>49
  THEN RETURN
50010 VA = 33728 - INT (YY/2) * 40 + INT(XX/2)
50020 VB = 2 ^ ((YY - INT(YY/2))*2)
  + XX - INT(XX/2)*2
50030 PP = PEEK (VA) : VC = 1
50040 IF PP = SY (VC) THEN PP = VC : GO TO
  50070
50050 VC = VC + 1 : IF VC < 16 THEN 50040
50060 PP = 0
50070 POKE VA, SY (PP OR VB)
50080 RETURN
50090 DIM SY (15) : FOR VC = 1 TO 15 : READ SY
  (VC) : NEXT VC
50100 RETURN
50110 DATA 123, 108, 98, 126, 97, 127, 252, 124,
  255, 225, 254, 226, 236, 251, 160
```

Fig 4

```
10 GOSUB 55030
100 AX = 12
110 AY = 20
120 GOSUB 55000
130 PRINT "EARL" ;
55000 IF AX<0 OR AX>39 OR AY<0 OR AY>24
  THEN RETURN
55010 PRINT "cursor home"; LEFT $ (AT$,AY) ; TAB
  (AX) ;
55020 RETURN
55030 AT$ = "24 cursor downs"
55040 RETURN
```

Fig 5



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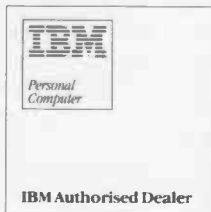
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BEEB TELETEXT CONTROL CODES

Mode 7 is the most useful mode for displaying title pages and instructions which do not require hires but can benefit from colour. The problem with mode 7 is the difficulty of putting the control codes which create all the special effects into PRINT statements. There are two ways in which this can be done, either with CHR\$ or by using the red f-keys to produce the codes for direct inclusion inside quotes. Both have their disadvantages: CHR\$ takes up a lot of time and space; direct inclusion can make editing confusing. In mode 7 the control codes take effect and in other modes they merely appear as spaces invisible to both the programmer and the COPY key.

That's the problem... now (for owners of OS1.00 or better) the solution! First, the easy bit — making all the codes directly available from the keyboard. *FX227,140 and *FX228,150 will do this (see below). Second, how to make editing in modes 0 to 6 easy. It is possible to redefine the appearance of the characters 128 to 159 in modes 0 to 6 without giving up any extra memory (&COO to &CFF have already been

<input type="checkbox"/> Cyan 6	<input type="checkbox"/> White 6	<input type="checkbox"/> Conceal	<input type="checkbox"/> Joined	<input type="checkbox"/> Separated	<input type="checkbox"/> Black Bk	<input type="checkbox"/> New Bk	<input type="checkbox"/> Held 6	<input type="checkbox"/> Unheld 6
<input type="checkbox"/> Normal	<input type="checkbox"/> Double	<input type="checkbox"/> Red	<input type="checkbox"/> Green	<input type="checkbox"/> Yellow	<input type="checkbox"/> Blue	<input type="checkbox"/> Magenta	<input type="checkbox"/> Cyan	<input type="checkbox"/> White
<input type="checkbox"/> Flash	<input type="checkbox"/> Steady							

f-key overlay

set aside for them). Since these are the same codes as the teletext control codes, it is possible to arrange things so that teletext control codes appear as symbols relevant to their function: eg, a small underlined R for red. The VDU statements in the program below set up such a set of characters shown on the f-key overlay.

If you intend to use these codes often the character definitions should be included in your key-define program (assuming you have one (!BOOT on disk)). The two *FX commands should be included in the *KEY10 (BREAK) definition. The character definitions may be stored on files in four ways:

- 1 As a Basic program
- 2 As a *SPOOL file of VDU statements.
- 3 As a *SPOOL file of the output of the VDU statements (as created by the example).
- 4 As a *SAVE file of the memory from &COO to &CFF inclusive.

Brian McCauley

f-key definitions

	Normal Definition	After °FX227&228 °KEY string	After °FX227&228 °KEY string
Unshifted	ASCII 128 to 137	ASCII 128 to 137	ASCII 128 to 137
Shift	ASCII 144 to 153	ASCII 140 to 149	ASCII 150 to 159
Control	Nothing	Nothing	Nothing
Control/shift	Nothing	Nothing	Nothing

Note: codes 138 and 139 do nothing so their omission is unimportant.

```

10*SPOOL CODES
20VDU23,128,0,0,0,0,0,0,0,0,0
30VDU23,129,124,102,124,108,102,0,126,0
40VDU23,130,62,96,110,102,60,0,126,0
50VDU23,131,102,102,60,24,24,0,126,0
60VDU23,132,124,102,124,102,124,0,126,0
70VDU23,133,99,119,127,107,99,0,127,0
80VDU23,134,60,102,96,102,60,0,126,0
90VDU23,135,99,107,127,119,99,0,127,0
100VDU23,136,126,96,120,96,96,0,126,0
110VDU23,137,62,96,60,6,124,0,126,0
120VDU23,138,0,0,0,0,0,0,0,0,0
130VDU23,139,0,0,0,0,0,0,0,0,0
140VDU23,140,102,118,126,110,102,0,126,0
150VDU23,141,124,102,102,102,124,0,126,0
160VDU23,142,0,0,0,0,0,0,0,0,0
170VDU23,143,0,0,0,0,0,0,0,0,0
180VDU23,144,0,0,0,0,0,0,0,0,0
190VDU23,145,124,102,124,108,102,0,102,0
200VDU23,146,62,96,110,102,60,0,102,0
210VDU23,147,102,102,60,24,24,0,102,0
220VDU23,148,124,102,124,102,124,0,102,0
230VDU23,149,99,119,127,107,99,0,99,0
240VDU23,150,60,102,96,102,60,0,102,0
250VDU23,151,99,107,127,119,99,0,99,0
260VDU23,152,60,102,96,102,60,0,0,0
270VDU23,153,62,12,12,108,56,0,102,0
280VDU23,154,62,96,60,6,124,0,102,0
290VDU23,155,0,0,0,0,0,0,0,0,0
300VDU23,156,255,131,153,131,255,131,255,0
310VDU23,157,255,153,137,129,145,153,255,0
320VDU23,158,102,102,126,102,102,0,102,0
330VDU23,159,102,102,102,102,60,0,102,0
340PRINT"*FX227 140"
350PRINT"*FX228 150"
360*SPOOL
  
```

ERROR TRAP

I have written a pair of subroutines for 3000 and 4000 series PETs, which provide an error trapping facility. They work by storing a command in the keyboard buffer, which is executed after an error, in this case causing a jump to line 12000. The interrupt routine is disabled when the trap is enabled, to prevent the user overwriting the command in the keyboard buffer. This also disables the

clock, the stop key, and the cassette motor. The trap must therefore be disabled before getting data from the keyboard, or using the cassette system. The routine clears the screen when an error occurs. To enable the trap use 'GOSUB 10000', and to disable it use 'GOSUB 11000'. The routines set 'ER' to -1 when the routine is enabled, and to zero when it is disabled. Your routine to deal with the error should start at line 12000, and its first

action should be to disable the trap. Although variable values are preserved, the contents of

the stack are lost, so you cannot continue a FOR-NEXT loop or subroutine. Robert Oakeshott

```

10000 REM ERROR TRAP ENABLE
10010 POKE 59411,60:REM DISABLE KEYBOARD
10020 ER$="JGF12000"+CHR$(13)
10030 POKE 158,LEN(ER$):REM NO. OF CHARACTERS IN KEYBOARD BUFFER
10040 FOR I=1 TO LEN(ER$)
10050 POKE 622+I,ASC(MID$(ER$,I,1))
10060 NEXT
10070 ER=-1
10080 RETURN
11000 REM ERROR TRAP ENABLE
11010 POKE 59411,61:REM KEYBOARD ENABLE
11020 POKE 158,0:REM CLEAR KEYBOARD BUFFER
11030 ER=0
11040 RETURN
12000 REM ERROR CAUGHT
12010 GOSUB 11000:REM ERROR TRAP DISABLE
12020 STOP
  
```

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MEDDLING WITH MICROTAX

Is Microtax the long-awaited solution to make light work of those formidable tax return forms? Tony Harrington discusses some of its benefits.

The first thing to be said about Microtax is that it is a serious venture. A lot of work has gone into producing it, and the initial impression is that not much has been taken for granted.

Anyone who has loaded games cassettes onto the Dragon, and that includes most Dragon owners, will know that instructions for a specific program can usually be found in the tape cassette folder. My first reaction, coming to the Dragon from disk based applications, was to look for the loading instructions in the Guide that comes with the cassette. This was a mistake.

The 'Guide', as it says on the cover, is a separate work from the program and is in no sense a reference manual for it. Although the program frequently sends the user back to the Guide, it is always for a more in-depth explanation of the UK tax system, never for additional information on how to operate the program itself.

In other words, the 'Guide' is in no sense an operating manual for the program.

Microtax is somewhat handicapped in its serious aims by the fact that the Dragon has not yet worked out how one program can be loaded and automatically run from another program. Using the remote jack plug that comes with the Dragon, it should, in theory, be possible for the program itself to load the next section of the program at the appropriate time, but the user still has to type in 'run', and press enter.

The tape contains half a dozen different programs on each side. The first program consists of a number of messages on the screen to guide you through the initial familiarisation stage. I had nothing against these, as a little too much advice is better than leaving the user to flounder around alone. Incidentally, it is worth noting that Side A, at least, of the tape will not accept decimal places, so amounts have to be rounded down to the nearest pound.

Since my remote jack-plug connection didn't seem to work, it was not possible for me to test the effectiveness of the program's ability automatically to call in the next routine. It flashed a message on the screen saying it was searching for the next program, but since the tape recorder remained motionless, I figured that the message was a little optimistic.

I opted for CLOADing from the beginning of the next program section. This was

Microtax is supplied by Tax and Financial Planning Ltd. It is designed to calculate income tax liability and tax payable for the year ended 5 April 1983, but it also assists with the completion of the 1983/84 tax return. It runs on the Dragon 32. The complete package consists of a 1982/83 UK income tax guide and a cassette containing a number of programs.

quite easy to do, but it made me long for a disk based system, with all the access facilities of disk. And it raises the question of how seriously one can take even the most efficiently designed tape-based program when it gets to this kind of size. It needs an enthusiast to go to some time and trouble doing this sort of thing. Most people, even those with a tax problem, don't want to be bothered.

Familiarisation

The introduction starts off simply enough by asking whether you have a printer to work with the program. I didn't, and was immediately advised by a neatly printed message (black on a green background) to take notes!

The 137-page Guide is long and comprehensive. Like encyclopaediae, you are not expected to read all of it, just the sections the program states are relevant for your needs. This comes as something of a relief since most ordinary users will not want to plough their way through 137 pages on the intricacies of the UK tax system.

Right at the start you are warned that if you are married and both you and your husband/wife work as employees, the tape will have to be run through twice. There was no explanation as to why the program couldn't handle both simultaneously, but within the limited capabilities of 16k, processing the values for one person's income and tax was probably as much as could be expected.

Pressing 'break' on the Dragon does dreadful things to a sequence of programs like this. So although the program uses the 'press any key' technique to move you on to the next screenful of information, it is thoughtful enough to add 'press any key but the break key...', which I found a nice touch. There is probably a potential user

out there who would have pressed it without this warning. There is doubtless one who will press the break key even with the warning, but there is not much a program designer can do about such folk.

The other point to bear in mind is that you cannot simply sit down with this package and bang out your income tax. Before you sit down to it you need to put in a bit of work gathering the necessary documents. The program tells you as much before you get very deeply into it: 'Before commencing we suggest that you gather together as much of the information as possible as listed in Appendix A.'

You also need to establish your domicile and residence status. These delays before you begin working out your tax are inevitable if the matter is going to be treated seriously. Nobody wants to get their tax into a muddle.

Documentation

The documents you require are: your tax return, as completed last year; your present tax return; your P60 form (the one given to you by your employer showing earnings for the year, your pension contributions and your tax deductions). Then you need the P11D and the P9D, which is the form returned by your employer, giving details of 'benefits in kind' (a company car is the prime example).

Other documents you need — or might need under certain circumstances — are your assessment for the past year; details of the number of days you spent working abroad; details of building society rates paid in 1983 in respect of your house, and details of other loan interest for which you know you get relief; dividend vouchers; share transactions and contract notes; tax deduction certificates in respect of any pensions received; vouchers from building societies, banks and so forth; as well as deeds of covenants made. Armed with all these you are ready to begin.

Well, almost ready to begin. One of the problems with this kind of program is that there are so many factors which have to be taken into account. The program cannot just assume that users will know definitely one way or another whether they should in fact pay UK tax.

The fact that Microtax asks questions

about domicile and residence seriously is evidence that the package is intended for serious use.

Problems

But there is a problem. Domicile is a thorny question. As the Guide points out, this is a problem of general law, not just of tax law. If you are new to the country or uncertain about your status, it might be possible to work out your tax obligations from the notes given in section A5 of the Guide. But I wouldn't advise it. The Guide itself points out that 'it is not possible to list all the factors that are considered in determining whether a person is domiciled in a particular country'. So if you are in doubt, get expert advice.

When you have sorted that one out and are in the position to give a confident 'yes' or 'no' to the question: 'Are you domiciled in the UK, yes or no?', you reach the next murky area, namely, questions about residence.

If you have never thought about your residence or domicile status before, it probably means that you don't have to. In that case, this section of the program will strike you as a little quaint. It has to be worked through all the same, but that only takes a moment or two. The real test of the program at this point is how well it serves those who might have a problem in this area.

About the best it can hope to do is to indicate what are the problems connected with being 'resident' or 'ordinarily resident' (the two are not quite the same) in the UK. And it does this reasonably well. You can omit the residence questions altogether if you are sure (as most users will be) that you are a resident.

If you do want advice here, the first thing the program tells you is that it is not really competent to deal with residence questions. 'These residence questions (on your screen) are not exhaustive. Please read the manual where advised to do so and seek professional advice if in doubt,' it says.

But it gives a sound idea as to what would make one a non-resident. Going abroad under a full-time contract of employment which is still in force is an excellent way of being non-resident (though you might still have to settle your current tax bill first, depending on when you plan to leave).

The program also asks you whether you have been physically present in the UK for 183 days in the 82/83 tax year. An extended holiday abroad can have great implications for your tax status.

Having answered all these questions you get a comforting message up on the screen asserting 'You are resident and ordinarily resident in the UK' — and so, by implication, it will be worth your while continuing with the Microtax program.

Tax jargon

As this is a serious tax program, from time to time it has to use the language of the Inland Revenue and of tax law. This language has nothing in common with the language of everyday. This means that the user must be prepared to go backwards and forwards between the program and the

tax guide.

An instance of this occurs when you begin the tax program proper, having answered all the preliminary questions. The screen asks: 'Do you have any earnings which arise from an office or employment in 82/83. See B.2.' In ordinary language, this does not make much sense. Earnings which arise from an office you might suppose to refer to earnings which you get from working in one. You'd be wrong.

Turning up the Guide you will discover that neither 'office' nor 'employment' have been defined in tax law. An office is usually referred to as 'an existing permanent substantive position which has an existence independent of the person which fills it, and which is filled in succession by successive holders'.

When you work your way through that one you might realise that earnings from an office means holding a company directorship or the like. Employment, on the other hand, arises when there is a contract of service as opposed to a contract for service. If you are paid under the PAYE system where you receive your pay net of tax, then you can be relatively certain that your earnings arise from a contract of employment.

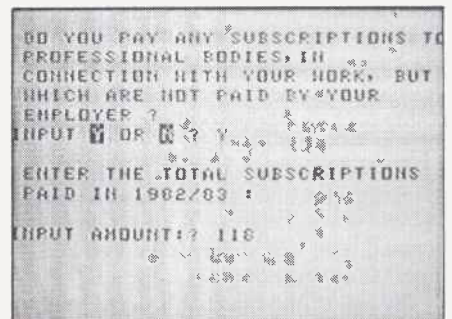
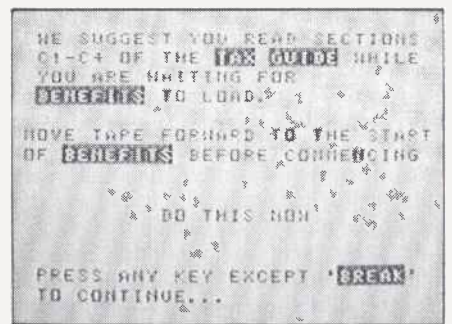
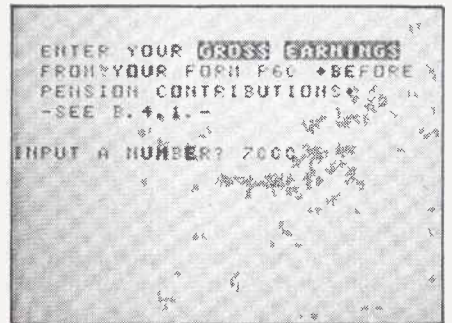
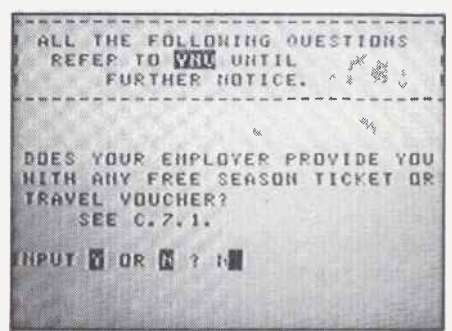
By now it will have struck most users that they are discovering a great deal about tax law that they do not really need to know in order to fill out their income tax returns. It might have taken the more curious among them some time to reach this point in the program. And still not a line of their tax return has been filled in. One way of looking at this program — for all its seriousness — is to see it as another elaborate question and answer computer game. That is why it strikes me that whatever the supplier's intentions, the program will appeal most of all to enthusiasts who want to get the feeling that they are doing something useful with their home computers.

The program goes on to ask whether your earnings are accessible as earnings under Schedule E, or as profits of a trade or profession under Schedule D. Most users who get this far on the Dragon will know from past history whether they fall under PAYE or not. If you don't know, the program won't be able to help you. It will simply bring you up short at this point.

Microtax can deal with up to five separate contracts of employment. Most people only hold one (nearly four million don't hold any, but that is beside the point since they won't be buying this package).

Having answered all the domicile and residence questions and decided that you do fall inside the PAYE NET, there is still one more barrier to cross before you start work on your tax. The program wants to know whether your employer is resident in the UK or not (the employer company, that is).

As the Guide points out, the residence of the employer is an ill-defined term under current tax law. You might have to go to your employer's accountant to find out if your contract of employment is with a non-resident employer. Once again, this is not a point that most users need bother with. But it does have important implications for your



Lucid and comprehensive instructions on the screen.

tax if, by some chance, your employer is not a resident UK company.

A large number of expatriates from abroad working temporarily in the UK will be put on the payroll of a non-resident company in order to reduce their tax liability. As the rest of the world has noticed, UK tax rates tend to be unusually high.

Comprehensive cover

Once through that, you are finally ready to begin. It sounds like an awful lot of work, but the program has had to foresee every eventuality. The sensible user should have skipped through everything to this point. But if you are the least bit adventurous, be warned. Filling in your tax return using this package is going to take you into some very strange waters.

The first value you are asked to put in is

MEDDLING WITH MICROTAX

your gross pay. That is an easy one, since if you don't know that, you are going to be in a pretty poor position to work out your tax! But the naive user will stumble again once he comes across Benefits-in-Kind (sections C.1 to C5 of the Guide).

You can omit the Benefits-in-Kind section altogether, or omit it for selective contracts of employment (if you have more than one). For those who need it, it is a vital section of the program, since working out what you owe the taxman for your company car can be a real headache.

The Car Benefit program is a separate program on the tape and has to be loaded separately. Theoretically, as I've said, the program can call up the next routine automatically. This didn't work for me since I had a rather elderly tape recorder. But loading each additional program was no real problem.

This section is designed to take you through all the details that the Inland Revenue needs to know in order to assess the taxable value to you of having a company car. The questions it asks include: how many cars were available to you; whether you changed the car during the year; whether it was more than four years old; what cylinder capacity it had and the number of days it was available to you.

It also wants to know the business mileage through the year. At the end of entering all the information — and this is true of all the following sections where you enter information — you get a chance to rerun the section, without reloading the program, to change any details you want.

When you have finished, the program comes up with a pound value of the benefit to you. Where the program gets this value from is not at all obvious, as it is based on the intricacies of what the Inland Revenue has laid down. Unless you are a tax expert yourself, you will simply have to take the program on trust here.

The rest of the Benefits-in-Kind section is contained in the next program on the tape. It deals with things like free season tickets; travel vouchers; credit cards, etc, living accommodation (explained in the Guide); heating, lighting, repair bills, etc, paid on this accommodation by your employer; and so forth. Once again, gathering all this information, if it applies to you, could be tricky, but it is information you would have to supply to the taxman anyway. If it doesn't apply to you, it can be whisked through fairly quickly.

Profit sharing schemes have become more popular recently, and the Benefits-in-Kind program includes a section on these.

Next comes the Expenses program. All the expenses reimbursed or paid to you have to be taken into account, and the program is at least useful in reminding you of this fact. These can include motoring, travelling, entertaining, mileage allowance, subscriptions, round sum expenses and so on. Free medical expenses, loans from your employer at an interest rate of under 15 per cent and getting goods or services below the

market rate are also taxable expenses.

Then the program goes on to ask about things like pension contributions paid by you through the year. Most of this kind of information you could get off your P60.

This is followed by another program called Working Abroad — a question and answer session designed to see to what extent you have escaped the PAYE net by working abroad through the year. If you have or think you might have been out of the country during the periods from the 6/4/81 to 5/4/83 or will be between 6/4/83 and 5/4/84 then this is the program for you.

Then comes a section on Compensation. The number of people who will buy this program and who will receive compensation for one reason or another through the year can probably be counted on two fingers. But if you need it, it is there. The final section on Side A of the tape is a summary section which totals all the values you have input so far. It tells you a) that you are domiciled in the UK (or not); b) what your company car and benefits-in-kind are worth if you have them; and c) what your expenses are worth. Having done all this, you then have to put Side B on and only at this point are you ready to begin actually filling out your tax return!

Form filling

Side B reminds you once again of the documents you need. Then it works through a maze of questions of the sort that you will find on your tax return form anyway. For example, were you married and living with your spouse during the tax year in question? Did your husband die during the tax year? and so on. It also tells you to do helpful little things such as entering the name and address of your employer on your tax form.

You would have done all this anyway without the program, but since part of its function is to tell you how to fill in your tax form these little prompts could hardly be left out. I found them pretty pointless, but there might be those who find them helpful. Remember, the tax form itself tells you to fill in this kind of information.

The next five sections in the program, headed Return 1 — 5, work through each of the sections of the tax return form, telling you to put in crosses, values and so forth.

Some of these sections are more com-

plicated than others — for example, entering the total value of life assurance premiums paid by yourself through the year is fairly simple; working out the tax due on rents from furnished or unfurnished property, on dividend payments and so on, is not. Once again, you are free to move quickly through the sections that do not interest you.

I was reasonably convinced that all the things that one would normally be caught out by in completing a tax form were included in the program. This includes everything from building society interests, to alimony payments, to supporting a permanently disabled child who has passed the home leaving age.

Return No 5 adds up all the information that you have put in on Sides A and B and lists everything. It also lists the personal allowances (£2445 as the married man's allowance).

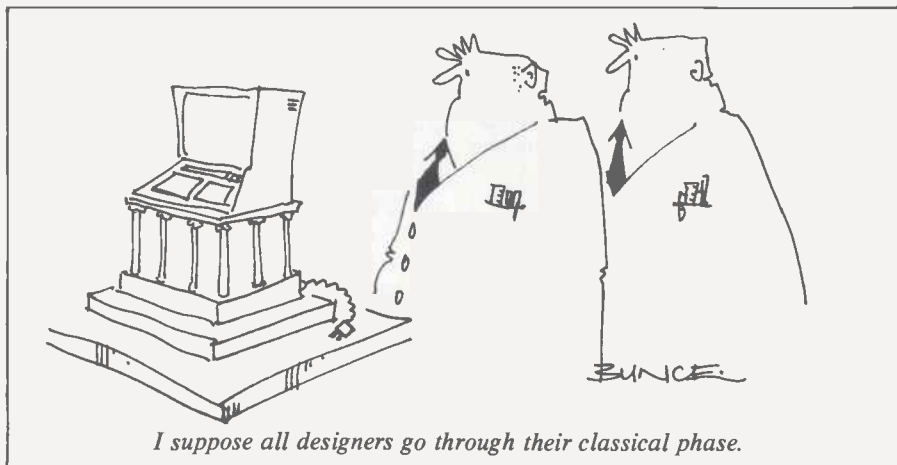
The last program deals with the computation of your tax. At this point you are finally in a position to receive all those good things that Microtax promises you on the cover wrapping. It does a little calculation to see whether you would be better off as a married couple electing for separate assessments. It also tells you whether you have overpaid your tax.

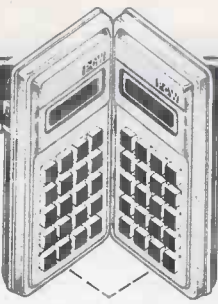
Conclusions

My feeling as I came to the end of the program was one of immense relief. If I had been using it to fill in a tax return, instead of simply reviewing it, I would have switched it off shortly after starting. But then, in my days as an employee, not having too much by way of dividend income or benefits-in-kind, and not having any handicapped relatives to support, filling in my tax return was always a rather simple business.

The program will be helpful, though, to the employee with all sorts of factors to take into account. (Microtax has promised that a program designed to meet the needs of the self-employed will be out shortly.)

So if you live in a house provided by the company, pay a minimum rent, have a company car and are blind, receive income from earnings abroad, have a profit sharing scheme and a couple of thousand shares in various companies, then this is the package for you. Alternatively, you might buy it for the joy of running a program that actually relates to the real world instead of to some programmer's fevered dreams of alien invaders.





SHARPER DEFINITIONS

Amanda Parfitt takes a closer PEEK at the Sharp PC 1500

The Sharp PC 1500 has six function keys referred to as F1 to F6 which the user can define in the RESERVE mode. These may be set for frequently used keywords or statements. By use of a selection key, each function key can represent three separate statements, the level of key selection being indicated by a I, II or III flag at the top of the display. Associated with each of the three levels of function key definition is a descriptor of up to 26 characters which can serve as a reminder of the purpose of the six keys at that level. The user has only to press the RCL key to be reminded of these definitions.

The definition of these keys may need to be changed to suit a particular program, but unfortunately these definitions are not passed to cassette by the CSAVE command. Consequently, the poor user has to spend several minutes manually redefining these keys after loading the new program.

The description below not only shows how you can incorporate function key definition into your programs, but also illustrates the procedure with a general purpose program which can be tailored to your needs.

The key to the problem lies in the 188 bytes that the machine uses for storing the three reminders (each up to 26 characters) and the 18 definitions. These bytes are described in Fig 1. In order that each of the 18 statements or keywords can be distinguished, a start byte is associated with each definition. On pressing a function key its reference byte is compared with each byte in the definition space (14422-14531) until the correct start byte is found. Then the succeeding bytes are brought into the keyboard buffer until a different start byte is reached. Fig 2 describes the values of these start bytes. For those of you with orderly minds the level II and III values do look as though they have been switched. This definition space is filled in the order that key functions are defined, so that start bytes may not appear in the order shown in Fig 2.

To put all this information to use, one has simply to do a little judicious POKEing within the particular program and thus define the function keys. There are many ways of doing this depending on the application. Fig 3 shows a general purpose program which should be CSAVED as it is but adjusted once CLOAded for particular applications.

The array A\$ represents the three character string reminders (of up to 26 characters) and the array B\$ represents the functions to be defined. Dummy

values have been assigned to both of these arrays up to the maximum capacity allowed for each. Using the editing facilities of the PC 1500 on these assignment lines one can replace the dummy values by those required for your application.

The small letter 1 in each of the three strings of A\$ divides the 26 character display into the appropriate areas for F1 to F6 so that the reminders appear over the relevant function keys. If you are not quite with me at this stage RUN the program as it is and press the RCL key to see what I mean.

When putting values into B\$ you must ensure that the first character of B\$(0) is a colon: and then use other colons to separate the functions or statements that you are defining. B\$(1) is a continuation of the first string B\$(0), so do not worry if you are only halfway through a definition at the end of B\$(0). The functions should be entered in the order F1 to F6 for level I, II and then III ending with F6 level III. Remember that you only have enough space for your definitions as there are dummy variables. If you run out of space look carefully at the functions or statements that you are defining and see if these can be abbreviated, for example, R is the short form of RUN.

This simple routine can be part of a larger program and hence will be passed on by CSAVE as required. There are other uses for these 188 bytes of course, perhaps as additional protected memory space.

Reserve Definition Memory Map

Location (decimal)	Purpose
14344-14369	RCL I 26 Character Reminder
14370-14395	RCL II 26 Character Reminder
14396-14421	RCL III 26 Character Reminder
14422-14531	Remaining space for definitions

Fig 1

Start Byte Values (decimal)

	Level I	Level II	Level III
F1	1	17	9
F2	2	18	10
F3	3	19	11
F4	4	20	12
F5	5	21	13
F6	6	22	14

Fig 2

PROGRAM LISTING

```

5:REM Reserve Key Definitions by
   Amanda Parfitt
10:DIM A$(2)*26
15:REM A$ holds the 3 levels of reminder
20:A$(0)="*****1***1***1***1***1*****"
25:REM A$(0) is set up it represents RCL I
30:A$(1)="*****1***1***1***1***1*****"
35:REM A$(1) is set up it represents RCL II
40:A$(2)="*****1***1***1***1***1*****"
45:REM A$(2) is set up it represents
   RCL III
50:FOR J=0 TO 25
55:REM Now we POKE in the RCL values
60:POKE J+14344,ASC MID$(A$(0),J+1,1)
70:POKE J+14370,ASC MID$(A$(1),J+1,1)
80:POKE J+14396,ASC MID$(A$(2),J+1,1)
90:NEXT J
100:DIM B$(1)*55
105:REM B$ holds the statements etc for
   reserve keys
110:B$(0)=":.....:
      :.....:"
115:REM Note the : is used to separate
   statements
120:B$(1)=":.....:
      :.....:"
130:R=0
135:REM POKE the reserve key definitions
140:FOR J=0 TO 1
150:FOR K=0 TO 54
160:P=14422+K+J*54
170:POKE P,ASC MID$(B$(J),K+1,1)
175:REM Check for the : deliniator
180:IF PEEK P=58 THEN GOSUB 2000
190:NEXT K
200:NEXT J
210:END
2000:R=R+1
2005:REM R holds the decimal value of the
   internal deliniator
2010:IF R=7 THEN LET R=17
2020:IF R=23 THEN LET R=9
2030:POKE P,R
2040:RE:URN

```

EXAMPLE

```

20:A$(0)=" RUN X1= Y1= X2= Y2= LINE "
30:A$(1)=" STATUS...0...1...2...3 "
40:A$(2)="COL0...1...2...3 LST LPRT "
110:B$(0)=":R.@:X1=:Y1=:X2=:Y2=:LINE
(X1,Y1)-(X2,Y2)::STA.@:STA."
120:B$(1)="1@:STA.2@:STA.3@:COL.@@:
COL.1@:COL.2@:COL.3@:LL.@:LP.: "

```



Random rumours

Rumours persist that IBM will soon announce its 'peanut' 16-bit portable computer, with flat panel display, 64 or 128k of RAM and an expected price between \$700-900. The unit is expected to be offered to mass merchandisers. . .

IBM is said to be studying the possibility of adding the Pick operating system to its repertoire of operating systems for the PC. . . Microsoft is reportedly close to releasing its word processor package and is beta testing a user shell for its MS-DOS to integrate its Multiplan and word processor packages in much the same manner as Lotus 123 and VisiOn. . . In the meantime rumour has it that VisiOn deliveries have been pushed back to August/September.

Random news bits

Microsoft has introduced a \$195 mouse device (made in Japan) with demo software. . . CBS has formed a division to publish personal computer software. . . Bill Synes, the chief designer of the IBM PC and an 18-year IBM veteran, has left IBM to join Franklin Computer (an Apple look-alike maker). . . Cannon Inc, Tokyo, a major supplier of calculators to the US, will shortly begin shipping personal computers. . . California Software Products Inc, Santa Ana, CA, has released a package that enables the PC to run IBM System/34 applications soft-without modification. They call it 'Baby/34'.

Big blue report

IBM has reorganised its marketing of the PC and XT

Sol Libes presents his monthly batch of juicy snippets from the Big Apple.

by giving its own direct sales force greater latitude. Discounts offered by IBM salespeople have been increased and they are now being permitted to accept orders on individual units (previously they were limited to accepting orders for 20 or more units). IBM itself is offering discounts of five per cent on 3-10 machines, eight per cent on 11-19, 12 per cent on 20-49, 16 per cent on 50-149 and 20 per cent on 150-249 units. IBM now has 770 dealers including 40 IBM product centers, 45 Sears Business Centers, 330 Computerland outlets, 350 independent retailers and nine value-added dealers.

Microsoft to offer Xenix via retailers

Xenix, the Microsoft implementation of Unix disk operating systems for microcomputers has until now only been available as a product bundled with a hardware system. Microsoft will now be selling a simplified version through computer stores. Initially a version for the Apple Lisa will be offered to be followed with an IBM PC version. It will include a hardware card which must be installed into the machine.

Commodore shipping new computers

Commodore has made initial shipments of three new micros to dealers: the B500, C128 and PET 64. Two more machines — the trans-portable SX100 and a Z8000-based 16-bit Lisa-like system — are expected within 90 days. The SX100 is expected to have a 5in screen and retail for under \$1000. A \$1500 colour version is expected to follow. The Z8000 machine is expected to sell for less than \$3000 and will include monitor and 896k of RAM.

The C128 (at \$795) uses the 6509 processor, has a 40 character-wide screen, sup-

ports full colour and is expandable to 896k of RAM. It is the first Commodore machine with a true RS232 port. The B500 (at \$895) is an 80-column black and white business oriented version of the C128. An Intel 8088 plug-in board with MS-DOS and CP/M-86 is expected as an option. The PET 64 is designed for educational use and will sell for \$695.

Two more business-oriented machines (B700 and BX700) are expected later. The BX700 is expected to have three processors: the 6509, Z80 and 8088, with the ability to switch back and forth between them. Also expected is a machine to be called the 'Executive 64' which will include 128k of RAM and bundled software.

Electronic software delivery

As if computer stores were not having enough competition in selling software from bookstores, they are now getting competition from radio, cable and timesharing companies. These companies have introduced electronic delivery of software (currently mostly games). PlayCable, a joint venture of Mattel Inc and General Instrument Corp, is currently sending video game software to cable TV subscribers in three cities. National Public Radio has received permission from the Federal Communications Commission to broadcast software in an unused portion of the FM radio band. And CompuServe Inc, a timesharing service for personal computer users, has initiated a service whereby users can download software and have it billed to their charge card.

Notebook portables arrive

The true portable computer market is off to a fast start with notebook-sized products from Tandy, Epson and NEC. IBM (see 'Random rumours' section) is expected to enter

shortly as is Commodore, Osborne and Apple. Commodore, which announced the HHC-4 hand-held computer back in January has announced that it has cancelled the project. The unit was to have had a 24 character LCD display and other features now considered too limiting in this new emerging market.

Tandy is expected to be the front-runner in this market for this year. Tandy expects to sell 100,000 portables (100 million dollars worth) this year alone. NEC, with a unit very similar to the Tandy unit, is expected to be second with Epson third. Epson is expected to introduce a new Z-80 based unit with 80-column display this summer to replace their current unit. Prices should start dropping by Christmas.

The portable computer market appears to be the first segment of the personal computer market in which the Japanese will assume a prominent position.

Home computers — a marketing game

The home computer market is behaving in a manner akin to the calculator field of the early 70s with prices dropping monthly. Home computers are no longer being sold by independent computer stores but rather are the staple of mass merchandisers and catalog sales organisations. The thing that is expected to save computer makers from pricing themselves out of business is the aftermarket for products such as peripherals and software.

Timex/Sinclair, Texas Instruments and Commodore are in a neck-and-neck price race, with Atari running a close fourth. The Timex 1000 (Sinclair ZX81) can now be purchased on sale for under \$40, the VIC 20 for under \$85 and the Atari 400 for under \$100. And there are rumours that we may see the VIC 20 go as low as \$29.95 and the Commodore 64 as low as \$199 by Christmas.

YANKEE DOODLES

The Commodore 64 is currently selling for as low as \$288 (including a \$100 rebate), which is half of what it was selling for last September. The Atari 800 is now selling for \$388 (with a \$100 rebate).

Atari is going through a reorganisation, moving manufacturing to the Far East to reduce cost and going into the chip manufacturing business to integrate vertically in an attempt to remain in the race. Tandy, despite the selling of over 300,000 colour computers, is now a distant fifth in the field and will most likely drop further back as game makers such as Mattel and Coleco step up their marketing efforts.

One drop-out already is the decision of TI to drop its new 99/2 computer, after test marketing the unit for under \$100. The basic problem is that the current 99/4 computer is now selling for under \$100.

The desk-top microcomputer market has also been the scene of price slashing. In response to IBM's 15 per cent decrease in the price of the PC, Apple cut 20 per cent from the Apple III, Texas Instruments cut 15 per cent from its Professional, Xerox

cut the price of the 820-II by 26 per cent and Zenith cut its Z-100 price by 12 per cent.

Book publishers move into computer book publishing

Doubleday, one of the largest book publishers in the country, recently gave an author a \$1.3 million advance (a new record) on a book to be titled *The Whole Software Catalog*. Virtually every major book publisher now has a computer book division and computer books are staples in almost every book store. Several of the book publishers have also begun software publishing operations as more and more book stores have begun to carry software on their shelves.

Zilog to release Z800

Zilog has finally officially

released the Z800 microprocessor, although samples will not be available until the fall. Production is expected in the first quarter of 1984. The Z800 is a greatly enhanced Z80 — Zilog claims five times greater performance. The Z800 will include a memory manager (for up to 16 Mbytes), DMA controller, counter/timers, serial I/O, 256 byte cache memory, interrupt controller, four additional addressing modes, four additional registers (including a second stack pointer) and memory refresh logic. It has a clock rate of 10-25 Mhz (Z80 current maximum is 8 Mhz).

The added functions include instructions for hardware multiply/divide, 16-bit arithmetic, 16-bit load, system/user calls (for multiuser/multitasking) and test/set (for multiprocessing). A floating point math co-processor (Z8070) was also announced. The Z800 will come in four versions (see below).

Prices	I/O	Pins	Address	Lines	Price in \$
Z8108	8 bit	40	19		40
Z8116	16 bit	40	19		48
Z8208	8 bit	64	24		60
Z8216	16 bit	64	24		72

The 8-bit I/O versions interface directly with Z80 peripheral chips while the 16-bit I/O versions work with Z8000 family of devices and have about twice the throughput. The 40 pin devices will omit circuitry such as serial I/O and DMA controller.

FCC fines microcomputer makers

Forty four manufacturers of personal computers and electronic games have been notified by the Federal Communications Commission that their equipment does not comply with FCC standards on radio frequency interference (RFI). Of 317 devices checked, the FCC found that almost 30 per cent were in violation.

CROSS-FIGURES

For those among you who were unable to come up with all the answers for our Cross Figures Puzzles last month, here are the solutions.

Solution 'Cross figure puzzles'

1	8	2
0		8
7	4	9

The clue for A-down is redundant.

5	6	7
2		7
9	8	7

All four clues are needed.

3	6	1
2		9
7	2	9

The clue for B-down is redundant.

Solution 'Theatre' clue

The year was 1576 (see library ref. books!). A-ac must be between 1000 and 1999. So C-dn (twice A-ac) must be between 2000 and 3998, ie, C-dn begins with 2 or 3. But 1st digit of C-dn is also last digit of A-ac, and C-dn is twice A-ac, so twice that digit must give a 6 for the last digit of C-dn: $2 \times 2 = 4$ no; $2 \times 3 = 6$. OK! So first digit of C-dn is 3, and C-dn is between 3000 and 3999.

1		2-3
	5	
		7
		6

So A-ac (half of C-dn) must be at least 1500, ie, 2nd digit of A-ac is 5, 6, 7, 8 or 9. Now let's look at the clue for A-dn: $5 \times 5 = 25$, so last digit of A-dn is 5. Remember that 2nd digit of A-

dn must be same as 1st digit of D-ac. Now some calculator work... Set 55 in calculator as first trial value of B-dn. Try values of D-ac starting at 15:

1	5-9	3
	5	
		7
5		6

D-ac * 5
xB-dn * 5-9 5
A-dn 1 * * 5

- 55 x 15 = 825 too small
- 55 x 25 = 1375 no
- 55 x 35 = 1925 no
- 55 x 45 = 2475 too big — try 65
- 65 x 15 = 975 too small
- 65 x 25 = 1625 no
- 65 x 35 = 2275 too big — try 75
- 75 x 15 = 1125 yes! But check all values:
- 75 x 25 = 1875 no
- 75 x 35 = 2625 too big. Try 85 and 95: no, no.

1	7	3
1	5	
2		7
5		6

So only one possibility: $75 \times 15 = 1125$

The digits of A-ac total 19. We have 1, 7 and 3, adding up to 11. So remaining digit must be 8, giving A-ac as 1783. So C-dn (twice 1783) is 3566. That gives 76 for E-ac, and the square of 76 is 5776, giving F-ac. And that's it!

1	7	8	3
1	5		5
2		7	6
5	7	7	6

To find solution without knowing the actual 'theatre year' (the first digit must be 1, of course!), you need a list of squares (from calculator or maths table) and determination! Clue for A-ac is important. Happy hunting.

Solution 'Common factor'

5	5	8	6
4		4	9
8	3		7
1	8	6	2

Four of nine clues are redundant.

Three out of every four computers going into schools are BBC Micros.

Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

The most sophisticated version (called

Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

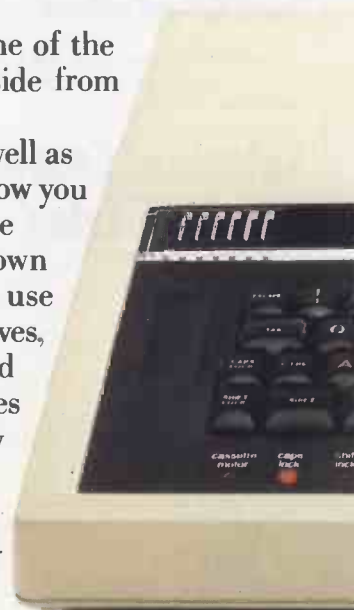
This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.

You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second



3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

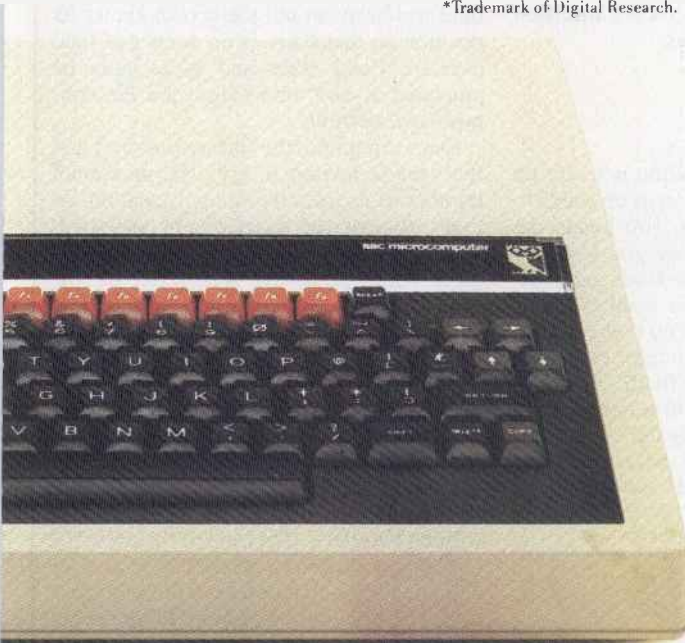
Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.



A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

The best possible back-up.

Your BBC Micro comes with the backing of the BBC and an extensive dealer and service network. Each approved dealer is able to offer advice and carry out expansion work and repairs.

BBC Microcomputer – Model A and Model B.
2MHz 6502A Processor.
32K ROM; 16K RAM Model A, 32K RAM Model B.
Full QWERTY keyboard with 10 user-definable function keys.
Mixed high resolution graphics and upper and lower case text.
300 baud and 1200 baud interface for standard cassette recorders.
Three-voice music synthesis with full envelope control feeding internal loudspeaker.
Interface sockets (Model B only) – RS423, for analog inputs centronics and user port.
6502, Z80, 16032 second processors.
Single and Dual Disc Drives with 100 and 800 K-bytes storage.
Teletext unit.
Speech synthesis.
Networking facility – via Acorn Econet®

How to buy your BBC Micro.

If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

All orders are despatched by fully insured courier and come complete with easy to follow 500 page User Guide and Welcome cassette.

 01-200 0200 credit card holders.

To BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please send me _____ BBC Model B Microcomputers at £399 each, inc. VAT and delivery. I enclose PO/cheque payable to Acorn Computers Limited Readers A/C or charge my credit card.

Card Number _____
Amex/Diners/Visa/Access (Delete)

Name _____

Address _____

_____ Postcode _____

Signature _____

PCW7
Registered No. 140 3810 VAT No. 215 400220

The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.



SOFTWARE DATABASE BENCHTEST

OMNIS

A universal data management package? Kathy Lang determines whether OMNIS lives up to expectations.

In this series so far, the great majority of systems reviewed have been for the CP/M and MS-DOS operating systems, which are very commonly available, and similar to one another to the point where MS-DOS disks can convert files from CP/M formats. This month the subject is a data management system which runs under UCSD-p — the Pascal operating system which claims to be the most portable of all. Certainly OMNIS runs on a very wide variety of systems, from Apple II through Z-80 based systems such as SuperBrain and Osborne to 16-bit systems like Sirius, IBM PC, DEC and SAGE II. In each case it uses the 'native' processor so that you don't need to install a Z-80 card to run the system. Here I shall be looking at how such a system, which almost any disk-based micro can use, compares with others which are more system specific.

OMNIS records are of fixed structure and length; the first field in each record must be a key field, and up to nine others may also be indexed. These indexes are all kept up-to-date. File structures can be changed only by copying the file out to a plain text format and back into OMNIS again. You cannot link one data file directly to another. Any record or group of records can be retrieved either via indexed key fields, or (more slowly) by selecting records which match criteria based on any fields. The package uses menus to get down to the level at which the user's records are displayed on the screen. When processing individual records, commands are used, but

you can ask for a list of those available to be displayed on the screen. Quite extensive security facilities are provided to ensure that users have access only to appropriate parts of the system, and to the information which the Master user thinks they need.

Constraints

The main constraints on the use of OMNIS are shown in Fig 1. The most significant for many applications is the restriction to a maximum of 79 characters in a text field — that is, each field must fit within a single line of an 80-column screen. On the plus side, you need not have all your data on a single screen — fields of a records may span up to ten screens in record insertion and amendment operations.

File creation

The first stage in file creation is to set up formats for one or more screens on which to enter records. To do this, you locate the cursor in the position where you want the field label to begin, type the label, and position the cursor where you want the field contents display to start. You then press an ESCape sequence to go into command mode to give details of the field. The first is the name by which the field is to be known to OMNIS (not necessarily the same as the 'label' displayed on the screen, as the OMNIS name is restricted to seven charac-

ters). You can include the same named field several times — for instance, a reference number once on each screen for applications where a record spans several screens. (That invaluable facility is not documented in the present manual, and can therefore provide an unnerving surprise if you type an existing name by mistake.) Other attributes to be supplied include the length and type of the field, whether it is to be indexed or not, and some additional optional characteristics such as the permitted range of values (which can include 'wild' codes), the precision of display of numeric fields, and, for calculated fields, the nature of the calculation to be performed. There is no provision for echoing, for instance, the value of the same field in the preceding record. When a field has been set up, the screen shows its position so that there is no danger of field overlap. Field sizes and types may be amended at any time before the file contains real records.

Once complete, the format is stored and the user is invited to give the maximum number of records the file will contain, so that sufficient disk space can be allocated. This took six minutes for a 1200-record file on a single Sirius disk. The space can be allocated on one or more disks. The OMNIS/UCSD-p volume assignments seem to use the Apple conventions. Being unused to these I found this part of the package a little confusing, but managed to set up the file for my Benchtest data correctly by carefully re-reading the manual.

Once a file structure has been set up, and records stored in it, it cannot be altered within OMNIS — not even to the extent of changing the fields to be used as keys. Nor can you decide that you need more records than you originally expected. (The details of screen display can, however, be altered — see below.) If you need to change field lengths, add extra fields, define more or different key fields for indexing, or increase the maximum number of records allowed, you must write the file out to a plain text file in DIF™ format (see below, under 'Links with Outside'), redefine the file format, and read the records back into OMNIS. This is a very slow process — see Fig 2 for my benchmark timings. Many packages have

Max file size	32,767 records, not limited to one disk
Max no records	as file size
Max size record	1023 characters
Max no fields	120
Max field size	79 characters
Max no index fields	10
Max no sort fields	10
Calculation limits	5 levels of brackets, 120 calc fields in reports
Report limits	240 rows by 240 columns
Field types	character, numeric, data (day/month/year — stored as 6 chars)
Field modifiers	upper case conversion, protection, decimal places to display

Fig 1 Constraints

this inflexibility over changing record structures, but few take it to the point of restricting changes to key field definitions, or to the maximum number of records, to such a procedure.

Data input and updating

Record insertion and amendment is carried out via the maintenance function on the main menu. Once this function has been requested, you have a number of commands available, including 'I' for insert a record, and 'E' for edit (the current) record. The commands are activated by pressing the ESC key — once or twice, depending on your system — followed by the command letter. To retrieve a record for editing, you can specify the value of any of the key fields. The procedure is to issue the 'find' command, which results in a screen display of the record in the format set up at creation time, with the cursor on the first field. By pressing the RETURN key, the cursor is moved from one key field to the next until the desired field is reached, when the data to be matched is entered. Once the field value is entered, pressing RETURN again instructs OMNIS to search for the nearest match. Alternatively, pressing CTRL/N will request an exact match. I found this an acceptable compromise method of retrieval, and quite quick to use (see Fig 2 for times). Records can also be retrieved for editing with the 'select' command, about which I shall say more later.

Once a record has been found and displayed, you can either issue the 'edit' command, or ask for the 'next' in sequence (of the field used to select the record for display). So you can scroll forward through records with identical values for the key field. You can't, however, scroll backwards. Data editing is carried out by direct screen editing, using the cursor movement keys in the usual way. Deletion involves pressing CTRL/D once for each character to be inserted, and then typing in the insertion over the spaces. You can also move backwards and forwards among the screens of data for one particular record, using commands. Since records are stored to the file after being added or edited, the indexes which give access through the key fields are automatically kept up-to-date.

Displaying data on the screen

The screen formats set up when the file is created are always used to display records when accessed by the 'find' or 'select' commands. Screen display can include not only the data items themselves — which incidentally may be shown left or right justified or centred within the space for the field — but also features such as lines drawn to make the display more readable. The screen format creation section includes some commands to make this an easy feature to use. You can mark a rectangle on the screen and then ask OMNIS to draw a line round the rectangle with user-specified

characters. In addition, the order in which fields are displayed need not be the same as their order in the stored record, so although the first field in the record must be a key field, it does not have to be displayed as the first field on the screen.

The restriction to a single overall display format for 'find' and 'select' access means that you cannot vary the way the data is displayed for editing according to the needs of different applications. You can, however, restrict the display so that particular fields are not shown if you don't want the user to have access to them. So it is possible, for instance, to permit a clerk to update staff names and addresses without also permitting that person to see, still less change, staff salaries. It is also possible to display data in a variety of different formats if the need is for viewing only, and no changes or updates are required. This is achieved by the 'report' function, as any report may be shown on the screen instead of being printed. So if you simply wanted to view a few fields from selected records on the screen together, listing them one line at a time, you would have to set up a report format for that function.

OMNIS also has two features which permit repetitive amendment. A group of records meeting certain criteria can be deleted 'at a stroke' with the 'zap' command. A group of records can also be amended by the 'multiple update' command, allowing such useful actions as increasing all prices by five per cent, or upgrading salaries for all individuals in a particular staff grade by £500. The criteria for selecting records to be deleted or amended are set up in the same way as criteria for use by the 'search' command, described later under 'Selection'. The calculation facilities in 'multiple update' are the same as those permitted during data entry, which are described later under 'Calculation'.

Printed reports

The provisions for printed reports in OMNIS are extremely powerful, but quite complex in their use and explanation. The format itself is designed in a very similar fashion to the screen display format, using a mainly 'paint-a-screen' approach which I personally find quite helpful. But the way in which sections of the report are specified is less easy to understand. Each report may have up to 12 sections — one detail section, a heading and a totals section, and up to nine sub-totals sections deriving their values from fields specified as sort fields. Instead of some form of labelling of these sections on the report, they are separated from one another by a single exclamation mark, so that only by counting can one identify (when designing the format) the detail, total and other sections. Any field for which a sub-total is calculated may, if desired, force a page-break when its value changes.

In addition to field values from the record, any section can include calculated values — up to 120 variables may be defined, calculated from field values and/or constants. You can also include the page number, a count of the number of records processed so far, or the current date. Report

formats can subsequently be modified (but I couldn't find a way within OMNIS to keep a previous version of a format and also use it as a basis for constructing a new stored format). The formatting of the 'detail' section is sufficiently flexible to allow inclusion of enough text to write personalised letters including OMNIS information. This is a big advantage, and not very commonly found in data management systems. However, don't expect full-blown word processing capability — for instance, you can specify that a field in a letter is to be of varying length, so that the rest of the line is moved over to close up the gap, but remaining lines stay in place rather than the whole of the rest of the paragraph being moved up in WordStar/Mail-Merge fashion.

The paper layout is specified by a separate menu option, so that you can control numbers of lines on the paper, margins and line spacing. You can also vary the number of records printed across the page, to permit the printing of mail labels which may be 'two-up' or more (up to six in OMNIS). If you only want totals printed, you can at this stage suppress the printing of the detail line. You can also specify pausing at the end of a page, in case it is necessary to print a report on single sheets rather than on continuous stationery. If the report is displayed on the screen, OMNIS pauses at the end of each screenful of information.

In addition to formatted reports, it is also possible to 'dump' a copy of the screen to the printer while editing.

Selection

For screen display, records may be selected either by the 'find' command which I talked about before, or by the 'select' command. This allows you to set up to ten criteria, which will be tested to see if a record meets the search requirements. The setting up process involves filling in up to ten lines of a form displayed on a separate screen, rather than by building up a single combined command. Fields may be tested for equality, less than, greater than, not equal, starting with or containing a constant value. (Matching against another value in the same or another record is not permitted.) If more than one test is employed, the results are 'ANDed' together, so that a record only passes the test if it meets all the criteria — this is to a large extent a consequence of the method used to set up searches. Searches may be executed immediately, or stored in a file for subsequent retrieval. Once a record has been retrieved through the 'search' command, it can be edited just as if it had been retrieved with 'find'.

Stored searches set up through the 'search' command may be used to control the retrieval of records for printed reports; this may be tied to the report format if a report always involves a particular selection, or activated dynamically when the report is invoked.

Sorting

If you retrieve records with the 'find' command, and then issue 'next' commands to

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browse forward through the data, the file will appear to be sorted in the order of the field used for retrieval. To get records sorted in order using more detailed sequencing, you must use the 'sort' facility within the 'report' function. This allows sorting on up to nine fields, each of which may be in ascending or descending order. Once sorted, records can be displayed either on the screen or on the printer as described in the 'report' section above.

Calculation

At input and during multiple updating, you can specify calculations based on constants or field values, combined with the conventional arithmetic operators. No memory variables are available for storing intermediate results, but at the expense of disk space you could allow an extra field or two in the record itself for this. The number of data fields allowed is quite generous. Order of execution of arithmetic statements may be modified by using brackets, which can be nested up to five levels deep. During the preparation of reports, up to 120 calculation fields may be defined, using the same features. These calculation features are relatively powerful, and should, with the provisions for totalling and sub-totalling, cater for most needs.

Multiple files

OMNIS can handle only one file at a time. However, communication between two files can be achieved through converting to DIF™ format and writing out again — see 'Links with Outside'.

Tailoring

Within its own provisions, OMNIS is a flexible package, and it permits the storage of search sequences and of report formats (including sorting and selection criteria) for subsequent use or modification. But it doesn't provide the ability to set up a sequence of operations which combine the use of several commands in a predefined sequence, to permit full tailoring to a particular application.

Security

Protection against ill-considered or unauthorised use of OMNIS is provided in a variety of ways. When the screen format for data entry is set up, fields may be protected; a record which contains one or more protected fields may not be deleted in normal operations. This provision applies to any user. An extensive set of facilities control the extent to which individual users or classes of user (four 'users' plus the Master user, each identified to the system by a password typed in when the system is started up) may access OMNIS functions, and

fields within records. Control may be very detailed, but the principle is that users can be given full access, allowed to modify and add data but not amend or create file structures. They can be permitted just to see records but not change them. Control over access to individual fields could be particularly useful in environments, such as hospitals or personnel offices, where information tends to be a mixture of the public and the confidential.

Housekeeping

Access to the housekeeping facilities of UCSD-p is included within OMNIS, so that by using an option given when the system is started, you can copy, delete or rename files. You can't at the moment format disks in this way, although by the time you read this article, OMNIS should include a formatting facility.

Links with outside

The link between OMNIS and the outside world is provided by the ability to read and write files in DIF™ format. This is a format devised by Software Arts to allow exchange of data in plain text form between packages. In the full form as used by OMNIS it includes the specification of field names, which makes it possible to use the format to bring back into OMNIS a file whose format needs to be modified, for instance by the addition or deletion of fields or by defining different key fields. It is relatively easy, if rather tedious, to create records in the DIF™ format in most programming languages. In addition, a number of other packages, notably VisiCalc, can read files in DIF™ format. The processing of DIF™ files within OMNIS is, however, extremely slow. I stopped my Benchtest 6, which usually imports 1000 records from an external file (DIF™ format in this case) after 800 records and 2 hours 45 minutes of continuous disk activity, to save further wear on my disks. I didn't carry out Benchtest 1, which involves adding one new data field to each record, as this would have taken the time to write a DIF™ file out from OMNIS, plus at least the time for Benchtest 6 to read the records back into OMNIS using the new record format.

Whether this slowness is a serious problem depends very much on your application.

User image of the software

As is so often the case, OMNIS is a mixture of good and bad in its ease of use. The blend of menus and commands is sensible. It uses menus to get down to the record handling level, and then commands to handle the individual records. The ability to show available commands on the screen on request is very valuable. On the other hand, I thought the menu arrangement unimaginative: in particular, all the record handling — insertion, amendment, selection for screen display — is covered by one main menu option called 'Maintenance', so that you would almost always have to call up the next level of menu to carry out the most frequently used operations. And the report formats were extremely complex to set up, although less difficult in practice than the current manual makes it seem. In particular, the method of numbering the fields on the screen, and the instructions for displaying sub-totals, were in my view very confusing. The report facilities do include the ability to test the format before live printing, a very valuable but necessary feature.

The users of OMNIS to whom I spoke were very happy with the package — one went so far as to say 'I don't know what we'd do without it'. The ability to span several screens, the power of the calculations, and the flexibility of reporting were features which were particularly mentioned.

Documentation and support

The documentation for my review system consisted of an A5-sized manual, which is in two parts: a tutorial section and a reference section. There is no summary of reference material — including commands — nor is there an index. So although the manual is much smaller and less intimidating than most, it is quite difficult to find exactly what you need to know. I also found the style rather dense and a bit sententious,

BM1	Time to add 1 new field to each of 800 records	NT — see text
BM2	Time to add 50 records interactively	2 sec/record
BM3	Time to add 50 records 'in a batch'	NT — only via DIF™ file
BM4	Time to access 50 records from 800 sequentially selecting on one field	20 mins 50 secs
BM5	Time to access 50 records from 800 by index on 25-character field	4 mins 35 secs + scrolling
BM6	Time to index 800 records on 25-character field	NA — updated
BM7	Time to sort 800 records on 5-character field	22 mins 25 secs
BM8	Time to calculate on 1 field per record and store result in record	25 mins 10 secs
BM9	Time to total 3 fields over 800 records	26 mins 15 secs
BM10	Time to import a file of 800 records	2 hours 45 mins

Notes: NT=Not Tested NA=Not Applicable — indexes kept up-to-date, new index fields not allowed

Fig 2 Benchmark times

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and the structure (with the chapter numbering continuous through both tutorial and reference sections) confusing. On the other hand, the tutorial section does give page numbers for the reference section showing where further information is to be found. The manual included all the major features of OMNIS itself, with some minor omissions. But I was sorry that it lacked a description of the DIF™ format, to ease the problems of people trying to get information into OMNIS from other packages, or out to other processing programs.

The disks as distributed include some example data files, which are very valuable for trying out the system to start with. Not all the examples in the manual had been tried out on the sample data, though. The example given of selecting a field from the same data file used in the manual specifies a search for which there are no matches in the sample file. . . It is to be hoped that this and other deficiencies will be remedied by the revised version of the manual, which I am told includes a complete rewrite of the tutorial section, and which Blyth Computers Ltd (suppliers of OMNIS) says should be available by the time you read this. But, as with any other package, you should make a point of looking carefully at the manual before buying.

Support for OMNIS is provided both by dealers and by Blyth direct, which has a support person working full-time on a 'hot line' for dealers and registered users. Customers speak well of Blyth's support — 'Blyth has been extremely helpful,' was a typical comment.

Conclusions

OMNIS is a powerful and flexible package, which is available on a wide variety of sys-

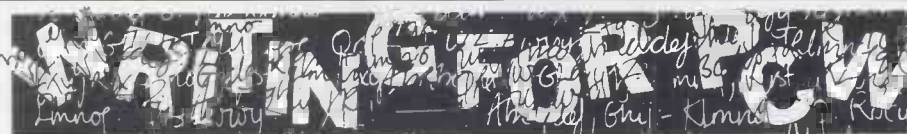
tems under UCSD-p, and is well-liked by its users. It can cope with quite large records, and its files can span more than one floppy disk. The calculation features are good. Its retrieval facilities are less flexible than some — the ability to combine selections only with AND would be a disadvantage to many — and it can cope with only one file at a time. The reporting is extremely powerful, but some of its features are not very easy to use. This is in contrast to the rest of the package, where by and large the mixture of menus, commands and direct screen entry using cursor movement was quite successful. If the other software you are using is not running under UCSD-

p, you would be limited to translating files across disk formats using the UCSD-p Xenophile utility.

The package is competitively priced, but its performance, as shown by my benchmark (Fig 2), is not particularly fast relative to other packages I've tested, except when retrieving records directly by key. In summary, OMNIS is well worth looking at for handling information with a fixed structure, especially if you are looking for a package running under UCSD-p. But make sure you take a good look at the manual, and see the package working on a size of file comparable with those you will be using.

Summary

Package Type	Data management: single file, fixed length records.
Facilities	Selection, ordering by indexes kept up-to-date automatically, powerful calculation in records and reports, good reporting, important export of files in DIF™ format, password protection on functions and fields, 'paint-a-screen' formats for screen display and printed reports. Changes to structure and max number records only by copying records out and back.
Ease of Use	Good, with exception of reporting.
Error messages	Clear when provided — some non-vital omissions.
Documentation	Not very clear, sententious, some omissions, no index or reference summary. Being rewritten.
Costs (ex VAT)	£195 for Apple II; £295 for Sirius, IBM PC single-user systems; includes 'hot-line' telephone support. Updates £15 per release. Special prices for networked systems.
Supplier	Blyth Computers Ltd, Suffolk. Tel: (050270) 371.



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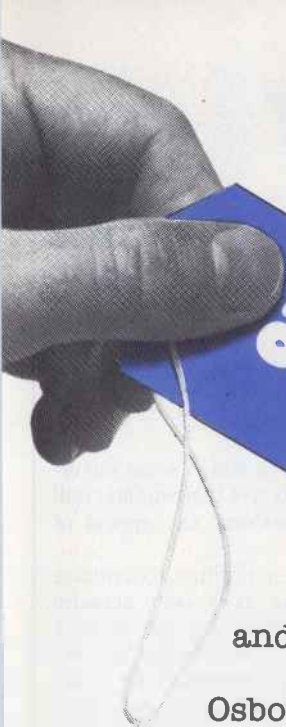
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THE DREAM MACHINE

A profitable use of myths? Maggie Burton asks whether the computer user is being exploited.

Two well worn stereotypes spring to mind when computers are brought into conversation. One is the huge laboratory filled with the requisite ingredients of germanic scientists, odd tubes and flasks full of bubbling noxious liquids and, of course, our old friend the computer with its whirring tape reels, bleeping noises and flashing lights.

The other is the 'open the pod door, Hal' Star Trek animal, as characterised in the film 2001. It knows where the space heroes are going, knows the sound of their voices and probably knows what will happen in the future. Again, all the bright lights, odd pictures on screens and huge tape reels are still there.

The supercomputer as immortalised in films and books for the past twenty years has not changed fundamentally since its conception. What has changed are the voices — they're more human; the lights — more aesthetically pleasing; and the shape, which is now more likely to be hexagonal or otherwise polygonal (witness the CPU of a Cray-1) than the wall-to-wall valves of sixties sci-fi.

Why am I talking about fantasy computers? The answer is this: the fantasy colours people's attitude to the fact. The advertisements perpetrate the myths. Users learn to exploit the myths for personal gain. Bureaucrats and banks hide their incompetence in the data banks of their mainframes. Fantasy computers have apparently random wiles and predilections. They have minds of their own and they can possess the minds of humans. They may make profound and unauthorised governmental decisions. They argue. They might let off nuclear rockets of their own will. On the bright side, they are mentors and encyclopaediae to their users. I read a story when I was about fourteen about a computer which was so powerful it could turn itself off and on at will — and thus could not be shut down by anybody. The machine took over the running of the government who installed it, and effectively scuppered the whole country's essential services. Another recently published novel depicts the tale of the little boy whose best friend is his little computer. Some of these fictional machines are credited with intelligence far greater than that of their human creators.

Now computers are in millions of people's homes throughout the world. They run many office services and are in use in medicine, science and law. But the myths live on.

The myths live on because the adverts tell you you can do anything with a computer; you ought to have one, it'll solve all your problems. The myths are also perpetuated because there's so much destruc-

tive publicity and so much bungling surrounding computers. Stories about computers messing things up are rife — apocryphal tales have won a permanent place in our culture and are in popular circulation. Computers do seem to have an almost human ability to make mistakes, and in this they are as human as the programmers who fit them for their work. But people still come out with nonsense like 'our computer won't allow that', and so on.

The myths live on because the adverts tell you you can do anything with a computer; you ought to have one, it'll solve all your problems.

In the Colour Genie software review on page 160 I tried to picture the disillusionment which must be felt by many home computer users when they get their machine home only to find it won't load a cassette. The reason for this sort of thing is good old time honoured human stupidity (on the part of the manufacturers, that is). It is reflected now everywhere you look in the computer industry — in marketing policy, in product quality and availability and in support. Particularly, in support.

In the case of cassette loading, I know some companies make cassettes which load far better than those of their competitors — and sell them for roughly the same price.

How, furthermore, can a micro be deemed an educational tool when there is no teaching software available for it? It is only educational as a micro to teach you about micros then, and you can bet your life your kids will be great at little more than playing space invaders or donkey kong after it's been in the house a while. It will not be truly worthwhile having a computer in the home (or in business for that matter), until its limitations are widely acknowledged. The machine can in no way do everything and we have a long way to go before computers are as useful as they might be.

There are still a large number of people of sound (even superior) intellect who hardly know what a micro looks like, never mind what it can do. Buyers are buyers because they 'ought to get one', because 'everybody else has one', because 'computers can make life easier'. They are still buyers in the dark, surrounded by a feeble lack of initiative and imagination and an oily sea of competing adverts. Try looking into what some of these ads must mean —

and the idiotic way in which some advertisements even try to give their square, dull coloured, sterile products sex appeal of all things!

I may not be in a position to criticise advertising (as long as it isn't actually lying) but I can say this: you can no more teach a goat to talk than you can educate your children using a computer for which the only available software is Asteroids, Adventure, Pacman or downright unfriendly. A lot of imagination, coupled with a lot of revamping of other, older bits of imagination, goes into computer games. Sooner or later it will have to be realised that there ought to be as much genuinely useful software as there are games. While the myths live on, the computers sell — there's no need to worry if there's no software for them. And next year today's popular small micros will inevitably be replaced by a bunch of new ones — with little more software than we know on our micros now.

The sum of all these points is simple: were it not for the myths and fantasies home computers would not sell to anyone who wasn't an enthusiast.

The end product of making computers available to the man on the Clapham omnibus has simply been to add to the confusion and, in many ways, to make even more difficult the integration of these machines into working and home life. I enjoy my computer; but I know what can go wrong. Afficionados can see the pitfalls into which the inexperienced may fall. There is such a rush to get people to buy and not enough of a rush to help them use and benefit from their computers. Money is made overnight. Some have become millionaires but not by being honest with their customers or by supporting their products — quite the opposite. As we have already seen, the trend is to keep a computer on the market for a year and then scrap it almost completely in favour of another one which offers twice the capability at half the price. The computer industry should offer at least the support we have come to expect of the motor industry — and this is often not enough. It is high time it was acknowledged that these machines need not be toys which are outgrown in six months — you can buy a video cartridge machine to do that. They have a whole lot of potential which is totally unexploited. Software (again!) should be written to stretch a computer and not hurriedly upgraded from a program written on an older and inferior beast. Is it too much to expect that users — even totally inexperienced ones — might one day get the best from their machines rather than be subjected to money making ploys?

END



GOOD MORNING CORTEX

C/WP CONTEXT has changed its name to CORTEX – but it's still the same powerful, cost effective, easy-to-use twin-processor microcomputer (faster in basic bench marks than IBM PC* or Sirius). CORTEX has superb graphics and C/WP's new version WordStar – best of the word processing software.

AN OFFER FOR EARLY BIRDS

C/WP makes you this extraordinary offer to celebrate the dawn of CORTEX. For £1895 you receive a 104k CORTEX with IBM-style keyboard, twin double density disk drives, CP/M operating system, the new Star 510 matrix printer, WordStar, Mailmerge and dBase II (the ultimate database system) with Autocode I automatic program generator – a present worth £2588.

Offer extended to 5.30pm 15 July 1983.

C/WP CORTEX

C/WP Computers, 108 Rochester Row, London SW1. Tel: 01-828 9000

APPLE LISA

Robin Webster and Leslie Miner give their exclusive report on Lisa. Here they weigh up whether or not Apple has succeeded in its aim of providing an integrated office system for the single user.

Not all traditional computer users will be happy with the new Lisa Office System from Apple Computer.

It is an indication that something serious has happened in the industry when people get opinionated or unusually picky about the suspected shortcomings of a product.

As the following review indicates, the Lisa represents a vast improvement in the ways in which users interact and the results they achieve with conventional systems. At \$10,000 Apple's new system is not low-cost, but it is powerful. While the hardware is state-of-the-art in complexity, everything else has been uniquely designed for one purpose: to simplify the interaction for the single-user. The ideal is that the machine, as one of its designers said, 'is finally cut from its roots in accounting and becomes primarily an extension of the user's ability to get results'.

With the mouse, a desktop interface, integrated software applications, and a high-resolution, multi-window display, the Lisa represents a new alternative: the office computer made as personal as possible.

In fact Apple has daringly and effectively cut across many perceived industry trends.

The feeling within Xerox, the company which did a lot of the conceptual work on window displays and icons with the Smalltalk software system and Star hardware, is reported as being, 'We blew it...'

The kind of response that Apple has had from its potential customers indicates an untapped demand for a Lisa-like machine. And since Apple is now ranked at 411 in the Fortune 500 (one of the youngest companies to attain the honour), it could be ideally placed to provide the right kind of computer solutions to its peer group.

In taking on John Scully as president and chief executive officer — replacing Mike Markkula, one of the co-founders — Apple has sharpened its marketing prowess, too. Scully, has already demonstrated his abilities by turning around the ailing international division of the Pepsi company, for which he was vice-president.

We had access to a Lisa for just a short time. Maybe Apple has gambled its corporate future on the roll of a dice, or maybe it has made a dramatic shift from being the company that started micro-computing with the Apple II, to the company that started it all over again with the Lisa.

SOFTWARE

This review of Lisa took place at Apple's Lisa division building located in Cupertino, California, in what had come to be known as the 'sneak room' — an area with six or so Lisas on permanent display to visiting Fortune 500 managers.

On entering the room, I placed some of my papers down on a table next to a Lisa which appeared to be switched off, and was surprised to see the screen suddenly glimmer. No keys had been pressed, the fact that I had inadvertently jostled the machine's mouse was enough to make it come to life.

Then the screen, sensing that no activity had occurred within a pre-set time, automatically dimmed. This is just a simple demonstration of Lisa's software capabilities.

The designers at Apple confessed that what they had held at the back of their minds was a 'vision' or central concept. This vision was the ideal user interface,

around which a whole new machine would have to be built, possibly a whole new genre of machines. Indeed, it would probably turn out to be the very machine that they themselves would prefer to use.

The result of this work is a far better understanding (as far as Apple is concerned) of how people interact with computer systems, and notably, a Lisa-like machine. To make absolutely sure that they were on the right track, Lisa's designers arranged with the company's personnel department that all new recruits into the Lisa division should be asked to act as test subjects on the prototype machines. These recruits first indicated the level of computer experience they had, and were then let loose on a machine. Careful monitoring of their responses in specific situations gave the design team a wealth of information.

The typical user interface (that is, the

operating system command line interpreter or shell) nurtures a small group of people who view computing as a challenge — a bit like bronco-busting in fact. They succeed more by conquering the command line interpreter than by using it to achieve results.

But even understanding how a conventional system functions doesn't guarantee that you will always be able to predict how it will perform. Disk errors, system lock-outs, incoherent error messages can destroy the work of even the best user. There's an ever-present fear of losing important data; a lack of reliability. This is what the Lisa team set out to conquer.

Not only is it visually clear where the Lisa user's data has come from and what's being done to it, but there is virtually no fear that any information will be 'lost' in the system.

With features like 'Undo Last Command', it can only get as bad as watching

Tom & Jerry ... after Tom is demolished in some way, you know that he'll reappear intact in the next frame.

Icons

Returning to the Lisa that automatically switched its screen on, let's examine what happens the moment a user begins to interact with the machine.

The first thing he sees is a blank screen except for a group of 'desktop' items that are at his disposal — a clock, calculator, clipboard, trash-can, and two special items called the 'ProFile' and 'Preferences' — see Figs 1 and 2.

The clock is used to set the system's time and date information; the calculator is actually represented on the Lisa screen as a full-function calculator and can be used as such; the clipboard is used for the temporary storage of information; while the trash-can is used as a hold area for unwanted files (the last item thrown into the trash-can can always be retrieved).

'ProFile', being the 5 Mbyte hard disk, is equivalent to a filing cabinet, while 'Preferences' is provided as a means of tailoring the Lisa's capabilities to individual requirements.

These screen images are called icons. In addition other icons can be generated; for example, if you wish to put a new file onto your desktop from a floppy disk, then a floppy disk icon will appear on the screen, with the document name beneath it once everything is loaded.

Even at this stage, there are those who are critical of the fact that such icons are used to depict 'real' objects, and they are critical of the specific icons that have been chosen.

We think that this is beside the point because the icons could be modified and improved upon if necessary. The real question is: 'Are icons a better method of interacting with a system than straight keyboard entry and special function keys?' Moreover, are they useful, and specifically, are they useful to Apple's target users?

What do you do with an icon? This is where the mouse comes in.

The Mouse

The mouse controls the screen cursor which can be moved directly to any icon. The icon can then be selected by pressing the mouse button once. Once selected, the icon changes into a negative image (that is, from a black outline on a white background to a white outline on a black background). The user can now act upon the icon by moving the mouse/cursor to a one-line menu bar across the top of the Lisa screen.

Menus

One-line system command menus are not new. The Lisa version seems to have some of the characteristics of the UCSD p-System menu. When you change from the top-level compile and execute menu on the p-System and go into the program edit level, the menu options change in

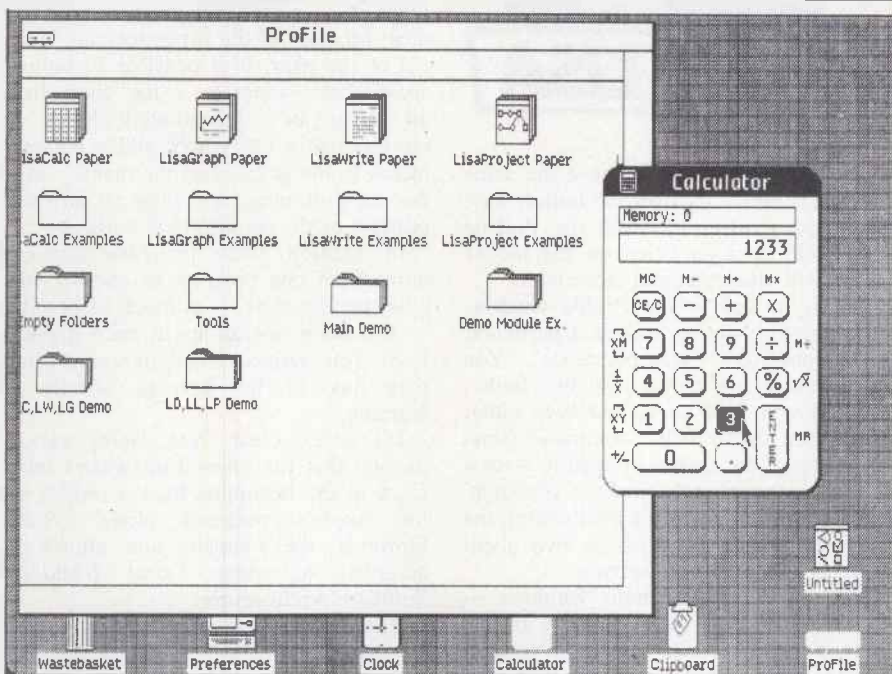


Fig 1 'ProFile' is equivalent to a filing cabinet.

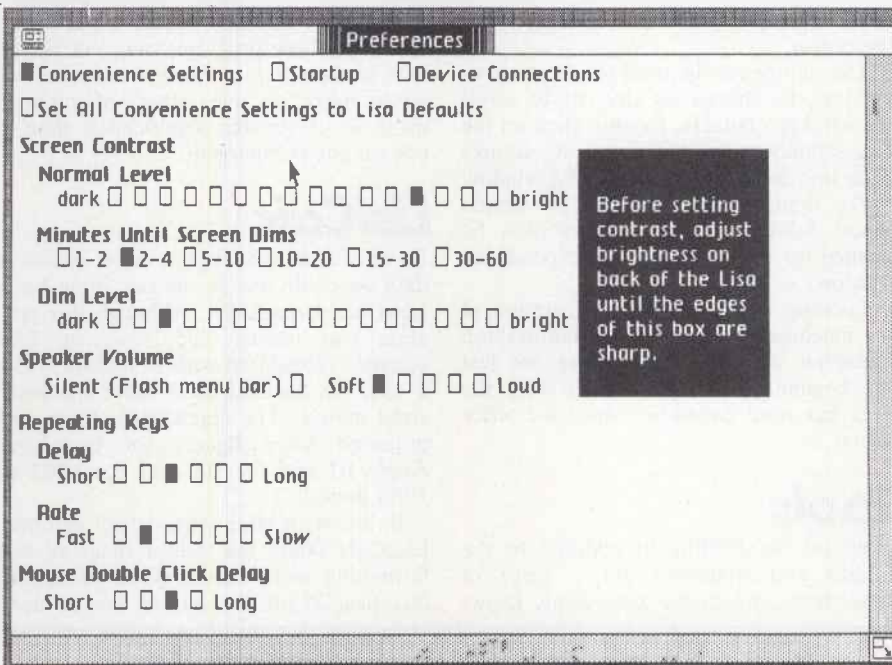


Fig 2 'Preferences' allows Lisa to be tailored to individual requirements.

keeping with the mode. It's no use having the 'Compile' option while you are still using the screen editor, to create code. The Lisa menu does change as well, not in terms of the mode (because Lisa genuinely is a modeless system), but simply to keep track of the applications currently in use.

If you are using the spreadsheet tool you are given a menu which reads: File/Print, Edit, Type Style, Page Layout, Format, Protect, Calculate. If you simply start at your desk and wish to see what's stored on your ProFile hard disk, you select 'View' from a simpler general menu: File/Print, Edit, View, Disk. By selecting View from the menu while holding the mouse button down, a range of more specific options are revealed in the form of a pop-out or pull-down menu.

'View' gives you three ways in which you can display the ProFile contents: Pictorial, Alphabetical, Chronological. Keeping the mouse button depressed,

you simply 'pull' the cursor down over the options and once the relevant one is backlit, let go of the button.

If 'Alphabetical' or 'Chronological' are chosen from the pull-down menu, the user is given a very recognisable directory listing which includes file names, file sizes, and the time and date they were created.

If 'Pictorial' is chosen, the user gets a first introduction to the Lisa's 'window' concept. An actual window opens up on the screen with the title ProFile. In the window are all the files on the disk represented pictorially as folders. New, unused files, seen as pads of stationery, are present too. The pads and folders are also icons and can be acted upon in the way described above.

Short-cut

For those readers who want to cut right through the menu selection route, there is

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a much quicker way to achieve the same result. In order to open a folder, say, within the ProFile, or even the ProFile icon itself, clicking twice on the mouse button will also open and close icons.

Once you are in the Profile window, suppose you want to look at a particular folder entitled 'Correspondence'. You again place the cursor on the folder, select it with one click, and then either click again or go to the command menu at the top of the screen to open it. A new window appears out of the Correspondence icon, and ends up overlapping the ProFile window — much as two documents would on a real desktop.

Note that although many windows — up to 20 or so — could be open on the desktop at one time, only one window can be active. If you want to look at a window lying beneath the currently active one, you must first select it with the cursor.

The mouse can be used to select either window, to change its size, or to scroll the window contents. Double click on the Correspondence folder and it shrinks back into its icon in the ProFile window — or double click on, say, an annual report folder, and its window will be opened up on top of the Correspondence window.

Looking at the graphics orientation of the machine — the windows, the desktop metaphor and the icon images are just the beginning — you can see why the Lisa has been called 'intuitive' for office users.

Tools

Held on the ProFile in addition to the folders and stationery are a range of other icons, which the user simply knows

'Lisa will be considered successful if the user can accomplish something unaware of the complex underlying engineering'

as 'Tools'. These are the six application programs, whose integration is a key feature of the Lisa system. To the user this means that he can use any tool on almost any document, at any time, just as he would at his desk.

The six packages are:-

LisaCalc — a spreadsheet program.
LisaWrite — a word processing program.
LisaDraw — a very impressive drafting/freeform drawing program that can be used in its own right, or to enhance the output from other Lisa Tools.
LisaGraph — generates all popular format graphs from LisaCalc or keyboard entered data.
LisaProject — generates a PERT-like project management schedule or flowchart, juggling tasks and resources. It is unique to Lisa.

LisaList — a personal database management program of the list processing kind.

For the user, it is possible to build a spreadsheet, generate a pie chart from all, or part, of it, immediately change the pie chart to a bar graph, add a personal memo to the graph, edit the memo, add a free-hand drawing, and then get an exact printout of the composite document.

In addition, while the Lisa user can move from one program to another with ease, he also uses — as much as possible — the same operations in each application. This reduces the amount of time that has to be devoted strictly to learning.

It's pretty clear from asking various people, that the name Lisa wasn't much more in the beginning than a project tag for Apple's personal office system. However, the company now allows the acronym to mean Local Integrated Software Architecture.

The following is a description of how we created quickly quite reasonable output illustrating some of the above programs — particularly LisaCalc, LisaGraph, LisaDraw, and LisaProject. Although these programs may not be the best in their fields, the fact that they all go to make up one integrated environment is of greater significance than a one-on-one comparison.

LisaCalc

First, we decided upon some fictitious data we could use as the raw input for a LisaCalc spreadsheet. Although this program can handle 255 rows by 255 columns (compared with Multiplan's 255 x 63), we decided on a more modestly sized matrix. The spreadsheet topic was projected sales figures for the Lisa, Apple III and the IIe over the 1983 to 1985 period.

In line with other spreadsheet systems, LisaCalc offers the user a range of cell formatting and formula creation/copying facilities. While the mouse can be used

to select cells for data entry, the cursor control buttons on the numeric pad can prove just as handy. There are two nice features about this program. It shows which cells are being changed during a 'what if?' calculation by shading them grey. And if you want to format, say, a money value, the exact way it will appear is controlled by the contents of the 'Format' pull-down menu. So, if you want your dollar amounts to be preceded by a dollar sign, and show commas for thousands, you would use the mouse to select the '\$1,235' option. If you wanted it to appear with cent amounts, you would choose the '\$1234.56' option.

Special cell features include cell lock, circle missing values (this highlights those cells referenced by a formula but which contain no valid data), 'Undo'

(can usually cancel the effects of the latest operation), and 'Revert To Previous Version' (this very useful feature can get you out of many sticky situations by dumping everything out and reloading the last saved version of a spreadsheet). Since LisaCalc can manipulate a 255 x 255 matrix, the multiple window feature — up to six horizontal or vertical splits can be made per spreadsheet — is also a necessity.

For the Lisa, we decided to show sales increasing over the three year period from \$100 million, through \$400 million, and reaching \$600 million in 1985. Figures for the Apple III were \$250 million, \$350 million, and \$500 million, while for the Apple IIe sales jumped up from \$700 million to \$1000 million and then on to \$1400 million. By entering a formula for the first column of data we obtained the total income figure of \$1050 million for 1983. This formula, which merely added the amount of each product's sales in 1983 together, was then copied over to the 1984 and 1985 columns.

The next step in the procedure was to select the six sales cells (the total income figures were not included) from the spreadsheet and place them on the clipboard icon for temporary storage. This can be achieved by clicking on the relevant cells, and then using the COPY function available from the Edit menu.

LisaGraph

To put the LisaCalc data into LisaGraph, we had to open up the LisaGraph icon. Once this was open, we used the 'Paste' option from the Edit menu to transfer the LisaCalc sales information from the clipboard to the graph. Almost immediately, we obtained the bar graph shown in Fig 3. By simply choosing one of the menu options the bar graph could rapidly be changed into one of the following: line, mixed bar line, pie, and scatter graphs.

Other features of LisaGraph are that data changes are replotted instantly in a 'what if?' manner; the screen size of the graph can be enlarged or compressed; graphs can be printed out in four different sizes — ¼ page, ½ page, ¾ page, and full-page — and graph areas can be shaded in many different patterns. Also, in keeping with the concept of integration, certain functions, such as the selection of numerous typestyles and combinations of typestyles for titles, Undo Last Command and Revert to Previous Version are ever-present.

At this point, we printed our LisaCalc/LisaGraph work out on a dot matrix printer and switched to LisaProject.

LisaProject

LisaProject enables a manager visually to map the progress of a project. Individual activity, or task boxes, are created by the user and linked to form a schedule of activities leading to a goal.

For review purposes, we decided to create a simple 'Apple Team Project' chart using somewhat makeshift data

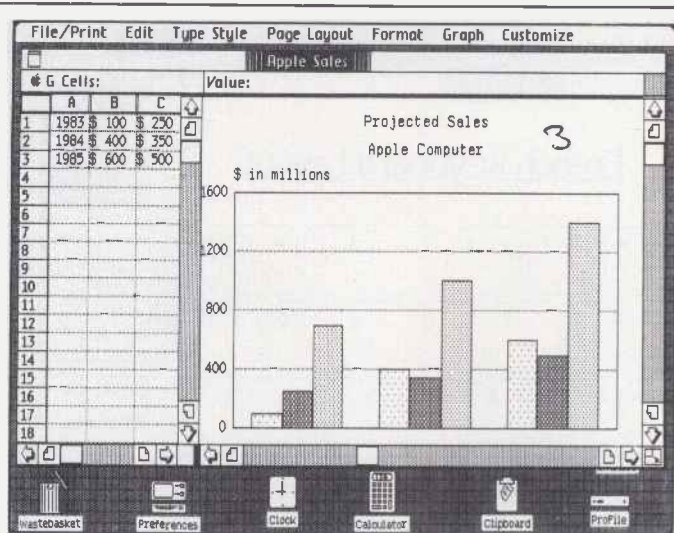


Fig 3 LisaGraph generates bar line, pie and scatter charts.

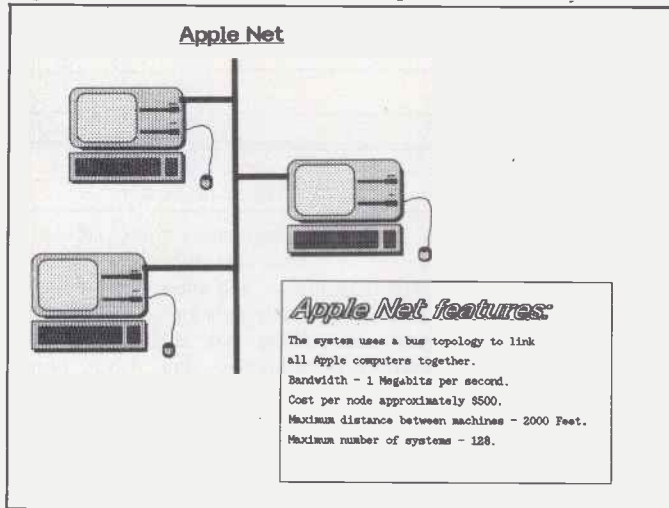


Fig 6 The Lisa drawing was composed with shapes from the palette, then shaded and cloned.

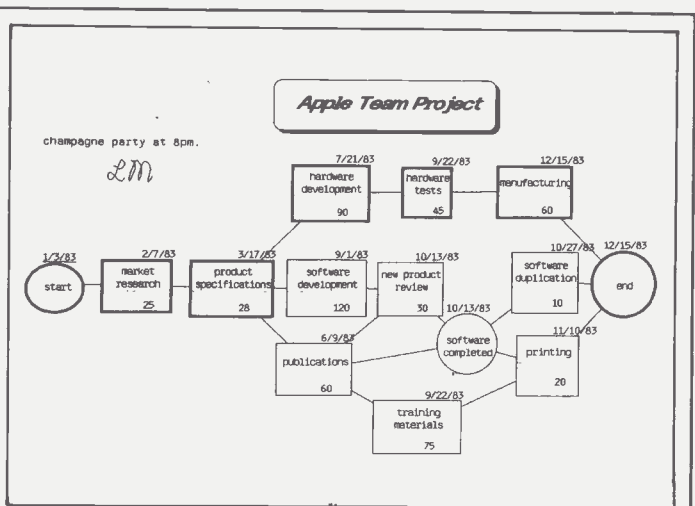


Fig 4 LisaProject automatically calculates completion dates for stages of the project and incorporates a 'what if?' facility.

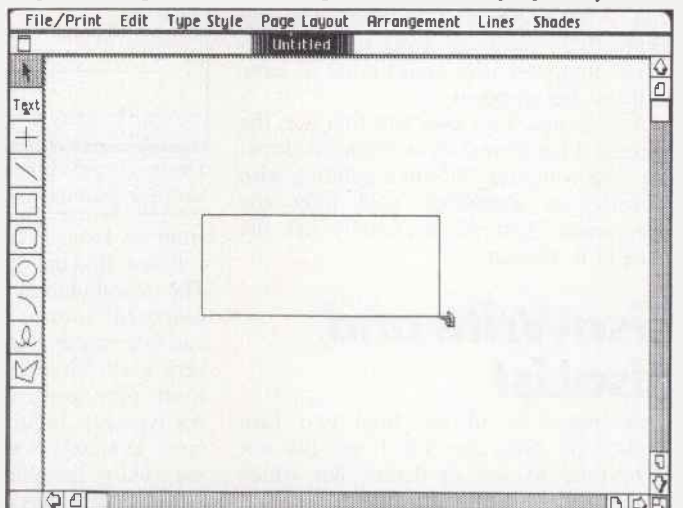


Fig 5 The ten options of the LisaDraw palette are displayed vertically on the left of the screen.

based on the Lisa project itself.

Every LisaProject chart has at least two 'milestones' (Start and End) which are displayed as circles. The specific activity boxes, such as the market research task and the connecting lines between them, are easy to draw with one movement of the mouse.

It is equally easy to add a box — like that marked 'training materials' — and to reduce the chart to a one-page display by selecting the relevant pull-down menu option from the 'Customise' command above (see Fig 4).

After each box is drawn a small cursor appears within it, signalling the user to insert text. This would be the name of the activity, its duration, and, perhaps, the particular staff member responsible for it. When we inserted the Start date within the left-most circle, LisaProject automatically calculated the completion dates for each activity and the End of project; it also highlighted the so-called Critical Path, the route along which any delays would delay the total project.

One of the major achievements of the Apple software designers is that they have brought the same 'what if?' scenario flexibility demonstrated in the LisaCalc and LisaGraph to LisaProject. Alter the data in any given activity box or boxes, and LisaProject will propagate this change through the chart.

This is not all. It is also possible for

the user to visualise project tasks and resources in two other forms besides the schedule chart reproduced below.

There is a Task Chart and a Resource Chart; the latter is a kind of personnel availability calendar, looking a bit like those holiday charts used in offices. The former, while it resembles the Resource Chart, displays projects tasks in the order in which they will be performed.

LisaDraw

Now here comes the fun ... We took our LisaProject schedule and pasted it into a LisaDraw window, so enabling us to enhance the diagram for use in a presentation.

A LisaDraw palette with ten options is displayed vertically down the left of the screen (Fig 5). Besides various shapes and lines, there is a free-hand symbol and a 'Text' option. Selecting the Text option, we first added a small memo (champagne party at 8pm) and then signed initials via the freehand line draw. We then gave the title a new typestyle, decided to reposition it, and put a box around it. Further enhancements to the text were always possible since there are eleven typestyles and other possibilities such as: Bold, Outline, Shadow, Italic, Hollow, Underlined, or any practical combination of these.

While the above is an example of

LisaDraw used to enhance something from another program, the next illustration was created entirely within the LisaDraw environment.

Again, the document was fictitious in nature (only the Apple Net specifications box is completely accurate). Using the Text option, the memo heading and other text was entered onto a piece of blank LisaDraw paper — no attention was paid to typestyle at this point. By selecting various primitive, or ready-made, objects from the palette (a rounded corner rectangle for the system unit, another for the screen, a right-angled rectangle for the keyboard, and so on) the Lisa drawing was put together. The mouse was a small box, but its lead, or tail, was drawn freehand (Fig 6).

The disk drive slots were drawn in under 30 seconds using lines of various thicknesses. At no time was there any fear of making a terrible mistake since all the lines and boxes could have been squashed to make them smaller, stretched to make them larger, or, if you really got into trouble, the Undo Last Command would come to the rescue.

Just to show how it would look, we then selected three different shades from a total pattern selection of 36, and placed each in a different part of the Lisa drawing. Then, the original drawing was copied twice and the two LisaClones were positioned on the memo sheet. The

APPLE LISA

box around the text at the bottom right was put there by again selecting the right-angle rectangle from the palette.

The titles 'Apple Net Features', 'Apple Net', and 'Memo' were then all customised using the timesteps option. The signature, on the other hand, was a bit more difficult.

Although we were the proverbial naive users, the main memo design work took about ten minutes (it could have been done much faster, and much better). Owing to unfamiliarity with the system, the freehand signature took maybe that much time again. There is no doubt that LisaDraw is the most visually impressive piece of software that an office computer user could hope to have at his or her disposal.

As any new Lisa user will find out, the hardest thing to master is freehand drawing with a mouse. 'It's like painting with a rock' as somebody said after the experience. You do eventually get the hang of it, though.

LisaWrite and LisaList

This brings us to the final two Lisa application programs which we did not have time to use in detail, but which should be covered briefly.

LisaWrite, the word processing pro-



There are 36 different patterns for shading. This French keyboard was created with the palette; freehand drawing with the mouse is the hardest to master.

gram on Lisa, is probably the best 'what you see is what you get' editor around. The combination of the mouse and keyboard allows fast selection, editing and reformatting of text. Block moves are very easy, for example, and all standard word processing features are provided. All typestyle, editing and Undo type features available with the other programs are used to their fullest in LisaWrite.

LisaList is described as being a personal database system. Essentially, it lets

a user input personal types of information — phone lists, customer lists, personnel details — and then sorts them by some specific attribute or combination of attributes. There are eight data field types: text, numbers, date, time, phone number, social security number, zip code, and money.

It comes with a file-recovery system that helps rebuild damaged databases in case of system or software malfunction. This should be welcomed by users since

Dialogue boxes (error messages)

Typical error messages, as you know and hate them, can be a pain to deal with. This is either because they are of the 'YXXE/2345.B, Diskerr...' type or they are crushingly blunt: 'Fatal error on system disk...'

If you are lucky, the manufacturer of the machine or the software vendor will have moved one step ahead by basing error codes on a numbering system. So, if you have a disk error, the system generates a particular code number and you look in the manual to see what action should be

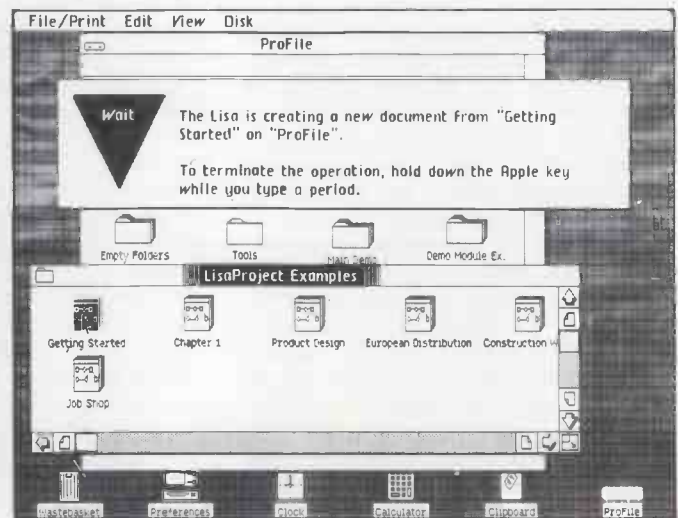
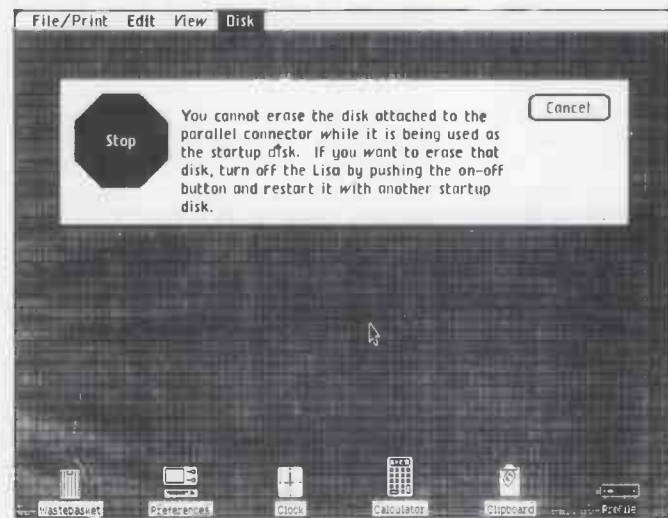
taken.

The Lisa, we think is way ahead in this field. Instead of error messages *per se*, the Desktop Manager communicates problems and warnings to users by the means of dialogue boxes. These dialogue boxes make use of familiar road sign shapes, so they are both visually obvious and unambiguous.

The messages included in the boxes do more to calm the user than quicken the pulse. The writing style is very casual, yet precise, and the boxes are big enough to

allow complete paragraphs of text, the dialogue road sign, and a menu selection area for the user. Cancelling a dialogue box cancels the command that brought it forth; selecting whatever other options may be offered will have a similarly logical effect.

Not once during the many hours we spent on the Lisa did anything catastrophic happen to data we were working on. Unlike the general type of error message, the Lisa version does not elbow aside your work just to make itself known.



LisaList can handle up to about 600,000 bytes (say, a 6000 x 100 character list) of data.

The main point about all of these integrated software programs is that they are designed to be understandable. They are not primarily designed for specialist tasks, but to make people feel comfortable rather than hesitant in their everyday office work.

The icons, windows and error messages (which appear as large road signs) are common to all programs, and are symbols of a physical world to which people can relate. The supposition is that people want to feel in total control of a concrete (rather than an abstract) manipulation of data for their concrete, real-world, projects.

As one of the designers told us, Lisa will be considered successful if the user can accomplish something without being aware of the underlying complex engineering that went into making the product reliable.

Lisa communications

Since the corporate office structure tends to be distributed both in a local and remote sense, Apple has had to devise a method of linking its Lisa equipment up into networks while at the same time keeping additional customer costs to the minimum.

The first communications product to come out on the Lisa will be Lisa Terminal. It will be another Software Tool and, as such, will be accessible through its own individual icon and tear-off stationary pad. LisaTerminal will provide TTY, Digital Equipment VT52 and DEC VT100 terminal emulation capabilities. The first release will not be able to handle sophisticated Lisa/host computer interactions; the uploading and downloading of text created in LisaWrite or LisaCalc is likely to be the major initial component.

Sometime later this year various IBM emulation programs will be released, putting the Lisa into an entirely different kind of ball park. There will be 3270/3271 Systems Network Architecture (SNA) support, 3780 Remote Job Entry support, and 3278 terminal emulation.

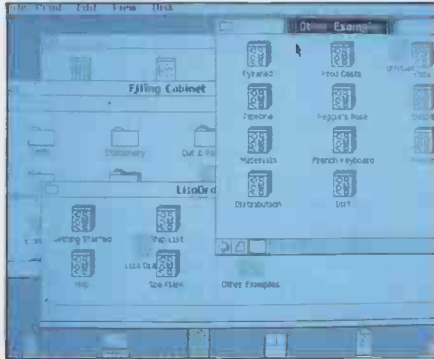
In a deal with Cullinet, formerly Cullinane, Apple will also be able to offer that company's Information Database product. This will allow Lisa users to top information stored on IBM mainframes in Cullinet's IDMS/R relational database product.

Also due for release this year is Apple Net — a low-cost, low-speed (1 Megabits per second) local area network system that can be installed at a cost of approximately \$500 per user connection, or node. This will link all of Apple's products — the Apple IIe, Apple III, and Lisa — together. It features the Carrier Sense, Multiple Access/Collision Detection (CSMA/CD) transmission protocol as used on the Ethernet system.

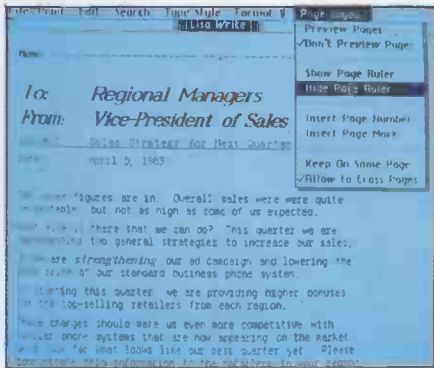
Up to 128 Apple machines can be supported on an Apple Net network which may use up to 2000 feet of coaxial cable.



Clear instructions.



Comprehensive choice.



Laying out a memo.

For those who want something more, Apple has arranged a deal with US company 3Com whereby 3Com will supply interface boxes that will tie Apple equipment into an Ethernet network (which has a 10 Megabit per second transmission capability).

The changing Lisa cursor

One nice touch about the Desktop Manager system on Lisa is that it has been programmed to take account of what might at first seem to be a trivial display aspect.

Although the main cursor is always shown as a slightly inclined arrow (↖), there are in fact six other cursor styles the user will discover. Within the matrix of a LisaCalc spreadsheet the cursor becomes a hollow 'plus' sign (+); in LisaWrite it becomes an I-beam (⌵) to allow the user to carry out precise selections, such as a full point or inter-character space, during editing work; in LisaDraw it takes on the shape of very small crosshairs (+) and the grab-hand shown in Fig 5. While the Lisa is doing a processing task that will take more than a few seconds, it also displays an hour-glass symbol, informing the user that it is busy.

The Application

Developer's

Toolkit

If the Lisa depends on any one thing in particular, it is the Application Developer's Toolkit (ADT) — the key method by which independent software companies will be able to create applications that make full use of the Lisa's mouse/screen/Desktop Manager.

The ADT has been under development for the last nine months and is now undergoing tests. The project was headed up by Larry Tesler, a key man in the overall Lisa project who originally worked on the Star system at Xerox. He has the honour of being one of the people who showed Apple staff members, including chairman Steve Jobs, the Star's abilities, an event which was to lead to a \$50 million, three-year project that came up with Lisa.

Independent software is already being put onto the Lisa; Xenix is expected to be available this month and CP/M-68k shortly thereafter. But it will not make full use of the Lisa's Desktop Manager. The user will get some fancy graphics, but not the cut and paste type of operations.

What the ADT does is to give the software designer direct access to a framework Desktop Manager — windows can be displayed as a matter of course, but the interactions possible and the types of data they will contain is left open. Essentially, the programmer fills the empty Desktop Manager with his own data control code. The ADT is a kind of Software Workshop. Problems like, 'how do you best represent an accounts receivable package with an icon?' are still not completely answered, though.

Apple research has shown that traditionally trained software people can take six months to get up to speed in terms of writing code for the Lisa, so the ADT will obviously be of benefit here. To make sure that they are not too strained, though, the ADT project workers have actually gone as far as extending the Pascal language so that classes of objects can be more easily referred to, but the code is still recognisably Pascal. Apple's Pascal with extensions is called Clascal and will most probably be made available as a separate product, outside of the ADT, at some future date.

As an added incentive to interested software companies, Apple is also offering selected organisations significant discounts on the Lisa (with a maximum of two machines per company) plus hotline support. Response has been high and machines are being shipped out. Companies like Digital Research and Microsoft have had machines for quite a while.

Apple states definitely that it does not want to get into the operating system or software development market. 'Six years from now there will be the same six applications from Apple and hundreds developed by independents' said one manager.

APPLE LISA

HARDWARE

Reviewing the Lisa in terms of what its hardware looks like and can do is rather misleading since there is no one part of the system which can be described as truly stand-alone. The integrated Desktop Manager software/the high-resolution screen/the mouse/the so-called Software Tools, and the CPU all work together in a highly coordinated manner. To force a distinction between 'the hardware' and 'the software' really overlooks the purpose of an integrated user environment.

At the very least, though, a description of the hardware will give you an idea of what it takes to make such a 'new wave' machine perform.

First of all, there are a couple of things to point out.

There is no such thing as a 'standard' Lisa in the conventional use of the phrase. Look at most computer manufacturers price lists and you will come across this mythical machine.

It always comes with too little main (RAM) memory; there probably isn't any disk storage included but, if there is, it will most likely be one drive; the video display will only provide the user with the simplest level of character generation; and, generally, no software will be present — except that locked in to boot ROM.

By the time you have purchased enough 'option' cards to make the thing do more or less what you want, the stan-

dard machine price has long receded into the distance and you really have made a capital investment. (Apple is a major offender here.)

This marketing approach, while comfortable for many manufacturers, tends to start customers off on the road to being something akin to system builders — they continually come across obstacles that can only be overcome by going out and buying more add-on equipment.

Such a situation is totally unsuitable for the professional/business customer, who is simply looking for methods of improving working practices. With this in mind, I'll give a quick overview of what the hardware looks like and then move

on to specifics.

For \$9995 a customer gets a complete Lisa system. This consists of the six integrated Lisa programs; the system box containing a 12in video display, the 68000 CPU, 1 Mbyte of RAM, and two of the Apple designed floppy disk drives; a 5 Mbyte ProFile hard disk; an IBM Selectric style keyboard; and, of course, the mouse.

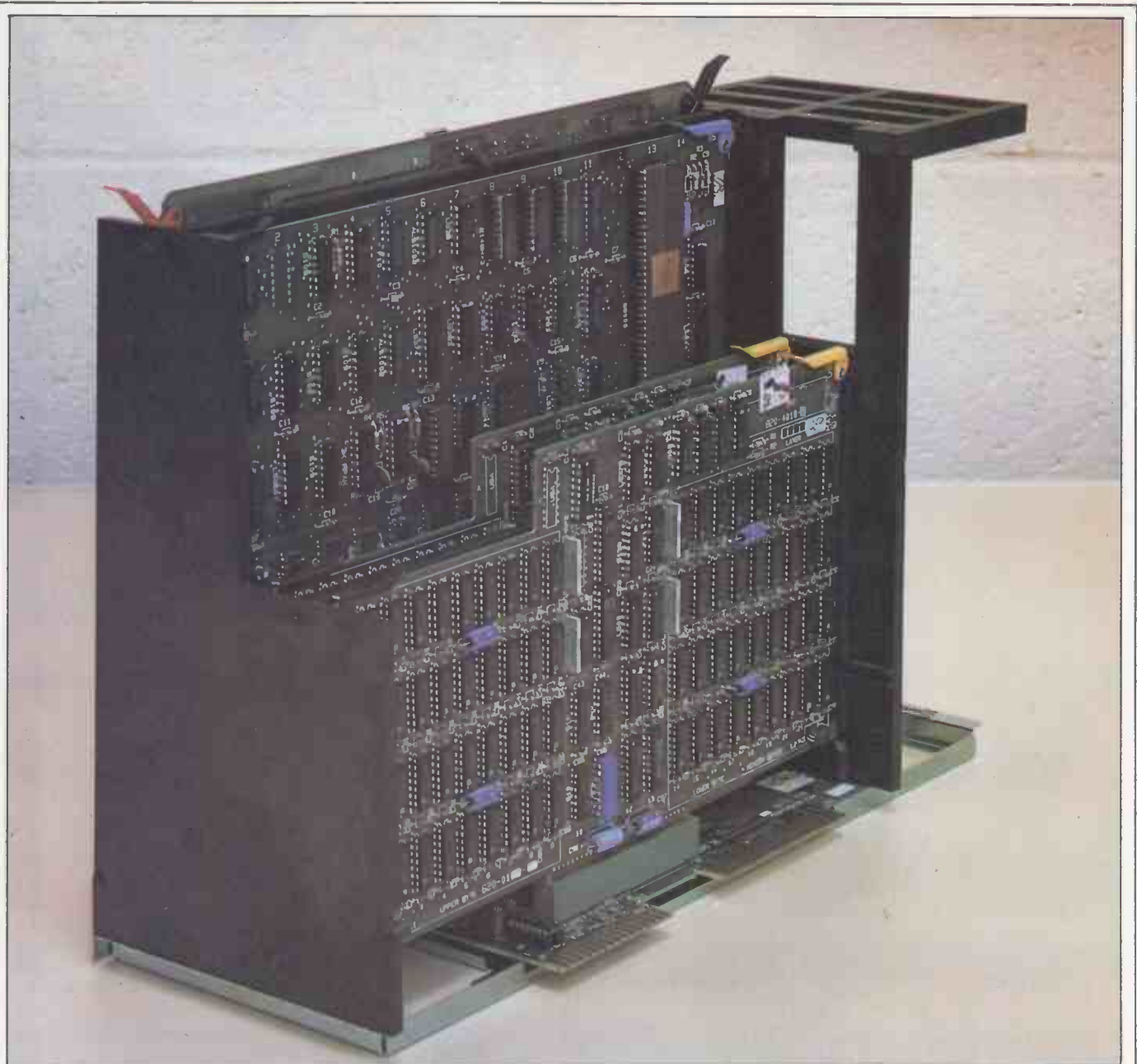
The System Unit: Lisa's case is made of moulded plastic and, while pleasingly compact, is smaller than one might imagine from photos. The 12in video screen is placed over on the left, while the two floppy drives are immediately over to the right. A nice touch is the hollowed-out area underneath the display and drives. Since the mouse is used for a majority of file and data manipulation tasks, this is used as a storage bay for the now under-used keyboard. Tucked almost out of sight to the right of this bay is the Lisa's shut-down key. Shut-down rather than on/off switch because the Lisa is designed to ensure that all open files are closed (that is, returned to



All 76 keys are programmable but the mouse is used to issue most commands.



The system unit is compact, incorporating 12in screen on the left and storage for the keyboard underneath.



A user can completely dismantle a Lisa into serviceable modules.

their relevant folders) before powering-down. This is a very powerful example of the interdependence between Lisa hardware and software.

One might imagine that because there is nothing but heavy disk drives and video equipment towards the front of the system unit, the Lisa might have a tendency to tip forwards. Apple designers overcame the problem by placing a couple of Sphinx-like paws on either side of the keyboard bay. Cooling vents are situated around the top, back and sides of the casing. All I/O connections are sited along the lower back.

Display

Having seen high-resolution systems such as the Three Rivers/ICL Perq and Apollo Domain, it wasn't too surprising to see a 720 x 364 bit-mapped video display which did a marvellous job of impersonating a piece of paper. The surprise is that it is now available on a commercial office product, using more or less standard chip technology, offering a set of six integrated software programs for

under \$10,000. Apple managed to keep the hardware costs lower than they might have been by deciding to use a 12in (half-page) screen format rather than the giant full-page (1024 x 900 pixel, or thereabouts) monitors supported by the Perq and similar devices. Also, since the screen is bit-mapped (each addressable picture element, or dot, can be represented by one or more bits in a reserved sector of memory), the smaller screen requires less attention from the CPU. The Lisa team decided not to use a graphics chip to handle the screen display (because they felt it might actually slow things down...) so the Motorola 68000 CPU currently timeshares cycles between main processing and the video memory map processing.

Mouse

A pointing device has now replaced keyboard input as the prime method of issuing commands to a system (see box for a discussion of mouse technology). Apple has trademarked the phrase Graphics Mouse Technology, which might suggest

to some that it is the first company to come up with a successful version of the device. This is not absolutely true. There have been many previous mice — some that were like enormous flywheels and just kept going in one direction. There are mice of various sizes, colours and complexity, including the three-button

**'Like a jet engine,
it can't turn a car into
an aeroplane'**

'Rolls-Royce' of mice made by a US company called Hawley. At the recent West Coast Computer Faire, a recent entrant — with just two buttons — could be seen controlling editing functions on an IBM PC. What Apple has done is to streamline the device, going for reliability and ease of use. While manipulating the palm-sized mouse is simple, its integration with the Lisa software (something which does not have to be obvious to the user) is very complex. Not just any mouse will do — end users should be

APPLE LISA

wary of advertisements and mouse manufacturers' suggestions of what their product can do. Like a jet engine, it can't turn a car into an aeroplane.

Keyboard

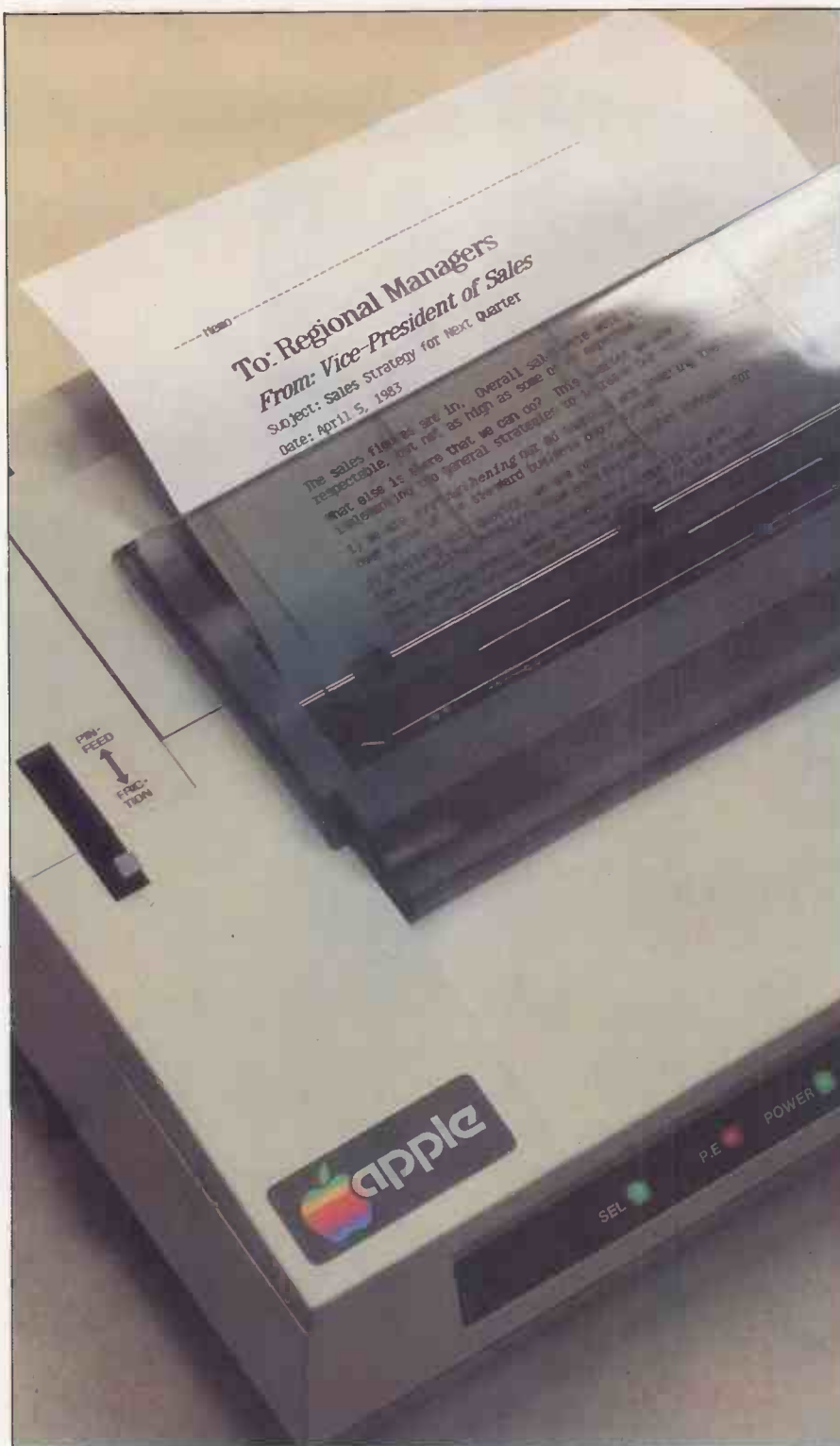
The Lisa keyboard is a standard, Selectric style version with 76 keys — all of them are programmable. Since the mouse has been given the main burden of issuing commands and manipulating objects and data, the keyboard does not come with row upon row of special function 'headstones'. To the left of the keyboard is the main section of the qwerty and multi-character keys (special symbols such as omega, mu, epsilon and pi, and other unusual characters are selected by the correct use of the shift key). To the right is an 18-key numeric pad which has the four left/right/up/down cursor control markings sharing key-top space with the '+', '/', '**', and ';' symbols. Although Apple decided against straight, one-punch, function keys, it is possible for the more experienced user to generate a wide range of special effect codes from the keyboard. For example, at certain stages while using LisaDraw it is possible to erase selected portions of an object by pressing the 'Apple' key (it has an Apple logo on it) and the 'Clear' key, rather than selecting the object with the mouse and then going to one of the pull-down menus to select a similar procedure. Both the keyboard and mouse are controlled by a COPS processor on the I/O board.

That's the quick overview; now we should turn our attention to more specific aspects of the Lisa hardware.

Inside

Getting into the machine is no problem since there is both a back and front cover. No special tools are needed for their removal. This design philosophy has been carried right through to the point where a user can completely dismantle a Lisa into its serviceable modules — the twin disk unit, circuit board carrying frame, power supply, and even single boards — in a matter of minutes (for the full implications of this, see 'Conclusion'). The only non-user accessible unit is the high-voltage video circuitry and monitor.

Inside the machine to the left there are three empty expansion slots. Currently, the indication is that Apple will not rush to fill these, rather, it will encourage independent hardware vendors to offer their products. From the hardware engineers' point of view, the expansion slots provide a very simple means of attaching all sorts of devices to the Lisa. Simple, because the slots provide add-on cards direct memory access (DMA) instead of routing signals via the CPU.



Apple has made the dot-matrix printer respectable.

Printers

It's nice to see that Apple has made the poor man's printer — the dot matrix system — respectable. To get the high-quality graphics printouts reproduced in this review, Apple had to inform the Japanese printer company, C Itoh, that its printer *could* produce the required quality. The printer, which now has a ROM chip customising it to the Lisa, 'paints' a piece of paper with dots. In low-resolution mode, the output is quite good; in high-resolution mode the output is of presentation quality. Most of the screen dumps reproduced in these examples were done in the low-resolution mode.

Reluctant to leave well alone, Apple decided that the Lisa user must have the option of a letter-quality daisy wheel printer as well — but it had to be able to do graphics. To achieve this, Apple created a completely new 130-spoke print wheel for a printer from Qume. It will reproduce all the special symbols, including foreign variations, and allow a single printout to combine various typestyles (such as standard mixed with bold and italics). Graphics output, using special dot symbol spokes, can cope with Lisa screen dumps, but they are not really as good as the dot matrix version.

Apple's only current exception to the 'no add-on cards' rule is a parallel interface board (\$195) which is needed to help manage the generation of high-quality output on a specially redesigned dot matrix printer from the Japanese company C Itoh. While this does take up one of the three expansion slots, Apple is working on a serial version of the matrix printer which will use one of the two RS232 ports on the Lisa.

All circuits boards, expansion slots, and even the I/O connections, are held in a specially designed slip-out carriage. This board holder is a novel method of securely retaining a lot of hardware in its place, while at the same time making access extremely easy.

Since the holder is only connected to the main system box by gold-plated edge connectors, simply tugging it towards you makes it glide out smoothly. If you ever ripped yourself to pieces trying to remove a board from an old terminal (the soldered side was usually loaded with razor-sharp objects right where you had to grip it), or ever found out too late that you had put the CPU board into the wrong slot, you'll appreciate what Apple has done for the user in this area. Every board has been supplied with colour-coded grips and unique edge connector layouts so that it is impossible to damage yourself or a board.

Although I mentioned earlier that the Lisa has a shutdown button, the machine is never completely off. A battery pack located on the I/O board maintains the system in a kind of slumber, waiting for some one to come along and press a key to reactivate it. This is rather like the temporary display blanking that some calculators use to conserve on energy while retaining numbers to be eventually used in a calculation.

Motorola 68000

Having conceived a complex software environment for the user, Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required to cope with the kind of activity that would be required of the Lisa.

There are a couple of reasons why the Motorola 68000 was chosen.

This 32/16-bit chip (almost all its internal CPU registers are 32-bit while the external data paths, along which data is fetched and sent back out, have a 16-bit transmission capacity) has been the choice of many specialist multi-user system builders for the last few years. Only recently has it been receiving the kind of general attention it warrants.

Sage Computer Technology chose the chip as a powerplant for the Sage II. It is also the featured chip in the Corvus Concept, the Tandy TRS-80 Model 16, the Fortune 32:16, the Wicat and the somewhat intriguing IBM 9000 scientific system.

Apple adopted the 68000 because it was the best advanced chip available in sufficient quantities at the time the Lisa project began (1979).

Early samples were used for prototyping, but it was not until Motorola could give assurances that 5 Mhz versions would be available in production quantities that Apple made the commitment.

While offering the power of a true 16-bit chip, assisted by its 32-bit internal structure, the 68000 couldn't give Apple's software designers one much-needed break. Sitting inside the Lisa is about 2.5 Mbytes of object code which makes up the Desktop Manager system. Add to this the code which makes up the various Software Tools — LisaCalc, LisaWrite, LisaDraw, LisaGraph, LisaList, LisaProject range in size from 200k to 400k — and you have an enormous problem shifting that number of

area are the cooling fan and the disk drives. This first problem was overcome in the Lisa by devising a passive, or convection, cooling system. Since warm air rises, the designers arranged for all the main circuit boards to be held upright in a special carrier frame. As the boards begin to generate heat, it is taken in by the surrounding air which then escapes through vents positioned at the top, back and sides of the casing.

It seems to work well as there were no signs of internal overheating during the review sessions. Nor did it get perceptibly warmer around the machines.

The second potential source of noise, the disk drives, never had to be dealt with. The 5 Mbyte ProFile disk (which

'Apple designers were aware, even at the theory stage, that a fairly powerful processor would be required'

bytes around in a reasonably professional manner.

Memory management facilities developed by Apple for the 68000 make the software handling task much simpler because it offers the ability to relocate blocks of code in memory — virtual memory in fact. To quote the Lisa specification sheet, the memory management system on the machine allows for the 'segmentation (of memory) into 128 variable-length blocks dynamically controlled by memory map table'. That's 16 Mbytes of virtual memory.

In addition to having an Apple-added virtual memory facility, the Lisa can do multi-tasking and lock out bad memory cells. While one job is being printed, a user can go ahead and use the LisaCalc program, or whatever. If memory errors occur, the system will not halt all processing until repairs take place. Rather, the parity checking system will steer all operations away from the faulty sector(s) and so allow Lisa to continue processing.

Diagnostics

Keeping with recent industry trends, the Lisa comes with built-in diagnostics that go into action when the machine is fully powered up. The user is given a set of visual symbols denoting which piece of the system Lisa is currently testing, and, if everything goes well, tick-marks appear in each symbol field. There is a full 64k of diagnostic code held in ROM (remember, that's the size of many standard personal computer main memories) and if the display is not working, the Lisa emits specific groups of tones from its internal speaker that can be understood easily by a user.

Noise

Noise can be a problem in an office environment and, as many personal computer users would testify, their machines are not always as quiet as they might be.

The biggest traditional culprits in this

was originally built for the reasonably successful Apple III) has always operated with a minimum decibel output. Most of the Lisas have ProFile placed conveniently out of the way on the main system unit. Although this is not a prerequisite, it certainly reduces space requirements on a desk.

Disks

Most floppy disk drives are worth just a quick look to see if all the bits and pieces are there and how much storage they provide. If you're really lucky, you might even find out that the machine you're thinking of buying can read disks of different formats.

In the case of the Lisa's drives, it's worth devoting more time, since by standards, they are excellent.

While the ProFile gives 5 Mbytes of storage — a common enough amount by today's standards if you look at computers like the IBM XT, ACT Sirius 1, and Wang Personal Computer which come with, or can be configured to have, 10 Mbyte drives — the two floppy drives cope with 860k formatted (1.4 Mbytes unformatted) storage each. Therefore the total removable storage is over 1.7 Mbytes...

Here's how Apple managed to create such a dense packing of data on a 5¼in disk.

Traditional double-sided disks rotate at about 300rpm and store somewhere in the region of 200k to 400k — a notable exception to the rule being the 600k+ drives of the Sirius 1. The Sirius 1 uses multi-speed drives that can spin standard disks at up to 350rpm when necessary.

Apple decided that rather than stay with commercially available drives, which didn't offer the kind of functionality or reliability the Lisa demanded, a totally new unit using a totally new 5¼in disk would have to be built.

A Synertek 6504, which is not too far off from the 6502 chip that has kept the

APPLE LISA

Apple II running and running, is dedicated to each of the Lisa drives, acting as smart interfaces with the main system. One of the jobs the 6504 has is to vary the speed of the drive in keeping with the position of the track it is reading or writing so that data is laid down in a regular density of 10,000 bits/65.4 tracks per inch.

Since ordinary drives rotate at one speed at all times, regardless of where the recording head is located, data is more densely packed on the tracks closer to the disk centre (where the disk surface is travelling more slowly than at the outer edge) and relatively sparsely elsewhere.

The internal set-up of the Lisa drive is also very different from other double-sided units. Rather than having both heads

positioned so that the disk media is pinched between them, increasing wear, the Apple drives have offset heads and special opposing pressure pads that access the disk surface through two cut-outs in the disk jacket. In the early development days of the Lisa project, having such unique disks was a definite advantage because even if a prototype machine had been stolen, illegally borrowed, or whatever, the fact that virtually all disks were kept safely locked up meant that no harm could be done.

Now that the Lisa is ready for the market, one wonders what kind of production arrangements Apple has made. Certainly, at the time of this review, no one at the company could give me any details on pricing, etc.

Security

We're not yet finished with the disks, because there are two remaining features that must be covered — data integrity and data protection by means of automatic

disk retention.

Files stored on a disk are located by means of a directory set up on a particular grouping of tracks. If this map-like data should be corrupted in some way — either by software or system failure — it is not always possible to recover all the lost data held on the disk. The Lisa drives, however, are made to lay down a special block of 24 bytes per each 512 byte disk sector. Contained in these 24 bytes is a description of which file the block belongs to and where in the file it should appear. Further pointers to disk space allocation are also held within files themselves and in the main directory. Inevitably, some information will be lost, but it will have to be precipitated by something fairly catastrophic.

If you've read something about the Lisa you will already know that its disk drives do not have the conventional flip-down doors which can be opened at any time, regardless of what is going on. Instead, the drives have an automatic lock and load feature made possible by automatic 'disk present'

The Mouse

The difference between the traditional keyboard and a mouse is essentially the difference between sending morse code signals down a wire or using a telephone. While the telegraph and telephone achieve more or less the same result, the speed of interaction, and what might be called the 'fluidity' of communication, are just not comparable.

People first interacted with computers via teletypewriters — electromechanical devices that generated printed text either from an attached keyboard or in response to computer output. So it is not unnatural that they should have become used to dealing with line by line printouts that were issued in true typewriter fashion. If they wanted to leave blank lines on a printout they had to hit the 'line feed' key the required number of times. If they wanted to write something only at the end of a line, they might use the space bar, or tab key, to move the print-head over to the right.

Things remained pretty much the same even when paper was replaced by cathode ray tubes (CRTs, VDUs, or whatever you like to call them) as the prime method of displaying user input and computer output. The print head was replaced by a flashing or solid cursor (an underline, or solid square), but the user could still only move around the screen in discrete up/down/left/right movements. Cursor addressing, a facility made more accessible by the higher-level languages, was used but this was handled strictly at the program level.

The mouse unlocks the cursor from its straight-line existence and instead gives the user total control of its positioning. Connected to a computer by a thin cable (the tail), the mouse consists of a palm-sized package of electronics and mechanical/electrical/optical equipment which converts analog movements (drawing of a circle, for example) into digital signals. These digital signals are then acted upon by the relevant onboard processor, and a circle appears on the display.

Apple's mouse is probably one of the

simplest to use. Where others come with up to three control buttons, Apple's has only one for all actions. The multi-button mice have a sense of function keys about them — you push this one to do action number one, then you push the other to do action number two. This is because they are generally used with far simpler software than that supplied with the Lisa. The Apple mouse demands only that a user follow the simple rule: if you press the button twice to open one icon, you do exactly the same for another icon, independent of the program or stage you are at; if you want to select something from the pull-down menus you always click the button once after the required option is backlit.

Of course, there are times when the mouse becomes clumsy or redundant and that's why there are still cursor control and special escape keys/key sequences on the Lisa keyboard.

Lisa's engineers are sometimes criticised for selecting the mouse rather than other quick data input devices — notably the trackball, touch-screen and light-pen.

They point out that the trackball (which can be thought of as an upside-down mouse) requires two quite distinct operations. First you use your fingers to roll the cursor control ball as is necessary, then you have to reach over and press a command button. The mouse user can both move the device and press a button at the same time, so maintaining smooth movements.

The touch-screen and light-pen both have the limitation that the user must first identify the location that has to be touched, and then a physical movement has to be made to identify or select an object. Delay and arm fatigue can be a problem here. Also, touch screens do get fingermarked and light-pens have a limited resolution. If there are two option boxes placed very close together on the screen the pen might only be able to straddle them, and not deal with them as two distinct objects.

The Lisa mouse is simply built. All the



A replacement for the keyboard?

electronics are held on one small internal circuit board, and there are only a few moving parts. One is the teflon-coated metal ball which partially protrudes out of the bottom of the mouse casing. There are also the rollers, placed at right angles to each other, which translate mouse movements into x/y coordinates. The rollers touch the teflon-coated ball and move in accordance with it. Depending upon the skill of the user, such mouse-controlled movements can be made highly accurate — it doesn't take much time to be able to pick out a specific pixel with the cursor. Since the office environment poses a lot of potential hazards to mouse mechanisms — cigarette ash, abrasive paper fibres from lots of paper shuffling, and even the left-over debris from eat-in lunches abound — Apple has made its product user-serviceable. By unscrewing a black plastic retaining ring, the teflon ball can be tipped out and both it, and the mouse insides, given a clean-up.

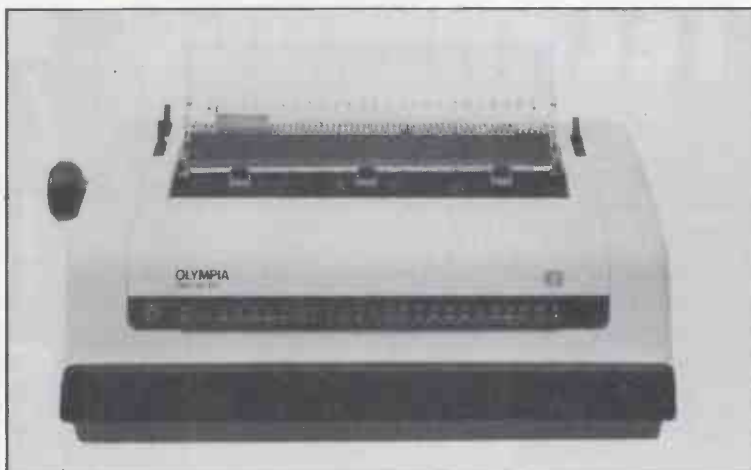
During this review, we found the mouse to be a truly natural method of interaction. The only problems were freehand drawing in the LisaDraw program and the fact that you had to keep your desktop neat — something managers may find difficult.

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APPLE LISA

sensors. If you want the disks back for some reason, you cannot just yank them out. To the right of each drive there is a disk request button which signals to the CPU that you want to remove a disk.

Before anything else is done, the Desktop Manager checks to see what files are open and then sets about closing them. Once everything is cleared from the desktop the disks are automatically ejected.

Having visited an office shortly after somebody lost 20 pages of WordStar text by removing the disks and resetting the system without doing the hallowed ^KD, I think there are many people out there who would consider the wait a reasonable price to pay as an insurance against going into a sudden state of speechless shock at losing an afternoon's hard work. And, anyway, what are you going to do with the disk if all your work hasn't been saved on it?

Documentation

During the review, provisional documentation only was available for use — the exception being a proof copy of the LisaDraw user's manual. The provisional material was more than adequate, but the LisaDraw manual — in fact it was more like a commercially published book — was probably the best.

It was properly typeset on good quality paper and there were many photographs and high quality prints of the Lisa and its display to provide visual backup. Contents and page number information was also

included. If all the documentation is of this quality, there won't be many complaints.

In addition to the manuals, Apple has written LisaGuide, an interactive guide on using the Lisa. It is quite a major achievement in itself since it avoids being condescending where it easily could be so. It makes full use of the display's high-resolution and the mouse, so helping novices quickly through the acclimatisation process.

Service

Apple is offering various levels of service for the Lisa.

The ordinary user will be able to take advantage of the Apple Care Carry-In service whereby the machine is handed to a local dealer who will swop out the faulty part and replace it. Dealers will carry stocks to cover most component failures.

Bigger users can take out a contract with Apple whereby RCA will send a service person to the site.

At the top end, Apple will provide in-house training so that Fortune 500 users can do all but the most major repairs themselves.

There is also a hot-line direct support service permanently available by telephone.

Discounts

Against the high single unit price of the Lisa, Apple is setting a series of discounts for customers prepared to sign 12-month contracts.

If you are prepared to show a definite interest in buying a few machines over the next 12 months then you can gain a 10 per cent reduction in the cost price per machine.

A customer which will commit to buying 275-549 units in the coming year can obtain 15 per cent discount. For 550-999 units the discount increases to 18 per cent.

At the top end, 1000 definite orders will yield a 20 per cent discount rising to 28 per cent for even greater volumes. International companies can gain these price reductions on a worldwide basis.

Prices

Lisa: \$9995 (UK price around £8500) — includes main unit, 1 Mbyte of RAM, display, system/applications software, keyboard, mouse, and 5 Mbyte ProFile hard disk unit.

Dot Matrix Printer: \$695

Daisy-wheel printer: \$2100

Languages: Basic Plus: \$395

Pascal: \$595

Cobol: \$795

Conclusions

Really to get an idea of what has happened, you mustn't compare the Lisa directly with other machines such as the IBM PC, the DEC Professional, or the Sirius 1. If you do the sums, they actually show that the Lisa is competitive in terms of price, and totally unapproachable in terms of integration (once all storage, software and necessary add-on boards have been accounted for).

Certainly, the recent announcement that Digital Research would be aiding and abetting Visicorp in implementing the mouse-controlled, window-oriented VisiOn product in the CP/M environment is significant. So too, is the fact that IBM, DEC and Texas Instruments have all said they will support the VisiOn package on their relative machines.

Microsoft, with its MultiTool word processing system, has also adopted the mouse as a viable alternative to laborious keyboard commands. The product has windows, and is modelled after the company's Multiplan spreadsheet program.

Both packages will be moderately priced — a few hundred dollars each — and this will obviously meet a vast number of users' needs. But consider that we're talking about different leagues here.

VisiOn and other similar products waiting in the wings, run on a range of manufacturers' machines that have not been optimally designed for such products. The keyboards are still the unhappy mixture of qwerty and dp functions; the mice are add-ons rather than a fundamental part of the computer's design philosophy; reliability in the software may not be mirrored by reliability in the hardware.

In summary, the hardware/software division is still maintained. Obviously, events in the next six months are going to provide some answers to such thoughts — but our feeling is that there is room in the market for both approaches.

Technical Specifications

CPU	32/16-bit Motorola 68000 running at 5MHz.
Other Processors:	SCC chip in keyboard and NatSemi COPS on I/O board to handle keyboard and mouse.
RAM:	Presently 2 x 512k boards or the option of 2 x 1 Mbyte boards — to be introduced shortly — that will fit in the same slots.
Diagnostic ROM:	64k start-up diagnostic code checks out disks, memory, etc. Capable of generating audio backup if the display fails.
Display:	Crisp, black on white background, video generation. 12 inch diagonal, 720 x 364 pixels, bit-mapped in upper area of RAM memory.
Keyboard:	IBM Selectric style, 76 keys (no straight function keys) including numeric pad.
Mouse:	One button, see and point operation. Accurate for cursor positioning down to individual pixels.
Floppy disk storage:	Two 860k, 5¼in, floppy drives integral to system unit. Unique twin access windows in disk envelope because of offset drive heads.
Hard disk storage:	1 x 5 Mbyte ProFile hard disk, as originally designed for the Apple III. More than one can be connected.
I/O ports:	Two RS232 ports, one parallel interface port.
Expansion slots:	Three empty slots are available.
System Software:	Desktop Manager operating environment, and six Lisa specific application programs: LisaCalc, LisaList, LisaWrite, LisaProject, LisaDraw, and LisaGraph. Others, including LisaTerminal, will follow.
Languages:	Basic Plus, Cobol, Pascal. Others are under development, including the Smalltalk language/environment.
Printers:	Dot Matrix graphic printer (parallel) and letter quality daisy wheel (serial) printers.

SCREENPLAY

Maggie Burton looks at games software for the Colour Genie

The Colour Genie is a very puzzling animal indeed. Writing good software for it demands considerable expertise, especially in the area of machine code.

In the Colour Genie Benchtest last month I concluded that great things are possible from the Genie if software is properly written. The machine includes a very powerful sound generator, good screen handling in spite of the unchangeable low-res background, and the power to give very fine shape definition when user-defined characters are used.

Oddly, though, cassette handling is not as good as I had thought. It is only after spending a great deal of time playing with different programs from different manufacturers that you can begin to get an accurate idea of how well a machine loads cassettes.

Machine code programs load fairly well using the SYSTEM command to enter a rudimentary monitor (it seems to be designed purely for the loading of machine code). Basic is loaded using the more conventional CLOAD command. You are told when a program is loading by the appearance of two asterisks in the top right-hand corner of the screen. The rightmost one flashes as blocks of data are fed into the computer's memory.

Basic does not seem to load at all well. After much fiddling and swearing I was able to load just two Basic programs

out of six — the others were abandoned when all the different volume levels had been tried. All of the cassettes were loaded from the Genie cassette recorder.

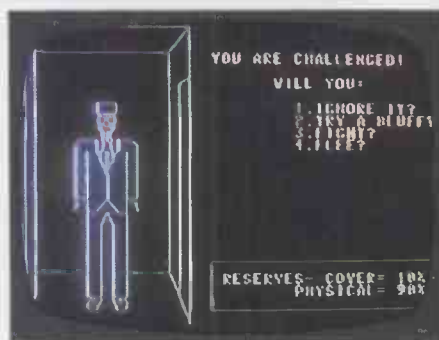
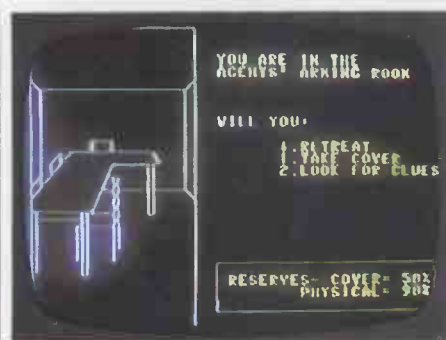
Loading is very error-prone; often the machine will load a program and run it even though the load is bad — the result is often chaotic, with odd characters appearing all over the place, controls refusing to work and screens filling with garbage. An error is indicated when the leftmost loading asterisk is replaced with a 'C'. Some machine code programs seem to cause unexplained corruptions when they are part-loaded. The most common was getting the response 'Syntax error' from the command NEW, even though the command worked. A lot of them disable the reset keys, making it impossible to empty memory without switching the machine off.

What is even odder is that the Genie seems to load better when it has only just been switched on. Once it has been running for an hour or so, and has got really warm, loading becomes progressively more unreliable.

Having now experienced the cassette loading/saving capabilities (or lack of them) on most home machines, there is only one thing which can be said. Almost without exception they are awful. This statement is not addressed at one manufacturer more than any other. Most

computers have some problems loading cassettes. The only one which rarely does is the Sharp MZ-80A, which has an integral cassette recorder anyway. While unsuccessfully trying to load programs I have often put myself in the place of the first time user. This person has proudly bought a machine and some software, gone home, set the machine up, and fiddled around for ages to get it tuned into the TV. Our unfortunate individual then decides to load his programs and try them out. He tries once. It doesn't work. He changes the volume level (if the manual tells him to, which some don't) and tries again. Eventually, after trying several times, not knowing how long to wait, not being quite sure what to expect, the program loads — by which time all the fun has gone from it. How many people, I wonder, have had that experience? It's a shame, in this age of microtechnology, that a better solution cannot be found than this.

The Genie software library is quite big. Most of the titles, unsurprisingly, are games. The seemingly impressive list of packages soon deteriorated into a very run-of-the-mill set of programs indeed. Some programs, though, are of a very high standard, as shall be seen from their reviews.



DOUBLE AGENT

Supplier: Algray Software
Price: £12.95

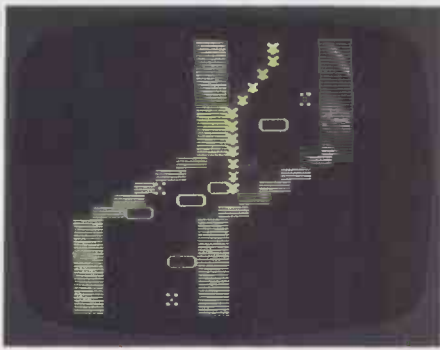
Fed up with traditional adventure games? Graphics? Sound? Role-playing? It's all here. Double Agent is positive proof that the Genie is capable of great things. It took me ages to load it like all the other games, but I wasn't at all disappointed. The plot is a very simple one. You are a double agent (one of 200 different characters, in fact, which you choose at the beginning of the game) in disguise, looking though a building seeking stolen documents.

In choosing your disguise you must consider your appearance and character so that you look the part. You are then entitled to carry some items as part of your disguise, which can prove useful later. You are also allowed to select some weapons from a short list, all of which will make your cover less convincing.

What is so good about this game is the graphic and sound effects. You actually walk around the building, open doors (or force them with a bang if they are locked), meet little men who look like traffic wardens and challenge you and discover objects which may or may not relate to

what you are looking for. You really feel as though you are the character you are playing. There is, though, what must be a bug in the game. If you turn left or right immediately at the entrance to the building, you become trapped in a location which probably should not exist and cannot get out. The screen becomes garbled and parts of the text are lost. The only way to get out of this trap is to restart the game.

On balance, though, old and young alike will love playing this game. It is well thought out and presented and is a definite step nearer to what adventures ought to be.



RACING DRIVER

Supplier: Molimerx
Price: £10.06

There are some really excellent Grand Prix programs around. Some of them are in 3D, other have lots of cars to control, bright colours, good sound effects. I mean no offence to Molimerx, but I've seen better games on a ZX81. Keyboard response is bad, shapes are poor, sound is boring and monotonous and all the graphics are in the same colour. The fact that it's in Basic is no excuse — the game is no good at all.



EXTERMINATOR

Supplier: Algray Software
Price: £7.95

This is a very fast moving game indeed. Your aim is to destroy some birds while avoiding a deadly indestructible missile which zaps towards you at every opportunity. When you have done all this you go on to the second phase — grabbing eggs (while avoiding more aliens) and putting them in an incinerator.

It's not a very spectacular game at all but it does include a 'hall of fame' of the best five high scores.



ROCKFALL

Supplier: MCE Software
Price: £5.95

Here's another (perfectly playable) game into which very little imagination has gone. The idea of the game is to catch Martian bombs (poor Martians — what have they done to deserve such a reputation?) and thus defend your cities. You do not fire or zap through millions of light years in time/space. It's a thoroughly two-dimensional game and a little too fast to be really enjoyable.



INVADERS FROM SPACE

Supplier: Molimerx
Price: £9.20

We'd probably better resign ourselves to the fact that Space Invaders (to give a dog a name) is here to stay. It's a horrible old game but once it was really good, because it was the only video game around.

With so much computing power around it seems idiotic that software suppliers still go on producing version after version of this derisory little scenario.

What I will say here is that this version is as good as a version of space invaders can be. It is colourful, keyboard response is good and it is true to the arcade original — ie, it leaves nothing out. Interestingly it includes a facility to freeze the game and start it again. Using it you can often get out of difficult situations by freezing and then using one of the cursor keys to move out of the way of falling bombs before they have time to drop on you. The instructions seem to be wrong in their explanation of this — they tell you to press break/clear to resume the game, which doesn't work; it should be one of either left/right arrows.



KONG

Supplier: Algray Software
Price: £8.95

Before I review this game I'd like to say that gorillas are charming creatures; very gentle and far more civilised than humans. It is a little unfair that they are often portrayed as vicious, woman-stealing, dangerous animals, but perhaps that's human nature.

Kong is also a version of an arcade game. Sound and graphics are very good but as far as I can see the game is nearly impossible. Basically, you have to climb up a building, avoiding the rocks the gorilla at the top will roll at you, and kill him with a hammer which you pick up at the beginning. Then you rescue the dame to win.

This is all lots of fun (apart from the abiding insult to the character of the gorilla) but sometimes you are killed for no apparent reason and you always die if you hit a ceiling when you jump — which makes it impossible to jump, most of the time, to avoid the rocks. At the best of times it's a hard game to play and really shouldn't be made any harder by bad debugging.



SKRAMBLE

Supplier: Algray Software
Price: £8.95

Algray seems to have got the hang of it on this machine. Skramble is one of the games I played again and again, but it's by no means original.

It's a version of the arcade game 'Scramble', and it's a very faithful one. It's also one of the few games which uses the Genie's excellent joysticks as an option. Those unfamiliar with Scramble will need to know that the game involves flying a little rocket over a varied landscape, killing alien ships and bombing fuel dumps until you fly through a long maze and come to a landing pad, where, logically, you must land to finish the game. It's a difficult game to play but lots of fun and quite picturesque.

This version is good but poorly debugged. You can explode on your own bombs, fly underground or impale yourself on your own lasers and exploding aliens.

If you're greedy and avaricious, you'll be pleased to know that Algray is offering a £100 prize to the first person to reach the end of the game.

DISKOGRAPHY

A BRIEF GUIDE TO FLOPPY DISKS

Jane and John Shemilt offer their advice on purchasing the correct disks for your computer.

This article is a short guide to the various types of floppy disk on the market and attempts to explain why it is important to buy the correct type of disk for your machine. It does not make any comparisons between disks from different manufacturers, so no 'best buys' are recommended.

There are two standard floppy disk sizes commonly in use: five and a quarter inch (mini) and eight inch (standard). Both these types have a similar construction, the heart of which is a mylar disk on which is deposited a metal oxide layer. The mylar disk is held in a sealed protective envelope with a soft inner lining including a cutaway for head access (see Fig 1). The disk has a large hole in the centre which fits onto the disk drive hub, which centres and rotates the disk inside the stationary envelope in the drive during use. There is at least one other hole in the mylar disk (the index hole) which lines up with the index/sector hole in the envelope once per revolution. If the disk is *soft-sectored*, there are no more holes in the mylar disk, but if it is *hard-sectored* it will have more holes in the disk which line up with the index/sector hole once each revolution. In this case, the disk is divided into sectors, ie, wedges or slices, by a series of holes (one hole per sector) in addition to the index hole. (Whether the division of the disk into sectors is hardware or software controlled will depend on the disk controller used by your computer.)

For eight inch disks, the index/sector hole in the envelope is in one of two positions depending on whether the disk is *double-sided* or *single-sided* while, for five and a quarter inch disks, the position of the index/sector hole in the envelope is always the same. The only other hole in the disk envelope of importance to the user is the write protect notch. Usually, on eight inch disks when the notch is uncovered, the disk may not be written to *write protect mode*, although on five and a quarter inch disks

this notch must be covered up by an opaque material to *write protect* the disk.

The label on the disk envelope usually has a large number '1' or '2' on it, followed possibly by a large letter 'D'. The number '2' indicates that the disk is double-sided, ie, both sides of the mylar disk have a metal oxide layer which can be written to, while a '1' denotes a single-sided disk. In fact, most single-sided disks are actually manufactured as double-sided where the oxide layer on one side of the mylar has failed on inspection. It is generally *not* a good idea to use single-sided disks in a double-sided disk drive as they can cause damage to the magnetic recording heads if used frequently. However, double-sided five and a quarter inch drives can be used on single-sided five and a quarter inch drives, but only as single-sided disks and the second side of the disk may be damaged if it is used this way frequently. It is possible to buy double-sided disks with two index/sector holes in the envelope so that both sides can be used, but only one at a time, in single-sided drives by turning the disk over to *change sides*. Unfortunately these disks, when turned over, rotate in the opposite direction to their previous motion so that all the dirt and loose oxide particles, which have collected on the liner by the side of the head access slot, are dislodged and deposited on the disk surface. This debris is wiped off on the recording head and pressure pad of the disk drive and can cause damage. Also, in this case, the pressure pad on the single-sided drive is in contact with a disk surface, which is used for writing to and reading from, and can damage this surface leading to the loss of data on the disk; usually the pad presses on the unused face of a single-sided disk.

Another special eight inch double-sided disk can be obtained where both the single-sided and double-sided index/sector holes are cut out in the envelope, so that the disk can be used as a single-sided disk on a single-sided drive and as a double-sided

disk on a double-sided drive. Of course, the index/sector hole which is not applicable should be covered up while using the disk. The main use of these special disks is in the transfer of software between different disk drives but, as most eight inch double-sided drives will also read and write to single-sided disks, these make a more readily available medium to transfer software.

The disk label also specifies the recording technique for which the disk is suitable. The standard recording technique of Frequency Modulation (FM) records a flux reversal on the disk at every clock pulse (4 microseconds) to produce *bit cells*. The data is recorded serially in the form of another flux reversal in the centre of the bit cell to record a '1' bit or no flux reversal for a '0' bit. (see Fig 2a). A disk capable of being used with this recording method is called a *single density disk*. In order to double the amount of data stored on the disk, a technique called Modified Frequency Modulation (MFM) is used. In this method (see Fig 2b), the clock frequency is doubled giving a 2 microsecond bit cell. However, there are normally no flux reversals recorded on the disk at clock pulses so that only data generated flux reversals (denoting '1' bits) are recorded. This could lead to synchronisation problems if a group of '0' bits happened to be recorded in sequence and, therefore, if one '0' bit is followed by another '0' bit a flux reversal is inserted at the clock pulse (see Fig 2b). Disks suitable for MFM recording are called *double-density* disks. The actual frequency of recording in MFM is not increased over FM (single-density) technique but this double-density recording is more susceptible to the quality of the disk. A double-density disk may be formatted and used in a single-density drive but a single-density disk should not be formatted for double-density as it is prone to errors. (In practice it is often possible to get away with formatting a single-density disk as a double-density one.) The letter 'D' following the '1' or '2' on the disk label implies that the disk is of double-density quality. Even though the recording technique used by a machine may not be FM or MFM, the disk type specified for use on the particular machine will be specified as 'single' or 'double' density.

For eight inch disks that completes the story but, for five and a quarter inch disks, there is one more option to consider when.

GOTO page 240

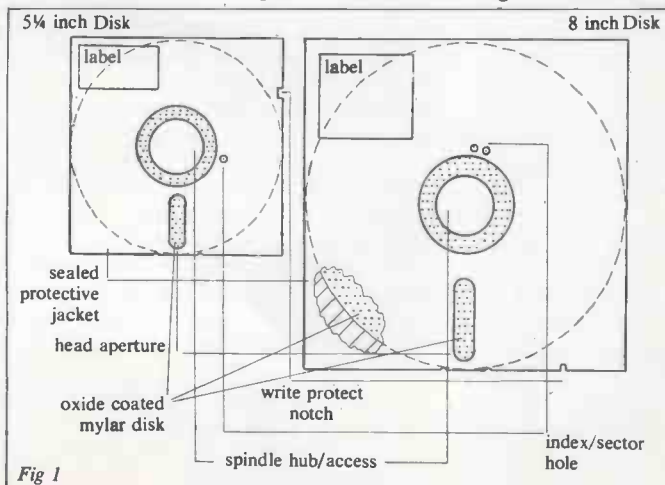


Fig 1

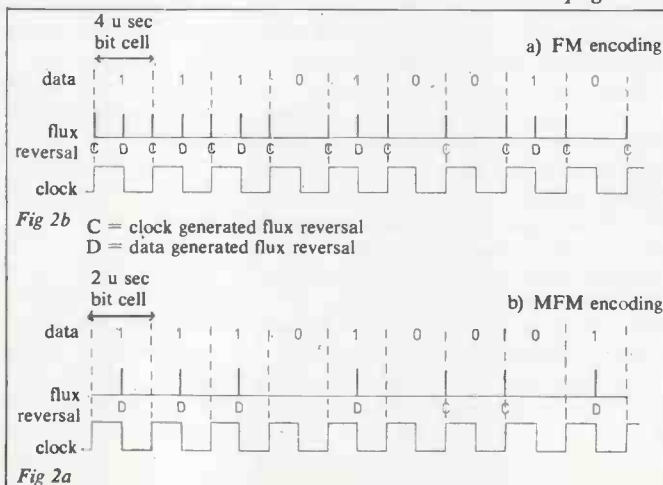
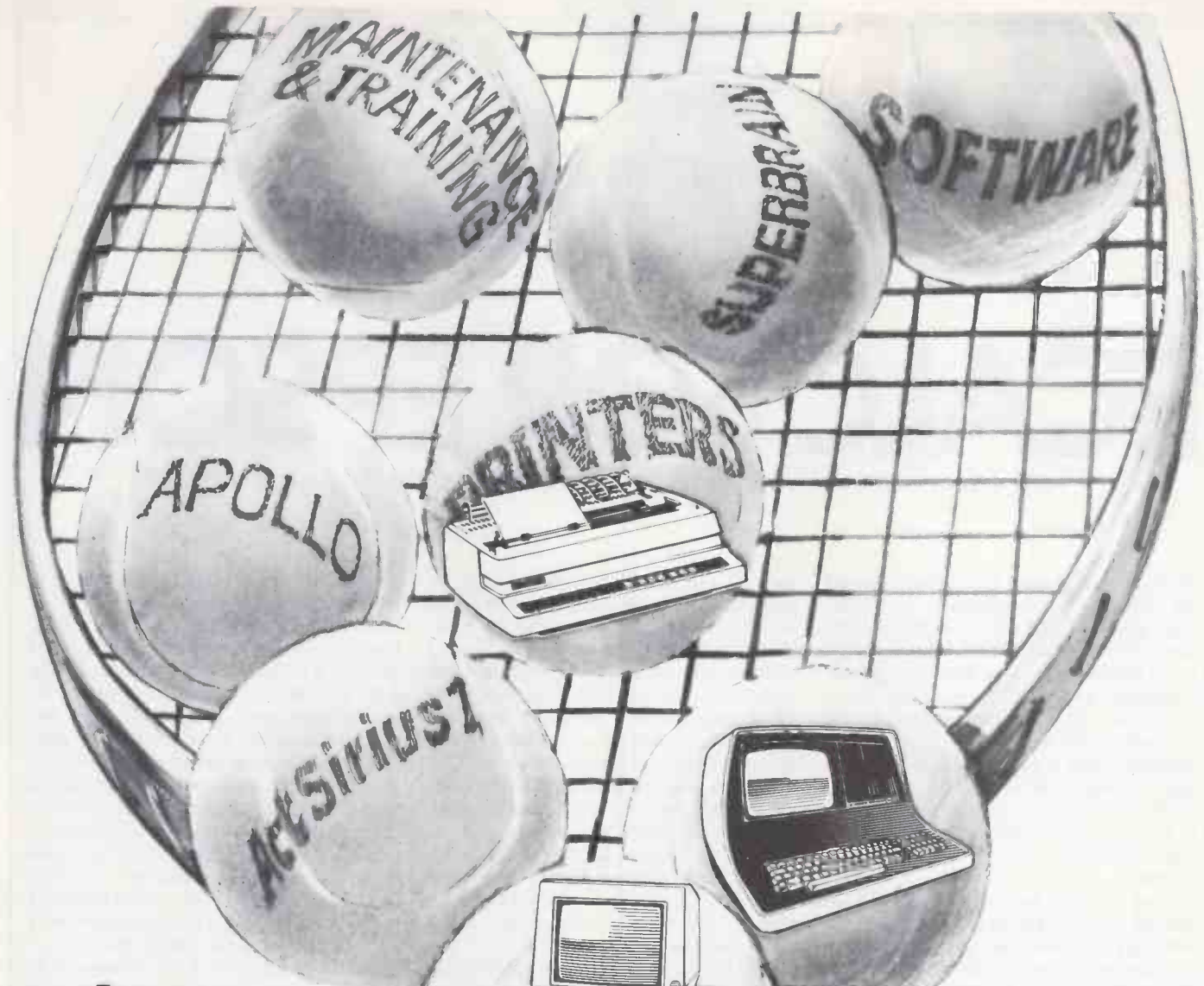


Fig 2b C = clock generated flux reversal
D = data generated flux reversal

Fig 2a



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ECALC FOR EPSON

Mike Liardet takes a look at ECalc — a spreadsheet system for the Epson HX-20.

In the last three years Epson has achieved an extremely good reputation as a hardware manufacturer with its highly reliable range of printers for micros. More recently, it has joined the growing band of Japanese companies exporting micros to the West.

The first of its micro product line to arrive in the UK was the HX-20, a portable computer only slightly bigger and heavier than this magazine (reviewed in December 82 *PCW*). This has now been joined by the QX-10, a more conventional desk-top micro (reviewed in this issue) running CP/M.

True to the industry norm, the HX-20 arrived on the scene to great acclaim, but with very little software to run on it. Now six months on, a trickle of software is becoming available, including a word processor called Intext, and ECalc, a spreadsheet system which is the subject of this article. To date, all Epson's offerings have served to reinforce the excellent Japanese reputation in electronics manufacturing. Now we have a first opportunity to see if it has software skills to match.

Back to Basic(s)

My complete review package, including all hardware, software and manuals, arrived in a neat cardboard box about the same size and weight as a briefcase. In fact, if you are not image-conscious, you could just about use it as a briefcase, since Epson has thoughtfully fitted a rugged plastic handle to the top.

Quickly opening it, I unearthed the HX-20 itself, with a mains adaptor, micro-cassette drive, two manuals and, of course, the ECalc package.

The first task was to fit the micro-cassette drive. Once fitted, it becomes an integral part of the body of the HX-20, with no trailing wires or other encumbrances. The cassette is actually held in place by a clamping lever, and there is absolutely no need to fiddle with screwdrivers or jack-plugs, or get involved in any wiring-up. The whole operation takes less time than I have taken to describe it!

As the HX-20 comes supplied with a rechargeable battery, it is not necessary to

use the mains adaptor. The battery is reputed to run for 50 hours without recharging. Since the adaptor did not have a mains plug, I opted to 'leave it for the time being'. I subsequently regretted this, when the battery died on me at a critical moment in the Benchtests, and long before 50 hours had elapsed. Presumably it was already greatly discharged when the system arrived. Anyway, I was able to resume work immediately the adaptor was connected, since it simultaneously powers the machine and recharges the battery. In spite of the power failure, the Epson had managed to retain the ECalc software in RAM, but I was unable to recover the spreadsheet model itself, and had to re-enter it all.

The ECalc package is attractively presented in a shiny blue paperback-sized box, holding the micro-cassette and slim spiral bound manual. (ECalc is also available, at a greater price, on a ROM cartridge.) Both the box and manual cover label the package 'Epson Calc' (for the sophisticated punter at the Derby?!), but the software and documentation refer to it as 'ECalc'. Presumably the marketing and technical departments have got their wires crossed on this one.

Before doing anything, I had to get the software on the micro-cassette read into the machine. In fact, once there, it stays almost indefinitely, surviving all switch-offs and low battery levels, somewhat lessening the advantages of the ROM cartridge. Of course it can always be explicitly erased to make room for another program perhaps,

and also it does get lost if you remove or really abuse the battery.

Anyway, I experienced a few initial difficulties loading the cassette, although it is actually a fairly straightforward procedure once you know what to do. Firstly, my review copy was unlabelled, so I was unsure which way to insert it in the drive and my initial guess turned out to be wrong. Further confusion arose when I missed a vital bit in the ECalc manual telling me that the HX-20 must be in Basic programming mode before the cassette drive commands will operate. However, after consulting the programming and hardware manuals and applying a bit of guess-work, I got the cassette drive reading the tape.

After a minute or so, I was informed of an 'I/O error', usually a sign that the tape or cassette drive is duff, though the ECalc manual had nothing to say on this matter. Trying again, I got the same message, and then — on my third attempt — it worked! Subsequent experiments failed to repeat the I/O error, so possibly it was caused by a speck of dust on the tape. Whatever the cause, the manual had no advice on the matter.

Having successfully read the tape, I still did not have an up and running spreadsheet system, being in Basic programming mode. Eventually I tracked down the instructions in the ECalc manual. It transpires that it is necessary to type RUN to get ECalc going. This is the usual command to run a Basic program. Could it be that ECalc is written in Basic? Well, somewhat to my surprise, I

Benchmarks and other measurements

Maximum number of columns: 14 (26 with 16k expansion unit).

Maximum number of rows: 15 (35 with 16k expansion unit); numeric precision: 7 digits; fixed column width: 8 characters.

As mentioned in the article, the formulae used in the Benchtests were slightly modified to comply with ECalc's formula syntax requirements. (Refer to *PCW*'s Feb '83 issue for more information on these tests.)

Benchmark 1 — to test calculation speed and capacity: (a) 9 rows (b) and (c) both 450 seconds, ie, 50 seconds per row (d) vertical scrolling speed: 18 seconds for 9 rows, ie, 2 seconds per row. Horizontal scrolling speed: 30 seconds for 13 columns, ie, 2 seconds per column.

Benchmark 2 — 15 rows (this fills every single cell with text).

Benchmark 3 — 15 rows (this fills every single cell with numbers).

Cassette benchmark: the 9 row calculation benchmark took 90 seconds to save, approximately one cell per second.



verified that it is. Basic, with its comparatively slow speed of execution is not normally the preferred language for implementing time-critical spreadsheet systems. The benchmark timings (see below) testify to this.

Putting it in perspective

The original motivation for spreadsheet systems was to provide a facility to help with pencil/paper/calculator operations. They ran on expensive (compared to a calculator, that is) micros. Although in one sense, the HX-20 can be regarded as an

extraordinarily cheap and portable computer, we can also view it as a rather large and expensive super-calculator. Thus ECalc is one of the first of, what I expect will become, a growing number of inexpensive calculator spreadsheet systems — taking the spreadsheet back to its roots.

It must be remembered that any spreadsheet system on the HX-20 is bound to be limited by the small screen display available: only 20 characters across by four rows down. Similarly the standard HX-20 comes with just 16k of RAM to hold both program and spreadsheet data.

Both of these hardware facts of life contribute to the attractive price and portability of the machine, but also affect the sophis-

tication of the software written for it. So it's really within this context that we must look at what Epson can provide.

Using ECalc

Once ECalc is running, the display clears to reveal the top-left hand corner of an empty spreadsheet. Just four spreadsheet cells can be accommodated in the display, two columns by two rows. The display's left-hand margin is reserved for the row numbers, and the top row has the column identifiers (letters A,B, etc). Thus ECalc uses the standard 'Visicalc style' for identifying cells on the spreadsheet; the first row of cells being A1. B1, etc, and the second

ECALC

being A2, B2, and so on. Of course, the display has no room for long-winded prompts, or copyright messages. The fourth and bottom line of the display are left blank, being used as 'input lines' displaying what has been typed at the keyboard. Fig 1 gives an actual size (with respect to character count) typical display.

Moving around the spreadsheet is very simple. The 'current cell' is marked by an underline cursor character. In fact this is redundant since the current cell is always the top left-hand cell on display. Anyway, the keyboard has two keys each labelled with two arrows, and each pointing in a different direction. Using these keys with and without the 'shift' key provides the four different key strokes necessary to move the current cell to the one above, below or to left or right.

After each keystroke the display is redrawn, so that the newly current cell appears in the top left hand position. The display is liquid crystal, and 'redraws' are slower than a video display would be, but because it's a small area being redrawn, this does not greatly inhibit the speed of moving around the spreadsheet.

Moving far enough to the right and down we reach the outer limits of ECalc's spreadsheet: 14 columns wide by 15 rows down. This is quite a small area but, unlike many spreadsheet systems, this is not simply a theoretical limit, since in most cases each and every one of these cells can be used without running out of memory. (In fact only the 'formula Benchtest 1' filled up all available memory before all the cells had been used.) The HX-20 also has an optional 'expansion unit', with another 16k of memory, which extends the limits to 26 columns by 35 rows. As the review system

did not have the extra 16k, I have only tested the smaller size spreadsheet.

Entering text, numbers and formulae follows the standard drill: move to the cell to be changed and type in whatever is required. To enter a formula, first press the '@' key to select 'formula mode' or else it will be treated as ordinary text. Similarly, numeric input is preferable in formula mode, since then the formatting is handled automatically. Formula syntax is rather more limited than usual: only simple arithmetic (+ - * /) can be used, and no parentheses. For some formulae this involves a little extra thought. For example, one formula used in the Benchtests (see *PCW*, Feb 83) is: $(12*(A1-1)/12)+2$. For ECalc this had to be converted to: $12*A1-12/12+2$. Note that ECalc evaluates from left to right, ignoring the normal algebraic precedence conventions. For example, ECalc would evaluate $3+4*5$ as 35 and $4*5+3$ as 23. It is easy to work out what is happening if you (mentally) add parentheses from left to right: $((12*A1)-12)/12+2$, $(3+4)*5$ and $(4*5)+3$ in the examples I have given.

ECalc does not automatically recalculate after every entry. This has to be forced by pressing the 'recalculate' (control-R) key, but once pressed the spreadsheet is completely updated to reflect all changes. However, recalculation is probably the weakest aspect of the system, since it takes an excessively long time, even for quite small spreadsheet models (see Benchtests below).

Other features

Apart from the basic facilities described above, ECalc has the following features:

- * Row and column totals. The last column and row of the spreadsheet can be used for row and column totals. This compensates somewhat for ECalc's lack of SUM function, available on most larger spreadsheet systems.

- * Display format control. The numeric display can be either integer (ie, no decimal point) or decimal (a decimal point and two digits after the decimal). The format control is global and cannot be used selectively on specified cells. In either format, very large numbers are displayed in 'exponential form', for example, 123456789123 is displayed as 1.2E+12.

- * Replication. Formulae, numbers and text can all be replicated along a single row or column, but not into an area. Specifying replication into an area (an area would be 'A1 TO F6' whereas a row would be 'A1 TO F1') produces a terse error message: 2D NO GO.

Replication of formulae can be in both relative or absolute mode. Absolute replication copies the formula faithfully, and relative replication modifies it according to where it will be placed. Relative replication is used when a formula has been set up to calculate, say, January profits, and it's to be copied along the row, into February to December columns. Clearly references to January cells in the January formula should become references to February cells in the February copy, and so on. Relative replication ensures that this happens.

Another nice feature of replication is the ability to move the cursor in mid-formula entry. As only four cells are on view at one time, it is easy to get confused when entering a complex formula. By moving the cursor the required cell can be located, then simply pressing '@' enters its identifier directly into the formula.

- * Printing. The HX-20 comes complete with an integral printer, using cash-till roll paper, and also an interface for an external printer. ECalc provides facilities for printing a specified area of the spreadsheet to either. The integral printer can only print 24 characters across: enough for just two columns of the spreadsheet, and wider reports are automatically broken into sections by the program, two columns at a time. For such a small device the printer is surprisingly noisy, and would doubtless cause a bit of a stir when used in a public place. Needless to say, being an Epson, the print quality is very good.

- * Saving and loading data. ECalc provides a fairly sophisticated cassette filing system. Before loading, the tape can be fast-wound (all under program control) to a numbered position, thus reducing search-times. Spreadsheets are saved with an eight character name, so it's possible to save more than one per side of tape, without getting them mixed up. And every time a save is made, the program prints out its position on tape with its name and the date, providing a hard-copy record for future reference. (By the way, the HX-20 has its own clock with calendar software, so it's not necessary to enter the date every time you use it.) Saving one of the benchmarks, just over 100 cells of 13 character formulae took 90 seconds, which seemed a fairly respectable speed for a cassette.

Missing features

It should be clear by now that ECalc is a fairly simple spreadsheet system. Of course it lacks consolidation facilities, split

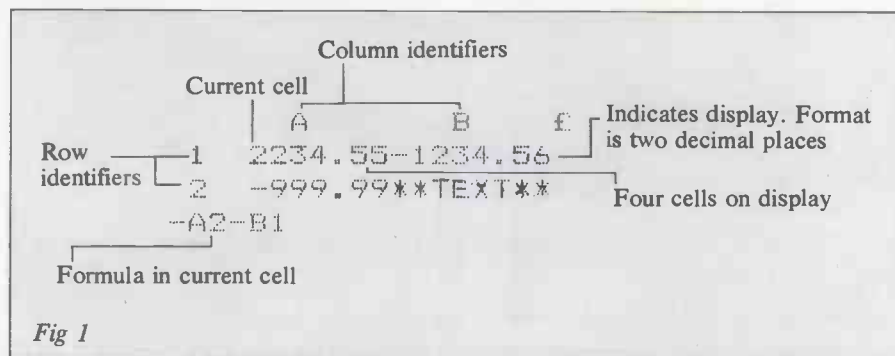


Fig 1

Checklist

Documentation: attractively packaged 32-page manual with tutorial, reference and index.

User-friendliness: relatively easy to use, but slow calculation speed, and limited help prompts.

Error handling: a few terse error messages.

Facilities: + - * / row and column sum. Can be configured as a turnkey system. Replication into rows or columns but not areas. Only three display formats: integer, two decimal places and exponential. Fixed column widths.

Manual recalculation only. 'GOTO' cell facility.

Supplier and prices (exclusive of VAT): £30 on cassette (and cassette drive costs £75). £85 on ROM cartridge. 16k memory expansion unit costs £75 and the HX-20 itself is £402. Contact Epson (UK) Ltd, Freepost, Wembley, Middlesex HA9 6BR. Freefone 2730.

screens and other sophistications, but these are hardly fair criticisms for a package in this context, so I will not dwell upon them.

However, it does also lack a few features of basic human engineering which, if present, would greatly contribute to user-friendliness. For example, there is no command to clear the spreadsheet, and there are no instructions on how to do it, either. In fact the spreadsheet can be fairly quickly cleared by exiting then re-running, a matter of a few keystrokes. Another source of annoyance was that it was impossible to abandon a menu option once selected, for example, once replication is selected you must go through with it, even if you hit the wrong key by accident. Also for some reason, the delete key did not operate in text entry under the menu options.

Although it is difficult to run out of memory before every cell available is in use, it would appear that there is no proper error-recovery if this does happen. When running the calculation benchmarks, the system simply 'died' if too many formulae were entered.

Of course more extensive arithmetic and faster recalculation times would also be desirable, along with improved editing facilities and row and column deletes. Particularly lacking was a flexible formatting facility. If working with small quantities it could be possible to squeeze four or five spreadsheet columns onto the display, but with ECalc's fixed column widths there is no facility to do this. Obviously, with just 16k of RAM, the implementors had to draw the line somewhere, since lots of facilities would mean no room for spreadsheet!

The manual

The manual is well presented: 32 glossy pages with information on getting started,

basic facilities, several tutorial examples and an index. Most of the instructions give a key by key account of what to do with all the keystrokes given in emphasised type, and keystrokes using special keys (like 'control' and 'return') printed in inverse, white on black. This is not quite as effective as it could be since emphasised type is also used wherever the product name appears, and in other instances as well. Thus it is still necessary to hunt through the text for which keys to use. Most of my initial problems with cassette loading stemmed from being unable to find information that was *actually* there, but obscured by inconsistent type-faces.

The content of the manual is passable, but not as clearly written as I would have liked. Possibly it lost a little elegance in its translation from Japanese, or alternatively it's always been in English but was not brilliantly written in the first place! Certainly it's better than some Japanese translations, in fact better than Epson's own printer manuals, but I did find it necessary to re-read most of the instructions before I could mentally digest them.

There are several tutorial exercises, including a December cash-flow problem for a certain Mr Fawkes of the 'Big Bang Firework Co' — a refreshing change from the 'Acme Widget' example that seems to pepper most of the American manuals.

Conclusion

Frankly, I was a little disappointed with ECalc. Of course, knowing the hardware limitations of the HX-20 I was not expecting a product in the Multiplan class (reviewed in *PCW*, April 83), but it would not be going into the realms of fantasy to expect a greater range of arithmetic functions and a more respectable calculation speed. After all, the HX-20 does have an

excellent Basic interpreter written by Microsoft — fully equipped with all the usual trigonometry and arithmetic functions. So all that software is already there, just waiting for connection to a spreadsheet system, and Epson failed to make use of it.

Curiously enough, I was not greatly troubled by the small scale display. Obviously a bigger display would be preferable, and Epson have plans for an external 32 by 16 character add-on, but it certainly did not render the system unusable. A particularly nice feature was the ability to move the cursor during formula entry, thus enabling the right cell reference to be found even if it was off-screen at the start of the formula entry.

The integral narrow width printer (24 characters) was just about adequate to the task, but a fair bit of cutting and pasting would be needed to fit together a wide report. As compensation, the HX-20 has good facilities for connecting to larger external printers and ECalc itself can optionally make use of them.

After some initial teething troubles the cassette behaved itself very well, with some fairly sophisticated facilities for loading and saving the spreadsheets, and at quite a reasonable speed (for a cassette) as well.

So all things considered, Epson have succeeded in implementing a usable spreadsheet system on their hand-held portable computer. It's a system that can support only fairly lightweight applications, partly because it's on lightweight hardware (for which the implementors cannot be blamed), and partly because of the software design (for which they can). Nonetheless, hand-held micro owners are not exactly spoiled for choice in this area at the moment, and so ECalc should prove of interest to the growing band of HX-20 users beavering away on buses, planes and trains.

END

NUMBERS COUNT

Mike Mudge presents another batch of mathematical mind-benders.

n-TUPLES OF ASSOCIATED n-TUPLES

A triple of positive integers is defined to be (a,b,c) where a, b and c are chosen from 1, 2, 3, ... The order of occurrence of a, b and c is not significant.

Two such triples are said to be associated if they have a common sum $a + b + c$ and also a common product $a \times b \times c$. We shall write, for example, (14,50,54)(a)(15,40,63) since $14+50+54=15+40+63=118$ and $14 \times 50 \times 54 = 15 \times 40 \times 63 = 37800$; (a) being read 'as associated with'.

Computational problems

(i) Determine the smallest common sum of four associated triples. Believed to be 118.

(ii) Determine the smallest common product of four associated triples. Believed to be 25200.

(iii) Discover any quintuples of associated triples.
(6,480,495)(a)(11,160,810)(a)(12,144,825)(a)(20,81,880)(a)(33,48,900).

(iv) Investigate empirically the existence of larger sets (n-tuples $n > 5$) of associated triples.

(v) Investigate empirically the existence of n-tuples of associated m-tuples for computationally feasible m and n.

Note: There are mathematical problems relating to infinite families of associated triples such as:-

(16ka, bc, 15d)(a)(10ka, 4bc, 6d)(a)(15kb, a d, 16c)(a)(6kb, 4ad, 10c) where $a = k + 2$, $b = k + 3$, $c = 2k + 7$, $d = 3k + 7$, $k = 1, 2, 3, \dots$ due to J G Mauldon but these

are essentially outside the scope of this article.

Readers are invited to submit a program, or suite of programs, which investigate the above problems. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize of £10 will be awarded to the 'best' entry received.

Entries, to arrive by 1 September, to: Mr M R Mudge BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note: Submissions will only be returned if suitable stamped addressed envelopes are included.

EPSON QX-10

Having made its name as a printer manufacturer, Epson took the world by storm with its portable micro, the HX-20. Will its desk-top machine have a similar impact? Peter Rodwell investigates.

Epson makes more dot matrix printers than all the other manufacturers put together and has an enviable reputation for producing well-made and reliable products. As well as selling its printers under its own brand name, it seems to have done deals with nearly every big name in the micro world to supply printers in any colour or casing with anyone else's name on the outside — even IBM uses Epson printers for its PC.

As part of the giant Seiko electronics group, it was perhaps inevitable that Epson would develop its own computers and this it has done, achieving an instant success with its HX-20 portable machine. The QX-10 is a 'grown-up' desk-top microcomputer which has already been available in Japan and the USA for some time but which has only just appeared in this country. It received rave reviews in the States and I'll say right now that this review will be of the same ilk — it's a nice machine.

Another thing which must be said right at the start is that the QX-10 goes completely against the current trend by being an 8-bit microcomputer, not 16-bit. But this is no ordinary, boring Z80-based, twin disk, CP/M-based machine. Yes, it's based on a Z80; yes, it has twin disks; and yes, it's a CP/M-80 machine, but unlike just about every other micro in this category, there's a lot more to it than this. Epson must, of course, be working on a 16-bit desk-top micro (it will certainly bring out a 16-bit portable before too long) but in the meantime, apparently dissatisfied with the state of 16-bit computing, it has chosen to put a lot of careful thought and ingenuity into considerably refining and developing the good old 8-bit formula.

On the printer front, Epson has enjoyed resounding success with its MX range of dot matrix printers. These have now been replaced by two new machines, the RX-80 and FX-80; the latter offering all the features of the top-of-the-line MX-80 but with plenty of extra bells and whistles, too. It seemed logical to evaluate this new printer at the same time, so you'll find a Checkout of it tacked onto the end of this Benchtest.

Hardware

The QX-10 follows the now conventional 'three box' design philosophy, which allows the user to devise whatever



Light, positive — and 103 keys!

relative positioning of screen and keyboard is most comfortable.

The main box houses the electronics and disk drives and, at 510mm wide by 340mm deep, is roughly the same size as an IBM PC box; it is, however, much lower, at 100mm or so, and this is achieved by the use of two low-profile disk drives. The box is in fact very slightly higher than the FX-80 and slightly less deep.

Apart from the disk drives, the only features on the front of the box are a small power light, a reset button deeply recessed into the lower edge of the moulding, and the socket for the keyboard cable, similarly hidden. The power switch is on the right hand side towards the back.

The rear of the machine has quite a few holes in it. From left to right, as you look at the back, these are: power connector, light pen socket, a socket

carrying video and power for the monitor, a row of DIP switches which configure the system's RAM, a tiny volume control knob for the internal speaker, a parallel Centronics printer interface, an RS232 interface and a series of snap-off plastic covers — the purpose of which we'll come to soon.

The keyboard unit is the same width as the main box but is only 50mm high. It connects to the main unit through a neat, coiled cable and recessing in both units allows you to push the keyboard right up against the main box, with the cable neatly hidden, out of the way. The 103 keys have a very light but positive feel, just right for very fast typing. All the main alphanumeric keys auto repeat if held down for more than a second or so. Across the top of the keyboard are ten programmable function keys, a block of four keys labelled 'Break', 'Pause', 'Help' and 'Screen dump', the functions of



Neat and stylish — the three-box system.

which are exactly as stated except for the Help key, which merely produced the characters '^@' on the screen. There are another four keys, each with a built-in LED indicator, labelled 'SF1' to 'SF4' at the right hand top of the keyboard; these allow you to alter the character set, as we'll see later. The main qwerty block is standard, but has a caps lock key with built-in LED at one end of the space bar and a graphics shift key at the other. This graphics key allows you to type in graphics symbols directly from the keyboard, using the main alpha keys; the symbols provided include the usual lines, boxes and shades as well as a little person, a tiny car, an unstable-looking aircraft and a half-full wine glass. There's also an odd one which may or may not be a telephone receiver.

Full cursor control is provided by four keys to the right of the main block, and this section also has a cursor home,

screen clear, insert and delete keys. At the far right is a numeric pad which includes a return key, all arithmetic symbols and a '000' key. All the main keys on the keyboard are a tasty plain chocolate brown, with subsidiary keys a lighter colour. And — a nice touch — the 10 function keys and the Break, etc, keys have removable transparent covers so you can put your own labels on them. It can surely be only a matter of time before Epson — or a similar company — produces function keys with dot matrix LCD displays built in, so that key labels as well as functions can be changed under software control.

The keyboard can be used in two positions — lying flat on the table top or tilted up by pulling out the two rear feet and turning them to lock them into the extended position.

The display unit simply sits on top of the main box; you can therefore swivel it

around but there's no way to adjust its tilt, which is a little odd although, in practice, I found it to be at the right angle anyway. Both power and video signals are carried along the same rather short cable. The only user control on the VDU is a brightness knob at the back although there's also a deeply recessed focus adjuster, for which you need a long screwdriver. The display is monochrome with sharp, green characters on a black background.

Overall, the QX-10 looks neat and stylish and takes up commendably little space on the desk. It's not too heavy — 18kg, in fact — to move around the office, either.

A closer look at, and inside, the main box shows that the machine is built to the very high standard we have come to expect from Japanese manufacturers. Undoing two philips screws at the rear allows you to lift off a small cover to the

EPSON QX-10

left of the main box as you look at it from the front. Inside, you have easy access to an area of the main PCB where all the RAM chips are housed — there are two groups each of 64k on the standard machine and sockets for another 64k to be added. And there are five sockets for expansion cards, one of which was occupied on the test machine with the multi-fonts card, supplied as standard equipment in this country. Each expansion card fits into a slot at one end and has a small 'foot' which engages in a hole in the PCB at the other, thus holding it perfectly steady, unlike the free-flapping arrangements found in some other machines. At the rear of the case is a panel of four snap-off covers which can be replaced by connectors for the expansion cards and there's also a tiny plastic cover hiding a DIN-sized hole for a connector to the fifth card — presumably this would be for something like a colour monitor connector.

Two screws are visible inside this area: they obviously hold down the rest of the cover, but at first sight there seems to be no access to the remaining cover screws. A closer inspection reveals two tiny plastic removable squares on the cover top; levering these up with a screwdriver reveals the other two cover screws, an impressively neat piece of design work. The two disk drives are fixed into the cover itself and with their leads unplugged — two easy-to-get-at connectors and an earthing strap — the

whole lot lifts off. Inside, there's a vertically-mounted power supply at one end of the machine and the whole of the rest of it is taken up with a gigantic PCB, crammed with components and beautifully made. Crammed though it is, though, there still wasn't room for everything and another, smaller board is piggy-backed on top of it. The standard of construction is very high and could act as a lesson for quite a few European and American manufacturers: everything is neatly arranged, there are no wires floating around, all the important chips are socketed and the whole thing has clearly been designed not only for efficient manufacture but for easy servicing, too.

The CPU chip is in fact a Japanese Z80A equivalent, a uPD780-1. The system contains a DMA controller, two counter-timers, a clock/calendar chip with battery back-up, Centronics parallel, RS232 serial and light pen interfaces and five expansion card slots — expansion cards can be inserted in whichever slot takes your fancy.

The system comes with 192 kbytes of RAM as standard, expandable to 265k. A 64k area is designated as the main bank and operates just like a normal CP/M-based system — see the Memory Map. Another bank, of 56k, is labelled 'BIOS' in the manual and appears to be reserved for the expanded CP/M used in the machine. Two further 56k banks are also available; Bank 1 comes with the standard machine and is used by the Multi-font Basic or can be accessed from CP/M as a 56k capacity memory disk called Drive F. You can use this just as



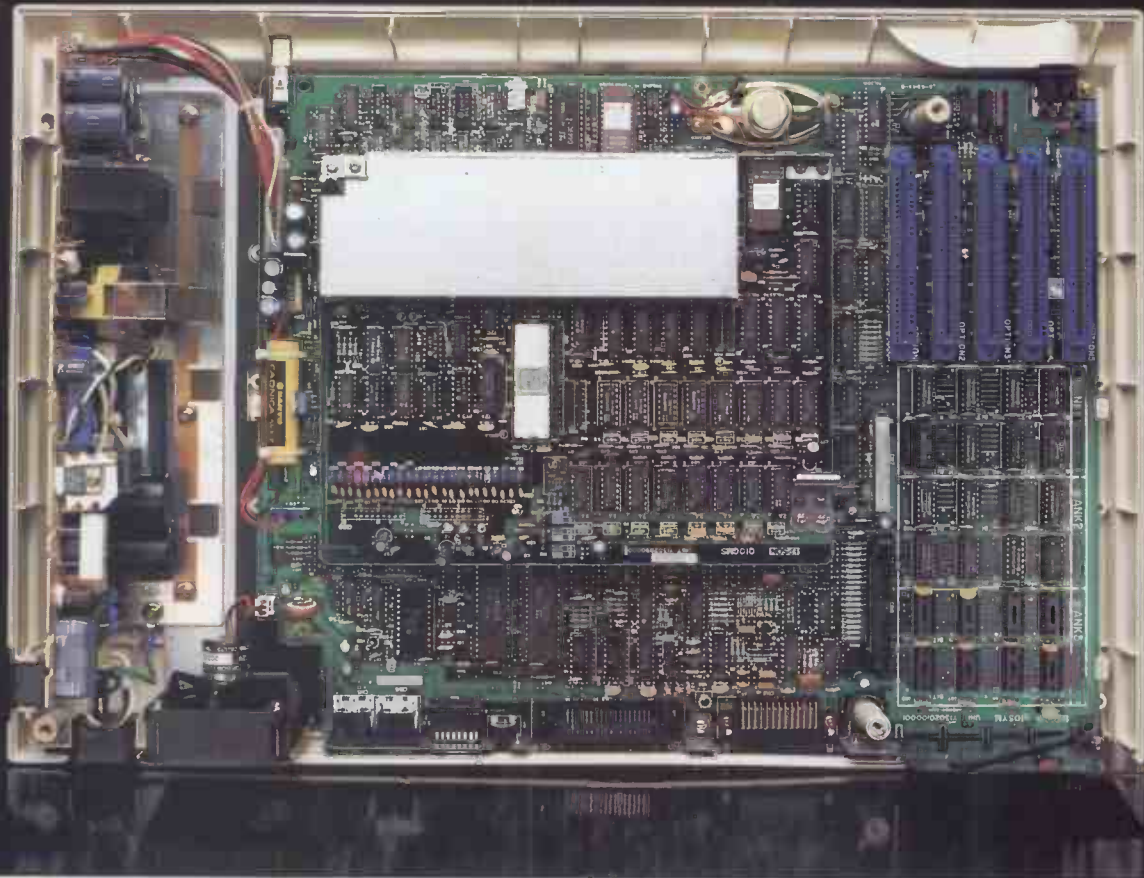
Rear view with snap-off covers



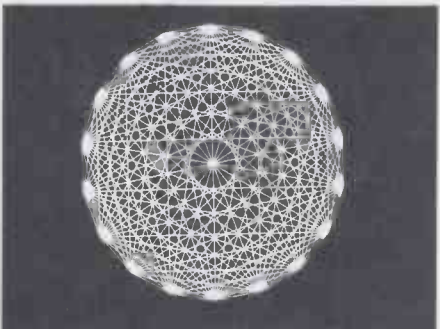
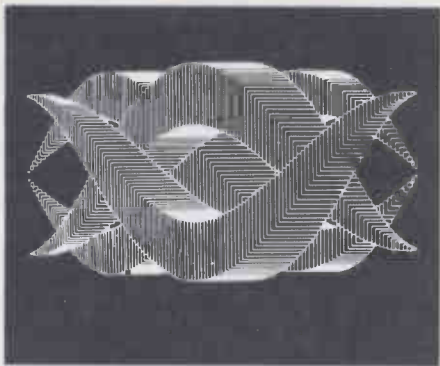
Low-profile disk drives



Expansion sockets.



Interior shows neat design: crammed with components and easy to service.



Hi-res and fancy fonts.

though it were an actual disk drive, and expanding the memory to the full 256k gives a second RAM disk, designated Drive E, also of 56k capacity.

A further 32k of video RAM is provided and a diagram in the manual seems to suggest that this can be expanded to 128k, although nowhere is this mentioned in the text; I assume this refers to the colour display option. The screen displays 25 lines of 80 characters normally, each character being formed on a 7 x 13 matrix. Curiously, the standard character set has virtually no descenders but is nevertheless very attractive and easy to read — the descenders in fact project below the line by a single dot. Using MFBASIC, you have either 20 lines of 80 characters or 20 lines of 40 characters — the latter being used for the fancy fonts. Graphics resolution is a very good 640 dots horizontally by 400 vertically.

The QX-10 system diagram in the manual also shows 2 kbytes of CMOS RAM with battery backup, although its purpose isn't very clear from the manual.

The double-sided, double-density 5¼in real disk drives have a formatted capacity of 278 kbytes per disk after the directory and operating system have taken their share of disk space; this is fairly low by today's standards.

In use

Setting up the machine is simplicity itself — insert the power lead, plug in the screen and keyboard, and you're ready to go. Switching on produces a quiet rushing sound from the cooling fan and the words 'INSERT DISKETTE' appear in the centre of the screen, with the LED on the left-hand drive lighting up to indicate which drive expects the disk. The low-profile drives are very, very quiet and hum slightly while the head is being moved across the disk. The QX-10 appears to go through some sort of diagnostics or configuring routine initially, which involves flashing all the LEDs on the keyboard, one at a time and then all together in a most festive manner. This all takes several seconds, during which time nothing appears on the screen to tell you what's happening, but eventually you get the CP/M copyright sign and prompt.

System software

The QX-10 comes with a considerably modified version of CP/M-80 2.2, allowing complete control over all of its fancy features. At boot-up, the 10 function keys are configured to provide all the most useful CP/M commands at a single keystroke: DIR, TYPE, LOAD, DDT, PIP, DUMP, SAVE, SUBMIT, and MFBASIC.

Most users will probably want to customise the system's configuration first, though, using the CONFIG program. This alters the system configuration information held as a file on disk and read during the boot-up process. It allows you to set up the machine for any of Epson's printers — but there's no option to allow you to specify another manufacturer's printer — which are assumed to be attached to the parallel port. The options included all the MX and FX models. The serial port can be set up for baud rates from 50 to 9600 and for all the usual framing possibilities (number of stop bits, parity, etc). If you need faster serial communications, you'll

have to install an option serial card which allows baud rates up to 19,200 baud. CONFIG then allows you to set the date and time for the clock/calendar chip before offering you a choice of eight 'language' options, which are in fact the possible character sets: standard ASCII, French, German, English, Danish (sic), Swedish, Italian or Spanish. Keyboards are available to use all of these characters, by the way, another lesson many Americans could learn.

A utility called CHARADEF allows you to create your own character sets of up to 66 characters and store them on disk. These can be accessed by applications programs and displayed on the screen, and provided you are using a suitable printer, they can also be printed out. The function keys can be re-programmed using a utility called PFKSET; this allows whole strings to be assigned to each key and files of these stored on disk. You can modify the table of strings used by the machine as standard settings and you can create your own tables; these can be loaded from disk and activated with the same program. This can happen automatically, if required, using the AUTOST program, which allows you to define a program for automatic execution when the system is turned on.

The QX-10 can be used as either a terminal to another computer or as a host computer with the TERM program. You can also alter the RS232 port settings with this utility. This would appeal to owners of both a QX-10 and an HX-10; the latter could be used 'in the field' for data collection, and the data could then be loaded into the QX-10 back at the ranch.

Other utilities, apart from the standard CP/M ones, include DISKCOPY, which transfers the entire contents of a disk from one drive to another and which can also be used with the RAM disks; FORMAT, which formats a disk; and DIRINIT, which initialises the directory of a disk and, effectively, erases anything on it in the process — this is useful for cleaning up the RAM disk after MFBASIC has cluttered it up.

Some very considerable extensions have been added to those already in CP/M. These are concerned with screen handling, dumping the screen's contents to a printer, serial port handling (both the built-in port and extra ones), reading and setting the clock/calendar chip, using the light pen interface, handling interrupts and the function keys and dealing with the memory system. This last includes routines for switching between RAM banks, transferring data between banks and using software at a specified address in a specified bank. These will all provide hours of harmless fun for the serious assembler language programmer but of course mean that any programs using them will be totally non-standard and unusable on other CP/M-based machines. This shouldn't be too great a discouragement, I feel. One would expect any sensible programmer to have long ago built a good degree of adaptability into his programs to take advantage of

Memory map

Main bank				
E000H	CP/M	System bank	User bank 1	User bank 2
	Program area	BIOS	User area or RAM disk F	User area or RAM disk E
100 H OH	Reserved for CP/M			

Provided on basic 192k machine

With expansion to 256k

EPSON QX-10

the advanced features now appearing on CP/M micros, and to have catered for the inclusion of these sorts of facilities in his software.

Character fonts

The QX-10 can display 16 different built-in character fonts, a feat unrivalled by any other CP/M-80 micro as far as I am aware. Yes, there are machines around which will allow you to generate your own fonts but none, to the best of my knowledge, come with them *built-in*, not only to the system but to the operating system, too, so that using them is actually easy.

The hard work is done by the MultiFont character generator card, supplied with the standard machine, which occupies one of the expansion bus slots. The card contains six 128 kbit ROMs full of character data and has its own 8-bit 8039 slave CPU, plus control firmware in a 2716 PROM.

A utility program, MFont, activates the card from CP/M. You can then select whichever font you require with the four 'SF' keys at the top right of the keyboard. Fonts are selected by pressing these keys in various combinations, the activated combination being shown by the little LEDs built into these keys. With four keys you have 15 combinations plus the standard one used by the system normally. The penalty you pay for typographical fun and games, though, is that you can only display 40 special characters per line with these fonts, instead of the 80 per line with the standard character set. This is a shame, for one or two of the fonts are much more attractive than the standard one and come with normal and italic versions, which would look nice for word processing. Most of the fonts are, however, decorative rather than practical and you would only want to use them for headings, etc, rather than whole blocks of text. Needless to say, the font generator can be controlled by CP/M applications programs, through what seems a complex series of commands; time just didn't allow me to experiment with this facility and I confined my font fun to playing with it from Basic instead.

My immediate reaction to the fonts facility was that it would make a superb tool for layout artists, but although the manual speaks of proportional spacing possibilities, I couldn't quite work out how it could be done. If the fonts were typographically accurate from the spacing point of view, word processor output could be displayed on the screen in its typeset form; this could also be dumped to a printer for rough layouts, although it naturally wouldn't be in a camera-ready condition — Epson dot matrix printers aren't *that* good!

The fonts provided are Bodoni, Old English, Flash Bold, Commercial Script, Helvetica light, Helvetica light italic, Helvetica medium italic, Broadway,

American typewriter medium, Light italic, Helvetica medium, Bodoni italic, sans-serif shaded, Microgramma Extended and Old Germany.

MFBasic

First the bad news: MultiFont Basic is an extended version of Microsoft Basic. Now the good news: the extensions are fantastic. As its name implies, it's designed to take full advantage of the multi-fonts facility and in addition it has comprehensive graphics abilities to make really good use of that superb 640 x 400 high-resolution screen.

But first I've just got to tell you about the editing facility. Anyone who has tried to write programs with standard Microsoft Basic must, like me, have been occasionally reduced to tears of rage and frustration at the appalling, horrible, unfriendly, fiddly editing arrangements for correcting all your mistakes. I hate it (and so does everyone else I know who is familiar with it and has seen the screen editing supplied on some machines). Well, Epson obviously hated it, too, because it has been swept aside on the QX-10 with a proper screen editor.

Let me explain this for those of you unfamiliar either with Microsoft's so-called editor or with proper screen editors. The Microsoft editor treats the screen as though it were a piece of paper emerging from a printer. To correct a wrong line, you type EDIT 15230, say, and you get the line number with the cursor next to it printed on the screen. Pressing the space bar moves you along the line, displaying each character one at a time. You thus have to position yourself just before the wrong character (which you can't see, of course) and then use special commands to insert or delete whatever's wrong with the line. There is a command which will display the line and put you at the start of a new copy of it but the whole process is too much hassle — I can never remember the commands for moving back and forth along the line and I always end up re-typing the line to the accompaniment of much swearing.

Even the original Commodore PET had a better arrangement than this. You LIST your program — or section of it, or

Benchmark timings

BM1	2.3
BM2	6.4
BM3	15.8
BM4	15.8
BM5	16.5
BM6	31.9
BM7	52.9
BM8	65.8

All timings in seconds. For an explanation and listings of the Benchmark programs, see PCW Vol 5 No 11, November 1982.

one line — on the screen, move the cursor to it, along it, back and forth, whatever, until you find your mistake. You can overtype, insert or delete (using 'insert' and 'delete' keys) and as you change what appears on the screen, so the program in RAM is changed. The only restriction found on some machines, including the Epson, is that changes are only accepted if you move to the end of the corrected line and press RETURN. Needless to say, I was immensely pleased to discover that I could edit programs using the Epson's cursor control, insert and delete keys. The last time I asked anyone at Microsoft when they were going to do something about their stupid editor I received some mumbled comments about hardware difficulties and a swift change of subject. Full marks, then, to Epson, for doing something about it.

Having raved about the editor, I must now confess to being able to say little more about MFBasic, as a manual was not supplied with the machine and requests for one didn't produce the goods in time for this Benchtest. It does appear to support standard Microsoft Basic, though and this would make it 'upwards compatible' — a program written in standard Microsoft on one machine should run on the QX-10 but one written on the QX-10 and using the machine's special features obviously wouldn't work on some other computer.

Loading MFBasic automatically activates the multi-font card and you can access the fonts directly from MFBasic. It also reconfigures the function keys so

GOTO page 240

Technical specifications

CPU:	Z80A-compatible
RAM:	192k main memory, expandable to 256k; 32k video RAM; 2k CMOS RAM.
Display:	25 lines x 80 characters in CP/M; 20 x 80 or 20 x 40 in MFBasic; 640 x 400 graphics resolution; 8 national versions of standard character set; 15 additional character fonts available from CP/M and MFBasic.
Keyboard:	103 keys including 10 programmable function keys, full cursor control, font change keys and numeric pad.
Disks:	Twin 5¼in floppy, capacity 278k per disk.
I/O:	1 Centronics parallel printer port, 1 RS232 port with software-controlled baud rates (50-9600 baud) and framing, light pen interface; 5 internal expansion slots (1 occupied by MF card) for optional IEEE-488, RS232, Omninet and fibre optic interfaces.
System software:	Enhanced CP/M 2.2
Languages:	Multi-font Basic (enhanced Microsoft)
Applications:	Optional Peachtree accountancy and word processing.

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- Correct answers are displayed if error made
- Full report at end of test

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- Correct answers are displayed if error made
- Full report at end of test

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your word processor can handle it, but of course there shouldn't be too much problem if you're using some other suitably configured software).

Graphics

A hefty section of the printer's thick, spiral bound manual is given over to its graphics capability. Again, a variety of modes are possible: 576, 640, 720 and 1920 horizontal dots, with variable line spacing to obtain just the effect required. Note that one mode gives the same horizontal dot resolution — 640 — as the Epson QX-10, Benchtested in the

preceding pages, and naturally the two are completely compatible. Seizing this fact, I cheated to produce the graphics shown below by dumping from the QX-10's screen to the FX-80.

Of course a major advantage of the dot graphics is that you can define your own character sets and produce all sorts of fancy effects, although the FX-80 has such versatility in its built-in character sets that I'd be hard put to find a use for any more which would justify the effort of designing and programming my own fonts. Still, if you want to do so, the manual gives full instructions. The manual, by the way, is clearly and con-

cisely written, with full details of how to set up the machine plus extensive examples, in standard Microsoft Basic, of how to send the character control codes. There are also complete diagrams of all the character sets and permutations possible on the machine.

Conclusions

The FX-80 has got to be another winner for Epson, even though a cheaper machine is being marketed — it wins on the massive range of facilities, which should be enough for anybody's uses. The only problem you might face is in interfacing it to your software; the range of facilities and the codes required to control them vary so much between manufacturers that it's extremely difficult for standard software packages to cater for all possibilities.

Although the FX-80 is slightly noisier than its predecessors, it is twice as fast and this makes a tremendous difference if you have lots of stuff to print out. As an all-round printer selling at a reasonable price, it definitely is worth seriously considering.

This is the FX-80's standard font
 This is normal but it's underlined
 and here is the italics version of the standard font
 This is the emphasised version of the standard font
 This is double-strike printing
 This is double-width
 This is what the condensed face, giving 132 columns, is like
 and it has an enlarged version, too
 This is printed in the elite face - 12 chars per inch
 This is proportionally spaced - it's automatically emphasised
 The FX-80 can also handle ^{superscripts} and _{subscripts}

Some of the FX-80's built-in fonts

SuperCalc AnswerKey (ta) Entry/Edit mode

The first character determines whether you are entering a formula or a text string (label). A quote mark (") starts a text string. An apostrophe (') starts a repeating text string. Any other character starts a formula.

While entering data, the arrow keys (which normally scroll around the worksheet) become "editing" keys:

Left arrow (or CTRL/B) --> Backspace one character
Right arrow (or CTRL/D) --> Move right one character
Up arrow (or CTRL/E) --> Insert one blank
Down arrow (or CTRL/X) --> Delete one character

Press any key to continue

The seven inch screen displays 80 characters per line

cessor as the Osborne 1, running at a perfectly ordinary 4 Mhz — which means that its performance on running program instructions in Basic is almost identical to its predecessor.

However, there are differences between one CP/M system and the next — depending on the way the processor board is constructed — and the Osborne 1 was relatively quick at running Microsoft Basic.

One factor which can affect benchmark timings is the number of 'wait states' that the processor gets caught up in, when signals are expected from its subordinate chips, and take longer than the Z80 would ideally like.

The operating system for the pre-production model supplied is CP/M Plus, which differs enormously from CP/M in several ways: one of these is the way it handles disks, and another is the way it extends memory.

The Executive has 124 kbytes of memory. Theoretically, under CP/M Plus, this could be extended in 'banks' of 48 kbytes, all of which share the same memory contents for the top 16 kbytes. On the Executive this theoretical expandability has been ignored, on the grounds (I think, spurious) that there simply isn't room in the case or power in the power supply for another memory board.

As to the power supply, the company may have a point. This system, like most modern desk-top micros, needs a fan to keep it cool. The vent at the front is obvious. At the back, there is a closable hatch over the fan — with it closed, the fan will have no effect except to generate a certain amount of extra heat. On the top, there is a larger ventilation hatch, identical to that on the newer, cased version of the Osborne 1, where simple convection was more than enough to cool it down.

There was a plan (still not rejected) to put a switch into the system, so that the fan only worked when the computer got hot. On the test machine, this heat sensing had not been included, so the noise of the fan simply had to be tolerated — and the noise, I'm afraid, did betray the fact that the power supply finds the disks a bit of a strain, because the note of the fan hum drops quite noticeably when they come on. It must also be pointed out that the power is much beefier than the Osborne 1 could put out, and this machine can operate both disks together — the old one would have blown a fuse.

Total memory in the Executive is 124 kbytes (see memory map diagram) with 60 kbytes of this available as the 'transient program area' — transient programs being things like SuperCalc and WordStar.

The machine can be connected to printers, terminals, modems and other peripherals through two RS232 ports, or a Centronics port which can be re-programmed as a universal HP interface bus (IEEE 488 standard). Invisible to the user but available to the system designer



Superficially the Executive is not dissimilar to the Osborne 1 but refinements have been incorporated.

THE OSBORNE EXECUTIVE

or the clever add-on merchant, there is a direct memory access (DMA) port.

The serial ports are considerably upgraded on the originals, being programmable to run at any baud rate from 50 to 9600. The Centronics port on the old machine was just an edge connector, which meant considerable trouble in tracing a suitable cable. On this one it is still not absolutely standard as a Centronics plug because it lacks the little wire 'hooks' that lock the cable in place. However, any Centronics cable will plug firmly enough into it. And it is, apparently, a 'standard IEEE socket'.

The Direct Memory Access port is of no interest to anybody who is not planning to upgrade the Executive into a 16-bit processor with the add-on 8088 card. No more need be said of it at this stage, since it isn't available.

The diskettes, apart from being half-height, offer no surprises to Osborne 1 users, nor to anybody else. The slightly disappointing surprise is that they are still only single-sided, double density, with a maximum capacity of 200 kbytes.

Against that, they are pretty clever, being able (used with care) to get data off the Digital Equipment Robin (VT180) CP/M kit, the Xerox five-inch disk format, the Cromemco minidisk, and the IBM (CP/M-86 only) double density, as well as from earlier Osborne diskettes. That is all without loading any special program.

With the use of specially bought programs, these drives can be used not only to read, but to format, and to write, for some 20 other five-inch formats, since the operating monitor program does not force user programs to go through CP/M disk handling routines, but offers the alternative of direct access.

Software

Standard software supplied with the machine is:

UCSD P-system (Pascal interpretative run-time operating software) and CP/M Plus as operating systems; CP/M utilities, and Osborne utilities for programming the machine or for changing its operating characteristics; Executive Data Base Manager; Supercalc 1.12; WordStar 3.4 (with Mail-Merge) and Microsoft 5.3 disk Basic (interpretative) with CBasic 2.37 (compiled) as programming languages.

Total shop value of that lot would be around £1500.

The utilities are worth a more detailed mention, because all too many CP/M systems skimp on these. This system comes with almost as full a set as one could wish.

In particular, the old insistence on supplying only standard CP/M programs that would work on any CP/M system has been dropped; and the assembler program ASM has been replaced by MAC. The difference is simple enough: MAC can cope with the extra instructions of the

Z80, whereas ASM.COM could produce only 8080 code.

The CP/M utilities are nice; but it is the Osborne utilities that make the machine. They get a special section to themselves, below, in the 'machine under test' section.

As on the Osborne 1, all the numeric keys are programmable to send a string of characters to the console, or to any other CP/M 'logical' device. There are a total of 288 memory locations in memory, set aside to store these strings, more than twice the limit on the Osborne 1. In addition, the cursor arrow keys can be directly programmed — on the original system, there was merely a choice of 'WordStar' or 'CP/M' standard control characters.

The screen is the first piece of hardware to show a definite reduction, rather than increase, over the Osborne 1.

Adam Osborne has said that the seven-inch screen was the right size improvement — that most people felt it was 'a lot bigger' than the old five-inch screen, whereas a nine-inch screen didn't offer much over the seven-inch.

But where the old five-inch screen displayed only 52 characters per line (and this new seven-inch screen displays 80), it actually was capable of showing you 128 characters, with a little clever scrolling.

That has gone (see above), and its loss will disappoint Osborne fans.

The Executive under test

Testing the machine was a challenge which I happily dodged. I am prepared to make slight apologies for not trying out the database or the program generator, or the terminal emulation facilities, each of which warrants a full software text on its own. WordStar version 3.4 is very well known; Supercalc is a spreadsheet which needs introduction only to those who don't know what spreadsheets are; and the assembly level utilities are of interest only to the user who has had the machine for some time, or for the systems software professional (who knows them all backwards anyway).

What I did test was the new Setup and character generation utilities, SETUP.COM and CHARGEN.COM.

Chargen is a character generator. It shows you a grid of pixels, and you can load existing characters in for alteration, or develop your own from scratch. Having gone right through the dot matrix for each letter, you can end up with a character set on disk, automatically loadable, which will give serifs for each letter. Or you can write in Greek. All you need is disk space to store the characters.

Setup does almost anything. It will program one user port to use the ET/ACK protocol, at 9600 baud; the next to do XON/XOFF, at 50 baud; or both; or neither. It can set the cursor to be visible or invisible, blinking or steady, block or underline, or any combination (though obviously not invisible blinking anything) and can change screen attributes to flash, underline, inverse, half-bright or graphics.

It can even be programmed to avoid 50/

60 Hz mains flicker. That is one of the more irritating things that can happen on US built machines, where the frequency of the screen refresh can often clash with the UK mains frequency, producing wobble, flicker and other eye-irritating nasties. On the Executive, Setup can be told what the mains frequency is, and will adjust the screen frequency to avoid these problems.

But one thing Setup cannot do is edit the programmable function keys. Nor, infuriatingly, can it be programmed to send two 'ESCAPE' characters (Hex 1B) after each other.

The most obvious use of Setup for programming function keys lies in telecommunications, where logging on to remote computers can be a matter of typing up to 30 characters in batches of 10 (or so) — any one of which, if mistyped, can force you to start again. Press the 'control' key and one of your pre-programmed function keys, and the whole string will go out perfectly.

I find this invaluable on WordStar, where quite complex sequence of multi-key commands can be transmitted with one finger. The trouble is that when you come to alter a sequence, you have to type in the new sequence from the start — you cannot just change the offending character. It may seem a small quibble, but when you have WordStar loaded, a file ready to save and find that you've accidentally left out the letter S in a complex save and print sequence, tempers can wear thin.

Since there is no editor, when typing in programmable sequences there has to be some way of telling Setup that you have finished. Osborne chose two ESCAPE characters as the indication. So you cannot program your telecom system to send two ESCAPE characters sequentially — which is something you have to do, using Osborne's own approved Amcall program, in order to transmit an ESCAPE to the remote computer. A silly oversight, and definite proof that nobody at Osborne uses Comshare electronic mail.

One other thing that Setup cannot do is change the screen width.

It is perfectly possible, with the Osborne 1, to set up the machine (using the SETUP.COM program) so that no user is ever aware that he has 128 characters, or that there is any scrolling ability. There were reasons why this wasn't done — principally, the 80-column WordStar menu displays, which would have been illegible.

But none of these apply to the Executive.

The designers have thrown that nice wide screen away. With automatic 'scrolling' off, the machine set to have a logical screen width of 80 columns and standard software running, no one would ever be troubled by screen flicker, or horizontal scrolling jump. The only possible drawback would be that since the new screen actually needs 12-bit memory, it would use up quite a few memory chips to do this — but with only 4 kbytes devoted to video memory, the extra involved could hardly be seen as prohibitive.

This is particularly irritating when you switch to WordStar.

GOTO page 242

Send your queries to Len Warner, 35 St Julian's Road, St Albans, Herts. Please note that Len cannot answer questions on an individual basis, so please don't send an SAE with your query.

Scientist's dilemma

I am looking for a cheaper alternative to the Hewlett Packard HP85 for use as a scientist's personal computer. The Newbrain is attractive for its graphics, and low price, while the BBC Model B is attractive for its faster Basic, and expansion capability.

The PCW review of the Newbrain suggests that a program will be executed faster on subsequent runs than on the first, as it only needs to be compiled the first time. If this is so, how much faster?

How complicated would it be to have a sub-routine to dump the contents of the screen to a printer with either of these machines?

How difficult would it be to use one of these micros plus a video monitor as a terminal to a mainframe?
J R Senna, London

The Newbrain 'compiler' compiles each line into a 'tokenised' form as it is entered. This tokenised version of the program is then run in an interpretative manner each time the program is run. There is thus no dramatic speed-up in execution, such as that associated with true compilers.

The ability to allocate 'devices' to 'data streams' on the Newbrain should make it relatively easy to copy the screen to a printer. On the BBC micro, the VDU command allows the screen and printer to display the same text when required, and routines have been published by Beebug and others to dump the high-res graphics screen to a matrix printer.

There should be no problems using either of these machines as terminals to a mainframe. The wide range of interfaces on the Newbrain and the power of the data

stream concept should take care of this. Equally, the RS423 port and the operating system commands of the BBC make this relatively easy.

P L McIlmoyle

Time to switch off?

I want to use my micro as a timeswitch to turn mains powered equipment on and off. Can you give me details on how to switch mains circuits from a computer?

P Halsey, Birmingham

There are several vital safety aspects to consider, and I advise you not to construct any mains unit unless your wiring skill, attention to detail, and electrical knowledge are of a high standard.

First, all low-voltage circuits must be properly isolated from the mains. This is to protect the users and, less important, the computer. The simplest way to accomplish this is to use a Solid State Relay to switch the power.

Second, the micro and all other equipment must be safe to leave switched on unattended.

Third, the equipment should be operationally safe. It should not present a hazard to people who do not know it is automatically controlled. Heaters and moving machinery might be a problem. What happens if your control program crashes and leaves strange combinations of units on?

These two products will solve the mains isolation problem:-
Gem Systems Ltd, 2 Crawford Road, Hatfield, Herts, tel 66148, supplies a Power Switch Box ready built, which will switch 3A per channel. The computer interface is Centronics or VIC 20. Four channels cost £69.95, and the system is expandable in modules to over 1800 channels.

TK Electronics, 11 Boston Road, London W7, tel 01-579 9794, offers the XK112 Mains Wiring Transmitter/Receiver kit. This controls appliances remotely by signals transmitted over the mains wiring. The interface is five lines driving opto-isolators. The two channel kit costs £42, and independent 2KW channels are allowed.

Len Warner

Bigger and better

Please can you tell me how to obtain enlarged characters, condensed characters, and all the other styles that the Epson MX80 allows. I am using a BBC micro and have tried sending control codes to no avail.

Joseph Thompson, Edgeware
Control codes sent to the printer are removed by the operating system on the BBC micro. You will be aware that to send output to the printer you must use VDU 2, and to stop output going to the printer you send VDU 3. For example:-
10 PRINT"APPLE"
20 VDU 2
30 PRINT "ORANGE"
40 VDU 3
will print APPLE and ORANGE on the screen, but only ORANGE on the printer. To send any single character (even control codes) you use VDU 1. The '1' must be repeated before each character sent. For example:-
10 UDU 2
20 PRINT"APPLE"
30 VDU 1,14 :REM enlarged
40 PRINT"ORANGE"
50 VDU 1,20 :REM enlarged off
60 VDU 1,271,69 :REM emphasised
70 PRINT"PEAR"
80 VDU 3
will print in normal, enlarged and emphasised mode in turn, and leave the emphasised typeface selected but printer

output off. Line 60 is the way to send 'escape'+ 'E'. One VDU command can contain the VDU 2 function, several VDU 1 codes, and the VDU 3 function, if required.

Sheridan Williams, Beebug

Spectrum machinations

I have recently purchased a Spectrum and have been experiencing difficulties in moving a number of things on the screen at the same time, which obviously needs machine code to make the speed acceptable. The Spectrum books I have seen shy away from the problem or give brief and poorly explained examples. I am looking for a book with a series of Basic examples of all the Spectrum functions with equivalent machine code routines to do the same job. What can you recommend?

B T Izzard, Chelmsford
I don't think you will find the book you ask for, because the time wasted in Basic is largely in scanning the program and data areas to find the right program line and variables. The function finally executed is in machine code and fairly efficient. A machine code program scores by using fixed areas of memory for program and data and by making direct calls to ROM routines. Sometimes machine code can eliminate lots of unproductive Basic internal housekeeping operations, eg, in a routine which is moving data with a loop containing PEEKs and POKEs.

The solution is to learn machine code and the architecture of your micro, so that you can choose the most direct way to carry out a task. I think you will find *40 Best Machine Code Routines for the Spectrum* by Hardman and Hewson very useful,

because it teaches machine code with a set of routines — which should be useful building blocks for later programs — and concentrates on screen handling problems.

It is available from MoI, 1 Francis Avenue, St Albans, Herts, tel (0727) 52801 for £6.90 post paid.

Len Warner

Engineering calculator

I would like to purchase either a small computer or a programmable calculator capable of dealing with engineering problems such as pipe-sizing, heating and cooling loads, etc. I have no knowledge of computers, and hence would be looking for a machine easily mastered by the layman. What would you advise?

P Bagnall, Riyadh

Assuming that you just want the right answer fast, and are not concerned either with having a detailed printout, or with writing your own programs, then I personally think there is a lot to be said for a dedicated electronic calculator for your application. This would seem to be especially so in your case, as there would be no moving parts to get sand into them, and no need for a mains power supply, which might be subject to voltage variations, etc.

The Hewlett Packard, Texas Instrument, and Casio ranges, should be able to offer what you need. The HP calculators tend to provide a range of programs by the use of magnetic cards which need to be fed into the machine. There could be advantages for you in the TI range, which use interchangeable plug-in ROM packs, providing TI have the programs you need in ROM.

P L McIlmoyle

Track record

Over the last few months I've been trying to work out how a trackball works. I've talked to my A level physics teachers and they haven't any ideas on the subject. The only way I can think of is by using changing magnetic fields. Is this correct? If it isn't, how do they work?

John Benfield, Hemel Hempstead

I confess, I have been intrigued by this too, and I don't know. However, let me suggest two feasible methods, and perhaps someone will write in and tell me if I am near the mark.

A trackball is a position controller similar to a joystick, except that you can rotate the ball continuously through as many degrees as you like by rubbing with the hand. So the problem is to resolve and measure the X and Y motions without being able to put a shaft through the ball. One way would be to have two small disks with their edges on the ball and mutually at right angles, so that one rotates for X motion and slips for Y, and vice-versa. The movement could be read by a shaft encoder, giving very low friction and direct digital output.

Another way would be to have a metal ball and five small solenoids with their poles forming the pattern of a cross at the ball's surface. The central pole would be energised with an AC bias, and the four surrounding poles would pick up equal signals with the ball still. If the ball moves, it will drag the eddy current pattern round and upset the signal balance. A differential amplifier, rectifier and a voltage to frequency converter for each axis would give a pulse signal proportional to movement.

Len Warner

Filing task

We have a collection of some 3600 photographic transparencies, and are looking for a micro-computer system to index and cross-reference these, perhaps by a keyword system. We would want to be able to find which slides showed which subject or combination of subjects, as well as a 40-character description of each subject. Is this possible on any of the cheaper (BBC 'B' or less) micros?

G Jenkins, West Lothian

The problem of attempting to use a machine such as the BBC Model B, or a similarly priced unit, for an application such as yours, is the large amount of data you wish to handle. Your application, as

described, would take up some 150 kbytes just for the 40-character descriptions. It is not really satisfactory to handle amounts of data such as this with an ordinary cassette recorder. Normally, I would strongly recommend disks for such work. Indeed, all the database systems with which I am familiar for such applications are disk-based, and typically cost £200-£600 for the software alone!

An alternative would be to use the system with Philips mini-cassettes for storage of data, as these run faster than ordinary audio-cassette systems. The Hobbit has been available for the Nascom for a long while, and the new BBC version has been receiving good reviews. Another possibility is the Sinclair Microdrive, when it becomes readily available.

It may be some time before many database packages are marketed for these tape systems.

If you do take the plunge with disks (with a minimum cost of £1000 to £1500 for hardware) then I would be thinking in terms of DMS, or possibly DataStar plus SuperSort, for your application.

P L McIlmoyle

Hold your tongue!

The Namal Supertalker produces speech from a 550 word dictionary in its internal ROM, and I have been able to write programs which use the ROM but I am unable to use the exten-

ded dictionary facility to add to the unit's vocabulary. According to the instruction booklet it is necessary to POKE the new words into addresses 12288 onwards. I have found it impossible to do this because these addresses are 'unPOKEable' on the Spectrum. I am obviously doing something silly and I would be very pleased if you could put me right.

W Cooksey, Cambridge

The ZX81 and Spectrum versions of the Supertalker have RAM space from 12288 for extending the dictionary. In the ZX81, this lies in the reflection of the 8k Sinclair ROM, so the ZX81 Supertalker switches this out using ROMCS. Hence ZX81 users can use Basic or machine code to POKE new words.

However, in the Spectrum this area is occupied by the 16k Sinclair ROM, so it is not POKEable from Basic. The Spectrum Supertalker has a memory bank switch to alternate between the Sinclair ROM and the dictionary RAM. You *must* use a machine code routine like the one in the booklet in order to swap these sections of memory in and out properly. Interrupts are temporarily disabled, then banks switched by an OUT instruction. Unfortunately the mnemonic code version of the routine and the denary machine code disagree about the port address, but since you have been able to use the ROM vocabulary I assume it is 127 = 7Fh and not 128 = 80h. A quick experiment will tell you which is right.

Len Warner





PHANTOM MOVES

Tony Harrington provides an insight into the seemingly magical effect of a chess computer, known as the 'Phantom', which mysteriously moves its own pieces.

For your true chess enthusiast, once the game has well begun the best that can be said about the materials, with which the game is played, is that they should cause as little of a distraction as possible. A chess board that draws attention to itself by its fluorescent colouring or any other oddity is simply an irritant. Similarly, an ornamental chess set modelled on the Chinese Mandarins of the tenth century might be a wonder in a showcase, but a pain in the neck to play with.

Much the same is true of chess computers. Once the game is under way, it really does not matter how the computer signals its move, so long as it does so clearly and concisely. Like most chess players, I've got used to the quiet flashing of a couple of LED lights, accompanied by a demure 'beep' whenever the machine has found its move.

So when I was given the opportunity to look at the Milton Bradley machine, which rejoices in the mysterious name 'The Phantom', I had my doubts. The marvellous feature of this machine, I was told, is that it moves the piece itself. It has a reasonable program, but that is almost beside the point — the point was that progress had been made in the direction of the magical.

The usefulness of a machine that could literally make its own moves was not clear to me. Why should it be a significant advance on existing machines which simply sit there, lighting up their LEDs in a friendly sort of way and waiting patiently for you to do the decent thing by them?

I sat down before the Phantom with some scepticism. Following the great — and now almost forgotten Bobby Fisher's dictum — I opened with the king's pawn. What followed is hard to describe. A motor started into life, rather audibly, and Black's king's pawn slid firmly out to e5 and stopped. So did the motor, and I was left in a deepening silence to think about my next move.

I brought the king's knight out to f3. The motor rasped into action and Black's pawn on f7 slid a fraction of an inch to one side. For a moment I thought the machine had slipped a gear, or sprung a solenoid or something. Then its knight moved majestically through the gap created between the pawns on f7 and g7 to take up its station on f6. 'What about the touch move rule?' I said to my absent opponent. But then, no-one had touched a piece, so I suppose it didn't apply. A pity, I hate playing against the Petroff.

More surprising things were to come a

few moves later when I took Black's pawn on d5 with my e pawn. There were several possibilities for Black, and I was brooding over a few of them when my e pawn, now on d5, suddenly sidled off the board and stood out of play. I was left staring at the blank square and wondering what it was going to recapture with. The pause could only have been a half second or so, but it produced a distinctly odd feeling.

The game itself was not particularly memorable, but it was interesting in its own right. As it developed it began to seem more like a game of chess than the circus performance it had seemed at the beginning. As a marketing gimmick, I think that Milton Bradley has hit on something rather special. My only hope is that the company doesn't put a voice chip in the blasted thing, or you may as well call the neighbour over and play a human being.

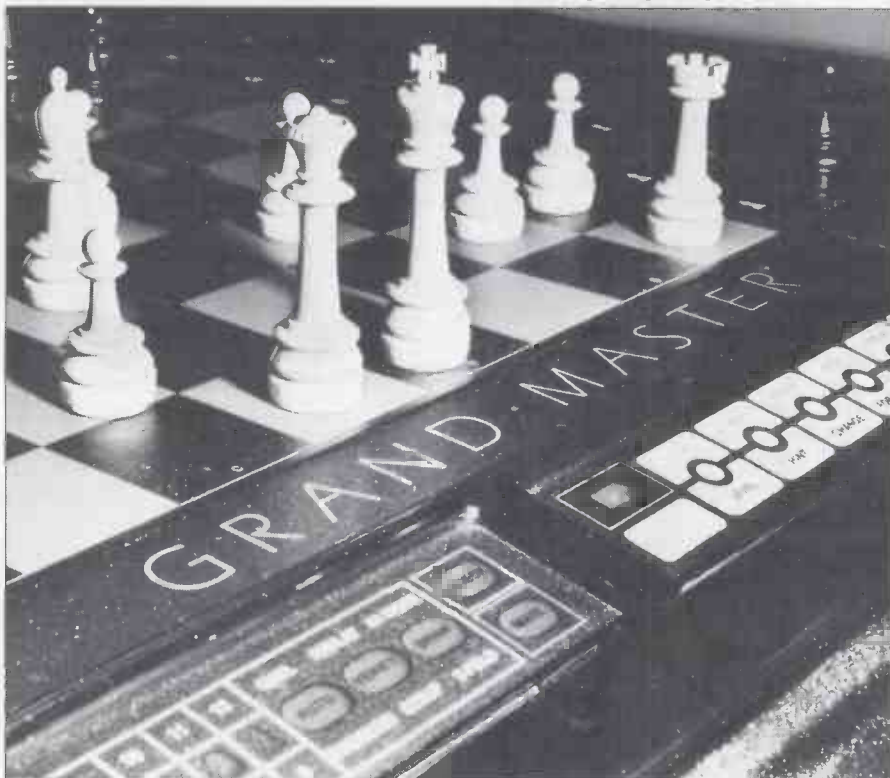
Now for the origins of the machine. Milton Bradley rang up Intelligent Software in June 1981 while David Levy and his colleagues were still hard at work on programs for SciSys. According to Levy, whoever spoke to him simply said that he wanted some advice on chess computers. They phoned from the States and asked Levy to go and see them at their East Longmeadow, Massachusetts offices.

'When I arrived they showed me into a room and, after asking me to sign the traditional non-disclosure agreement, they put a machine on the table, switched it on, and a pawn moved — as if by magic — from e2 to e4 — without any human intervention or any visible, physical device for making it move. I was fascinated,' Levy said.

This was the idea they wanted to develop: that is, they wanted the mechanism that had just moved the pawn developed to the point where it would be reliable enough to be used in a consumer product. And they wanted a chess program that would work with this mechanism.'

Levy phoned the technical director of Intelligent Software from Milton Bradley's offices and told his colleague about this new machine. After a brief huddle, they decided that this was very much the sort of project they wanted to get involved in. In Levy's words: 'It was the most exciting chess product that we had been faced with and we could not resist the challenge.'

All the chess programming that Levy and Intelligent Software had previously



A side view of the 'Phantom', known in the US as 'Grand Master'.

been involved with had been straightforward software programming. This was the first time that they had to get involved with electro-mechanical technology.

Despite this, they undertook to write the chess program and the software to control the electro-magnetic system which moved the pieces. Levy reckons that when he was first shown the machine it worked to the point where it was possible to demonstrate the idea, but there was still quite a way to go before it could be turned into a reliable product which would stand up to the rigours of life in the average home.

So how does the machine move its pieces? The idea is basically simple. There is a solenoid (an electro-magnet) underneath the playing surface. This is connected to a mechanism which moves on two axes, consisting of two metal bars. The one can move down the length of the board, while the other moves down the width of the board.

The solenoid is fixed onto the one axis and is constrained to move by the other axis so that it is always at the centre of the cross-hairs formed by the intersection of the two axes. The bars are controlled by two belts (with teeth), which go round two wheels (also with teeth). A photosensitive device counts how many teeth on each of the wheels move past a certain point. So by counting how many fractions of a turn each wheel has made, the program is able to tell exactly where the solenoid is located under the chess board.

Each piece has a permanent magnet in its base, and when the Phantom wants to move, it first moves the solenoid to the exact position of the piece on the board (all the pieces are of course tracked by the program). It switches on, detects that there is indeed a piece on that square, and then moves to the target square — 'dragging' the chess piece with it.

In the case of captures, it first moves the captured piece from its square to a place at the side of the board, off the playing surface, set aside for it. The surface of the board is a touch sensitive surface, much like that of the Sensory Nine. When the player captures one of the computer's pieces, that piece has to be placed at the side of the board as well, and there is a symbol for every piece set out in two lines on the right and left hand sides of the chess board.

One of the quirks that fascinated me was the fussiness of the machine. Each time I captured one of its pieces and put it down on its square, there was the audible sound of its motor starting up as the solenoid rushed over to check that I had placed the piece correctly on the square appointed for it. According to Levy, if I had put the knight down on a square reserved for a queen, the machine would have immediately moved it — by the shortest possible route (no inefficiency here, please) — to the right square.

As with the Sensory Nine, when the player makes a move, it is necessary to press down lightly on the square of the piece that you are moving and on the square that you are moving to. Levy reckons that the program has an approximate rating of 1550. This is considerably weaker than that of La Regence,

Intelligent Software's own machine, released last December (which has an estimated rating of 1750).

The explanation for this is that La Regence was designed after the Phantom, and with a more leisurely research and development period. Levy's brief was to produce a program stronger than the Sargon 2 running on the Apple computer. The processor involved was the 6502A processor with 2k of RAM and 16k of ROM.

'The rating of 1550', he said, 'comes from 40 games played against the Sensory Nine and the Sargon 2.5, both of which were chosen as adversaries because they have already been rated by the United States Chess Foundation. Thirty games against rated players or rated machines are enough to get a statistically reliable result,' Levy said. 'We played 40 in order to gain even greater confidence.'

'We had never done anything using electro-mechanical devices before. When we first discussed the machine in the company's offices, I was asked how long I thought the job would take. More specifically, I was asked if we could do the work within five months. When I phoned our technical director I didn't tell him the time period Milton Bradley was considering. I just asked him how long he thought it would take. He said: 'five months...'

My guess is that with Intelligent Software already marketing a machine with a stronger program than the Milton Bradley machine, it won't be too long before the Phantom gets a program worthy of its mechanical dexterity.

Games section

White: Fidelity Sensory 9 (level 3);
Black: Phantom (level 10); Pirc Defence;
Notes by David Levy.

1	e2-e4	d7-d6
2	d2-d4	Ng8-f6
3	Nb1-c3	g7-g6
4	f2-f4	Nb8-c6
5	Bf1-b5	

(Unusual and rather pointless. The pin on Black's knight is of no consequence and the bishop would be better placed on almost any other square.)

5	...	a7-a6
6	Bb5xc6+	b7xc6

(Black has an isolated pawn (a6) and doubled pawns (c7 and c6) but despite having made these concessions in its pawn structure, the Phantom actually has the better long-term prospects. This is partly because White has ceded bishop for knight; partly because of the attacking prospects along the b-file; and partly because White's impressive looking pawn centre might eventually prove vulnerable to pressure.)

7	Ng1-f3	Bf8-g7
8	0-0	0-0
9	Bc1-d2	

(A poor square for the bishop, but 9 Bc1-e3 accomplishes nothing after 9...Nf6-g4. Perhaps White should have tried 9 h2-h3 and 10 Bc1-e3.)

9	...	Ra8-b8
10	Ra1-b1	Bc8-e6
11	Qd1-e2	

(Otherwise...Bc6-c4 might be embarrassing, and now White threatens 12 Qe2xa6.)

11	...	Rb8-b6
12	e4-e5	Nf6-g4
13	h2-h3	Ng4-h6
14	Nf3-g5	Be6-f5
15	Bd2-e3?	

(Too slow. I would have tried 15 g2-g4, when 15...Bf5xc2 16 Rb1-c1 Rb6xb2 17 Bd2-e3 wins a piece (17...Bc2-d3 is best met by 18 Qe2xb2 Bd3xf1 19 Rc1xf1, rather than 18 Qe2xd3 d6xe5 19 f4xe5 Bg7xe5!).

Since Black cannot capture on c2 after 15 g2-g4, play might continue 15...Bf5-d7 16 Qe2-f2, with an eventual Qf2-h4 and f4-f5, attacking Black's king.

The move played in the game hands the initiative to Black.)

15	...	Qd8-b8
16	g2-g4	Bf5-d7
17	e5xd6?	

(A serious positional error. White weakens itself on the a1-h8 diagonal. Better would have been 17 Nc3-d1, followed by Qe2-f2 and Qf2-h4.)

17	...	e7xd6
----	-----	-------

(More dynamic than the obvious looking 17...c7xd6. Black now has the possibility of play along the e-file.)

18	Nc3-a4	
----	--------	--

(Putting the knight offside. White's only chances lie on the K-side, so again 18 Nc3-d1 was called for.)

18	...	Rb6-b5
19	c2-c4	RB5-a5
20	Na4-c3	Rf8-e8
21	b2-b4	

(Further weakening White's position.)

21	...	Ra5-a3
22	Qe2-b2?	

(22 Qe2-d2 was essential.)

22	...	Re8xe3!
----	-----	---------

(A simple combination which wins material.)

23	Qb2xa3	Bg7xd4
----	--------	--------

(The point. As a result of the numerous threats created by the discovered check (if Black moves the rook from e3), White has no time to defend the c3 knight.)

24	Kg1-h1	Re3xc3
25	Qa3xa6	Bd7-c8!

(Winning another pawn, since 26 Qa6xc6 loses the queen to 26...Bc8-b7.)

26	Qa6-a4	Rc3xc4
----	--------	--------

(Black has a significant material advantage (two bishops and a pawn for a rook), and its king is much safer than White's, so the result of the game is hardly in doubt.)

27	Rf1-e1	Bc8-d7
28	Re1-e7	Qb8-d8
29	Re7-e4	

(If 29 Rb1-e1 Bd4-c3, threatening...Bc3xe1, ...Rd4xb4 and ...Rd4xf4.)

29	...	f7-f5
30	Qa4-a6	d6-d5
31	Ng5-e6	Bd7xe6
32	Re4xe6	f5xg4
33	Rb1-e1	

(Threatening to win Black's queen by 34 Re6-e8+.)

33	...	Kg8-f7
34	f4-f5	Nh6-f5
35	h3xg4	Qd8-h4+
36	Kh1-g2	Qh4-f2+
37	Kg2-h3	Qf2-g3 mate

MICRONET 800

AN ELECTRONIC MAGAZINE?

Maggie Burton explores the derivation and growth of the viewdata service, Micronet 800.

Micronet 800 is the new approach to Prestel. It's a subscribers' viewdata service which allows micro users to link their computers into the large Prestel network through its own database of micro tips and information.

Prestel was the first ever public teledata service. Run by Buzby's 'Politburo', it was quickly found to be a rather expensive prospect — what with subscription fees, special television sets, page charges and phone bills. From the start, the user base

was small, and it still is. Promotion has always been virtually nil, and people often do not realise how much valuable information is contained within its pages.

Well-intentioned though it may be, Prestel has previously been little more than



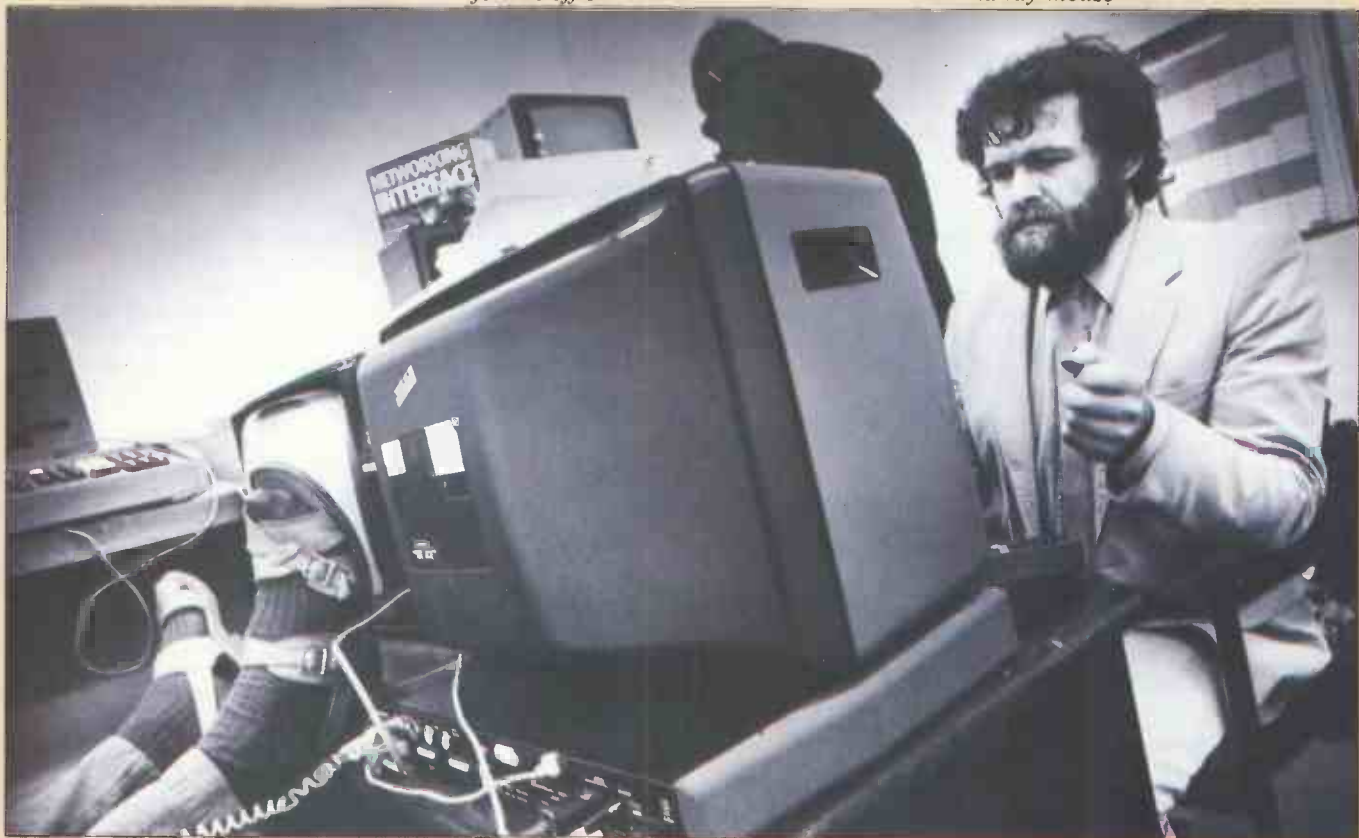
Micronet software display



News reporter Sid Smith in his free-format office



Reporter Dave Babsky chases a runaway mouse



Babsky contemplates news copy: Smith's feet indicate a higher degree of relaxation.

Photography by Tony Sleep



The Spectrum with modem attached and the Micronet acoustic coupler.

an 'executive toy,' a plaything of company directors. Now perhaps that is changing, thanks to Micronet 800 which combines the speed and efficiency of the teledata system with the hard-won views of the printed media.

Origins

Micronet began as EMAP's (East Midlands Allied Press) venture into information provision for Prestel. Information providers have to make their services pay in some way, either to offset Prestel charges or, if they're selling something through it, to make a profit. EMAP's venture was a loss-making one. Richard Hease, the owner of ECC (publisher of *Educational Computing*), had become involved with EMAP following the sale of some of ECC's computer publications to EMAP. He was working as a consultant in the area of computer publishing when EMAP asked him to look into the Prestel venture and, literally, either to make it work or close it down.

Hease became interested in the idea of telesoftware. Coincidentally, a competition was being run in *Sinclair User* to design a cheap, reliable Prestel adaptor. 'I thought the only way Prestel was going to work was to make it possible to link micros into it and develop a database micro users would want,' he says. Realising that his idea would need sound financial backing, Hease decided to seek it out.

The idea of a computer users' database — combining free telesoftware, news and on-line shopping facilities — was presented to Prestel. Prestel liked the idea and invested in it. The Department of Industry also moved in with financial backing.

'Both Prestel and the DoI,' says Hease, 'moved faster than I've ever seen a government or bureaucratic organisation

move. Within weeks we had everything sorted out.'

Provisions

Micronet was first presented to the public last summer. Advertisements invited enquiries and, on the basis of the replies, the first users accessed the database in March this year.

The variety of information and services is already considerable and, by the end of the year, should be even greater. At present, Micronet has a large news section, updated daily by intrepid reporters (*the end of the weekly is nigh — Ed*), free programs which can be downloaded straight into a micro, onscreen games which are resident in Micronet, product news and facts from companies like Sinclair, a teach-yourself Basic course, Computer-mart: second-hand micro advertising (and jobs too), a mailbox, problem page (Agony aunt's 'Elpful Area), quizzes, reference lists . . .

These are all great if you happen to have a micro or an interest in micros. Micronet offers educational value and, because the screens are bright and often very funny (the Computer Club title frame depicts a row of micros leaning on each other, all wearing boots), kids should like it and learn from it. Some of the onscreen games (that is, those which you don't have to load first) offer prizes for the winners. A version of adventure offers a prize draw between users who solve it.

Following Micronet is a little bit like playing an adventure game, but easier. It's a big, cheerful, Alice-in-Wonderland database and, if you haven't seen it before, it can be both confusing and fascinating. 'Something new is always just around the corner,' explains one satisfied user.

Micronet, besides being a large computer information service (it has a capacity to support 30,000 frames and is at present big using half that), seems to have become something of a hobby in itself for some of its users.

One of the obvious but largely unspoken aims of the editorial team is to make it into a communication base of computer users all over the country. Every Micronet subscriber has his/her own personal mailbox number, through which he/she can send messages both to Micronet itself and to other users. In this way people so inclined can set up a soapbox and pontificate, or can make micro-friends. It's unlikely to develop overnight into a substitute for the good old postage stamp, though, because the person to whom you are sending a letter needs to be a Micronet subscriber and you need to know his/her mailbox number. Besides, you do expect people to open their post. Some users may not access their mailboxes for weeks.

Hardware

The hardware involved is both easy to use and inexpensive. For the BBC Computer, an acoustic modem has been produced but this is now being pushed out in favour of a direct connect one. Present users can buy a modem from £49 plus VAT — the price depends on the computer and includes software and a manual. Direct connect modems cost £69.95 plus VAT. At present the BBC micro is the main computer for which Micronet caters — simply because it was the first one for which the modem was developed. A special unit for the Spectrum, a little black box which clips neatly underneath it, will be available very soon. Other micros which will be able to access Micronet are the

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MICRONET 800

TRS.80 models I and III, RML 380Z and 480Z, PET (3,4 and 5 series), Apple II, Oric and, hopefully, ZX81 (a solution is being sought to the inevitable problems with the ZX81).

The Spectrum unit is rather neat. It eliminates the problem of noise interference caused through having to leave the phone off the hook by forming a 'bridge' between telephone line and TV through itself and the computer. This means that, as the call is taken from the line before it reaches the phone, you can hang up after you've got through. If you talk down a phone while it is transmitting data, you will get a screen full of garbage — it takes a lot less than that to interfere with data on a smaller scale.

The Lynx and Atari will not, at this time, be added to the Micronet list. 'The user base isn't big enough at present,' according to Robin Wilkinson, Editor-in-Chief.

One of the nice things about the Micronet modem is that it will conform to the Prestel standard of 1200/75 baud (1200 transmitting speed, 75 receiving) while allowing for 1200/1200 communication as well, which means you could use one of these modems to talk to your mate's computer over the phone. The modems are made by Prism Microproducts, Sinclair, Atari and Texas's distributor, a company in which Richard Hease is a partner.

Micronet itself also allows subscribers full access to Prestel. The subscription fee to Micronet includes the Prestel cover charge, which is £5 per quarter. Micronet is £8 per quarter. This means a total subscription cost of £52 per year.

The first 10,000 users are entitled to a special offer which includes a free jack plug installation within 72 hours of joining Micronet. The price of the modem will probably have to rise after this number have been sold.

Unfortunately cost does put the service out of some people's range. When you add the price of the modem and all the phone

calls you'll make over a year it does mount up. At present accesses to Micronet are very high — in April they were over one million — but it has been suggested that this will drop when people get their phone bills!

Usage

The way in which the 'have and have not' element could possibly be solved is by having Micronet in schools. Certainly it is educational in itself. Just in case there's any doubt as to its value in this area, part of the service is an educational branch. It includes educational programs, directories of educational software suppliers, computer courses and diary events and information from the Microelectronics Education Programme.

But there are practical problems with putting something like this in a school — you could only really have one terminal in a classroom (many more would be far too expensive to set up), and how many classrooms provide telephone lines? It is possibly the sort of thing which will appear in special rooms in some schools.

Plans for the future include business Micronet, which is already in its beginning stages. One feature of this service will be telex, enabling business users to send messages to each other without the receiver having to access Micronet to see it.

Business users can buy areas of Micronet and keep them closed from other users, thereby enabling confidential information to be transmitted over long distances secretly, and very quickly.

The teleshopping area of Micronet will grow bigger as suppliers overcome their preoccupation with the novelty of it and begin to act more adventurously. Telesoftware will expand and — before too long — there could be a Hong Kong Micronet, one in Australia and one in Boston, provided by clubs there using their own computer. The Boston scheme

is in the pilot stages.

The target for subscriptions is 12,000 by the end of the year. 'What really surprised us was the interest,' says Hease. The initial interest has been followed up by the rapid growth of an enthusiastic following. Jeremy Dredge, an estate agent, was Micronet's first ever user. 'It's opened the door to Prestel,' he said. 'I'm delighted with it'. He feels the friendly attitude of Micronet is what makes it such a success — and successful it is. Over 2000 subscriptions in two months and a 50 per cent reply rate on promotional mailings could hardly be called a failure.

Hease also agrees that Micronet's friendliness is a big part of its popularity. The chattiness is a conscious (but not forced) approach. 'We try to inject a bit of friendliness and fun into the whole thing,' he says.

Other users also enjoy Micronet. Hilary Brindley, who has been accessing the database for about a fortnight, says she enjoys being able to download programs and explore Prestel as well.

Conclusions

So people are having fun with it and learning from it. But does it actually bring people nearer to taking teledata into their homes, or is it simply another toy, confined to micro enthusiasts instead of company directors? Some Micronet subscribers feel that they would not be interested in Micronet or Prestel if they were not aware of microcomputing as well. It's also felt that big steps still have to be taken in this area before it is truly universal. There is a lot of potential in what Micronet represents which could be applied to other hobbies or businesses — especially those which need the transmission of large amounts of information. The closed areas available on Prestel offer businesses a step into electronic mail which could make communication far more efficient and far less wasteful than it is at present — imagine having your old bulky filing cabinet transformed into a neat screen and keyboard.

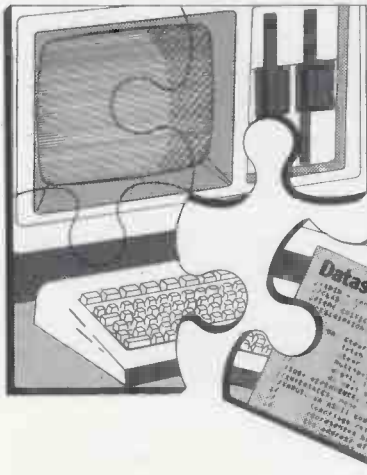
Micronet, as it stands now, represents good value for money for all types of computer user and enthusiast. Some reservations have been expressed about the originality of the games supplied free, but there is the promise that more programs are being added all the time. It is very like a magazine in its approach (but not, by necessity, in its structure), and keeps up to date with the news much faster because it is updated rapidly and is available instantly. Since information is left in the database for some time users don't generally miss anything.

It's to be hoped that Micronet 800 will continue to grow and develop, possibly spreading a little out of the computer market and further into Prestel's idea of a universal information database. Certainly its friendly approach, and the amount of useful and regularly updated information within it, makes it an example which other viewdata services and information providers could do a lot worse than follow.



Technical manager Mike Brown knows his way round.

END



PCW SUBSET

Alan Tootill and David Barrow present more useful assembler language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET, PCW, 62 Oxford Street, London W1A 2HG.

UNSPECIFIED 8085 INSTRUCTIONS

Concerning the unspecified 8085 op. codes reported by Jonathan Marten (PCW February), and Peter Caunt last month, Mark Hammes of

Loughborough finds, as did Peter, that 10 hexadecimal on his processor executes a 'SRA HL', a 16-bit arithmetic shift right, retaining the sign in bit 15.

Z80 CUBE ROOTS

Last month we printed John Kerr's lucid account of root extraction, carrying on from Steven Weller's square root programs (PCW August, 1982). Now that you have all

had a chance to apply this thinking to some code of your own, here — as promised — are John's own Z80 cube root routines CURT1 and CURT2.

DATASHEET

```

;=CURT1 - 16-bit unsigned integer cube root
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates the cube root (integer part) of a 16-bit
unsigned binary number, giving remainder
;/ACTION: Clear 16-bit accumulators for result, remainder & subtrahend
Repeat six times: Shift left input into accumulator (3 bits)
IF accumulator > current subtrahend
THENaacc := acc - subtr - 1; rotate '1' into result LSB;
shift left subtr (2 bits) & add in 18 * result.
ELSE rotate '0' into result LSB
shift left subtr (2 bits) & subtract 6 * result.
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: BC holds 16-bit unsigned binary input number
;/OUTPUT: BC = 6-bit cube root; HL = 13-bit remainder
;/REGs USED: BC,HL
;/STACK USE: 6
;/LENGTH: 64
;/T-STATES: 1509 max
;/PROCESSOR: Z80

CURT1: PUSH AF ; Save registers, F5
PUSH BC ; getting input C5
EX (SP),IX ; into IX DD E3
PUSH DE ; D5
LD A,+6 ; A is loop counter 3E 06
LD BC,+0 ; Clear three 01 00 00
LD D,C ; accumulators 51
LD E,C ; 59
LD H,C ; 61
LD L,C ; 69
JR START ; Single bit shift 1st time 18 08
REPEAT: ADD IX,IX ; Then shift three bits DD 29
ADC HL,HL ; of input number ED 6A
ADD IX,IX ; into accumulator DD 29
ADC HL,HL ; ED 6A
START: ADD IX,IX ; DD 29
ADC HL,HL ; ED 6A
RL C ; Assume subtract will fail CB 11
SCF ; Take (subtrahend + 1) 37
SBC HL,DE ; from accumulator, and ED 52
JR C,ADBAK ; if result nonnegative 38 0A
INC C ; then set new bit 0C
EX DE,HL ; Subtrahend into HL EB
ADD HL,BC ; effectively multiplied 09
ADD HL,BC ; by four, and 09
ADD HL,BC ; 18 * current result 09
ADD HL,BC ; added in to obtain 09
ADD HL,HL ; new subtrahend 29
  
```

```

ADD HL,BC ; 09
JR SHIFT ; Continue 18-09
ADBAK: ADC HL,DE ; Subtraction did fail; ED 5A
EX DE,HL ; restore accumulator EB
OR A ; New subtrahend is B7
SBC HL,BC ; 4 * old value, minus ED 42
ADD HL,HL ; 6 * current result 29
SBC HL,BC ; ED 42
SHIFT: ADD HL,HL ; Done; now restore 29
EX DE,HL ; remainder to HL and EB
DEC A ; continue with next three 3D
JR NZ,RPEAT ; bits of input 20 D5
POP DE ; Restore all D1
POP IX ; registers 20 D1
POP AF ; F1
RET ; End of CURT1 C9
  
```

DATASHEET

```

;=CURT2 - 32-bit unsigned integer cube root
;/CLASS: 2 (flags not preserved)
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates the cube root (integer part) of a 32-bit
unsigned binary number, giving remainder
;/ACTION: Clear 24-bit accumulators for remainder (A,HL) and subtrahend
(C,DE); clear stack top to hold result
Repeat eleven times: Shift left input into A,HL (3 bits)
IF A,HL > C,DE
THEN A,HL := A,HL - (C,DE + 1); rotate '1' into LSB of
(SP); let C,DE := 4*C,DE + 18*(SP).
ELSE (SP) := 2*(SP); C,DE := 6*(SP).
;/SUBr DEPENDENCE: Local SLEFT
;/INTERFACES: None
;/INPUT: BC,DE holds 32-bit unsigned binary number
;/OUTPUT: BC,DE = 11-bit cube root; A,HL = 23-bit remainder
;/REGs USED: AF,BC,DE,HL
;/STACK USE: 8
;/LENGTH: 97
;/T-STATES: 5480 max
;/PROCESSOR: Z80

CURT2: PUSH BC ; Move input into C5
EX (SP),IX ; index registers, DD E3
PUSH DE ; saving their D5
EX (SP),IY ; original contents FD E3
LD BC,OBOOH ; Loop counter B = 11; 01 00 0B
LD A,C ; clear 79
LD D,C ; all 51
LD E,C ; other 59
LD H,C ; registers 61
LD L,C ; and 69
PUSH HL ; stack top E5
JR BEGIN ; Skip one shift 1st time 18 03
AGAIN: CALL SLEFT ; Then shift three bits CD YY YY
BEGIN: CALL SLEFT ; of input number CD YY YY
CALL SLEFT ; into A,HL CD YY YY
SCF ; Take (subtrahend + 1) 37
SBC HL,DE ; from accumulator A,HL ED 52
SBC A,C ; but jump to restore 99
JR C,NOSUB ; if now negative 38 15
EX (SP),HL ; Subtraction successful; E3
ADD HL,HL ; new result bit 29
INC L ; is '1' 2C
PUSH HL ; save new result and E5
ADD HL,HL ; multiply 29
ADD HL,HL ; by four; 29
EX DE,HL ; add this into EB
ADD HL,DE ; subtrahend 19
JR NC,NOINC ; 30 01
INC C ; 0C
NOINC: ADD HL,HL ; Double 29
RL C ; subtrahend CB 11
POP DE ; Retrieve saved result D1
ADD HL,DE ; & add into subtrahend 19
JR NC,NEXT3 ; 30 16
INC C ; 0C
JR NEXT3 ; 18 13
NOSUB: ADC HL,DE ; Subtraction didn't go; ED 5A
  
```


ADC	A,C	;restore accumulator	89
EX	(SP),HL	;Shift left result-so-far	E3
ADD	HL,HL	;new result bit is '0'	29
EX	DE,HL	;Subtract	EB
SBC	HL,DE	;result	ED 52
JR	NC,NODEC	;from	30 01
DEC	C	;subtrahend	0D
NODEC: ADD	HL,HL	;Shift left	29
RL	C	;subtrahend	CB 11
SBC	HL,DE	;Repeat last two	ED 52
JR	NC,NEXT3	;operations	30 01
DEC	C	;	0D
NEXT3 ADD	HL,HL	;In either case, the	29
RL	C	;correct new subtrahend	CB 11
EX	DE,HL	;has now been calculated.	EB
EX	(SP),HL	;Restore operands and go	E3
DJNZ,	AGAIN	;back for next 3 bits.	10 C2
POP	DE	;Final result into BC,DE	D1
LD	C,B	; (top word BC cleared)	48
POP	IY	;Restore index	FD E1
POP	IX	;registers	DD E1
RET		;End of CURT2	C9
SLEFT: ADD	IX,IX	;Local subroutine shifts	DD 29
ADC	HL,HL	;one bit of input number	ED 6A
RLA		;into accumulator A,HL	17
ADD	IY,IY	;	FD 29
RET	NC	;	D0
INC	IX	;	DD 23
RET		;End	C9

CASE OF MISSING INFORMATION

Apologies for the fact that 6502 processors across the globe have lain idle for three months while their owners contemplated CASEOF (as

mentioned in April *PCW*). Below is the missing information to get those processors up and running again...

6502 CASEOF

Most readers of Sub Set will be familiar with the idea of the 'case' structure in which control is passed to different parts of the program depending on the match of a variable with associative keys.

Peter Villadsen of Copenhagen in Denmark provided Sub Set with a 6502 'case' routine, CASEOF. CASEOF searches through a table of addresses to routines, each of which has an associative key. If a match is found between the input variable in the X register and any key byte in the table, then a jump is made to the location whose address is held in the two bytes immediately following the matched key. If after a complete search of the table no match is found then CASEOF causes a jump to a location whose address could be an error message handler or other such routine to deal with no match.

The return address to the instruction following JSR

CASEOF remains on the stack for control to be passed back to the calling program after the requested routine has been executed.

CASEOF needs the base address of the table to be in page zero memory before it is called and uses another two bytes of page zero memory to store the found address. By transferring the address to page zero in this way, control can be passed to the subroutine by means of an indirect jump.

The routine is not limited to any one table but the maximum table size it can manage is 84 cases. Using indexed addressing, no more than 256 bytes can be addressed and each case takes 3 bytes; one byte for the key and two for the address. Still, there can be very few programs that require case structures of greater dimensions.

The table format for CASEOF is shown in Fig 1.

TABLE		: number of keys * 3 (ie, 3n)
TABLE	+1, 2	: address of action 0 (no match)
TABLE	+3	: key 1
TABLE	+4, 5	: address of action 1
TABLE	+6	: key 2
TABLE	+7, 8	: address of action 2
•		•
•		•
TABLE	+3n	: key n
TABLE	+3n+1, 2:	address of action n

Fig 1

Z80 CASEOF

Andrew Bain of Welwyn Garden City who benefitted enormously from Peter Villadsen's ideas (see above) has sent in three Z80 routines along the same lines as CASEOF.

We give here two of them, CASOFZ and CASTXT. The first one, CASOFZ performs an identical task to CASEOF and uses a table format which differs from that used by CASEOF only by requiring the first table byte to give the number of keys in the table rather than the number of bytes.

CASTXT doesn't match single byte keys but whole strings using the concepts of Simon Sellick's routine CPSTR (*PCW* November, 1981) and, according to Andrew, could be used in writing a Basic interpreter. The table format differs in that the address is given first, followed by a byte giving the string length, then the string to match. The final address (of the 'no match' routine) is followed by a zero or null byte and always 'matches' if no other match is found.

DATASHEET

```

;-CASOFZ - Single byte key Case handling routine
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Branches to action associated with matched key
                or "no match" action if no match found.
;/ACTION: Until match OR end of table
                Move pointer to next key and compare with input key
                If end of table then reset pointer to table start
                Increment pointer to associated address and transfer
                address on to stack, and "return" to required action.
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: Key to match in A
;/OUTPUT: Branch to required action effected
;/REGs USED: A
;/STACK USE: 8
;/LENGTH: 30
;/TIME STATES: Match: 158 + 38 * key position
                No Match: 182 + 38 * no. of keys
;/PROCESSOR: Z80
TABLE: DEFB NN ;no. of keys
        DEFW NOMTCH ;address of no match action
        DEFB KEY1 ;1st key
        DEFW ACTN1 ;address of action for match on key 1

;table continued for all keys
CASOFZ: PUSH HL ;save registers E5
        PUSH DE ; D5
        PUSH BC ; C5
        PUSH AF ; F5
        LD HL,TABLE ;HL = table pointer 21 NN NN
        LD B,(HL) ;B = no. of keys 46
        LD DE,+3 ;DE = no. of bytes each case 11 03 00
LOOP: ADD HL,DE ;move pointer to next key 19
        CP (HL) ;test for match of input key BE
        JR Z,IN ;and exit loop if found 28 05
        DJNZ LOOP ;else repeat 10 FA
OUT: LD HL,TABLE ;start of table for no match 21 NN NN
IN: INC HL ;pick up address associated with 23
        LD C,(HL) ;matched key, or no match address, 4E
        INC HL ;in HL 23
        LD H,(HL) ; 66
        LD L,C ; 69
        POP AF ;restore all registers F1
        POP BC ;putting address C1
        POP DE ;of required D1
        EX (SP),HL ;action on stack E3
        RET ;and "return" to it. C9

```

DATASHEET

```

;-CASTXT - String key Case handling routine
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Branches to action associated with matched string
;/ACTION: Read address of associated action and key string length
                Until end of string OR corresponding bytes don't match
                Compare action key string with string-to-match
                If no match then loop back and do again for next key
                If match then branch to associated action
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: DE is pointer to string-to-match
;/OUTPUT: Branch to required action effected
;/REGISTERS USED: DE
;/STACK USE: 10
;/LENGTH: 40
;/PROCESSOR: Z80
TABLE: DEFW ACTN1 ;address of action for match on key 1
        DEFB NN ;byte length of key string 1
        DEFM ;key string 1

;table continued in like manner for all keys, then:
        DEFW NOMTCH ;address of no match action
        DEFB 0 ;zero length string to ensure "match"

CASTXT: PUSH HL ;save registers E5
        PUSH BC ; C5
        PUSH AF ; F5
        LD HL,TABLE ;HL = table pointer 21 NN NN
NXTKEY: LD C,(HL) ;transfer next routine address 4E
        INC HL ;to stack via BC 23
        LD B,(HL) ; 46
        INC HL ;moving HL to point to length byte 23
        PUSH BC ; C5
        LD A,(HL) ;A = length of string to match 7E
        OR A ;test for null length = end of B7
        JR Z,DONE ;table and exit if so 28 0B

```

TOP SECRET

George Sassoon explores the code of public-key cryptography.

A few years ago, there were curious happenings at a meeting of a learned mathematical society. Armed security men burst into the lecture hall; fist-fights broke out around the podium; equations were hastily rubbed off the blackboard. The cause of it all? Someone had finally invented what security agencies dread most: the unbreakable cipher.

But all these efforts were in vain. The secret was out; and the basic principle of the cipher is so simple that one kicks oneself for not having thought of it first. Credit for that must go to three workers at the Massachusetts Institute of Technology, Messrs Rivest, Shamir and Adleman. From their initials, the cipher is known as the RSA public-key cryptosystem. Why 'public-key'? The reason is that the key comes in two parts: the encryption key, which is made public, enabling anybody to encipher messages; and the decryption key, which is kept secret, enabling only the originator of the cipher to decode messages.

Until the invention of public-key sys-

tems, the only really secure cipher was the so-called 'one-time pad'. This is simply a pad printed with random numbers. If each sheet of the pad is used only once, then the system is 100 per cent secure; problems arise, though, in the distribution of the pads, which must be done by trusted couriers. If a pad is lost or copied en route to an agent in, say, Moscow, then the whole pad is compromised and must be replaced. The RSA system, with its two-part key, avoids this difficulty; the encryption key could be published in the Moscow telephone directory without compromising the system!

The separation of encryption and decryption is achieved by means of modulo arithmetic. The modulo function amounts to dividing one number by another, throwing away the quotient, and keeping the remainder. Thus 11 mod 3 is equal to 2, the remainder when 11 is divided by 3. Supposing that the original message, the plaintext, was '11', and the ciphertext was '2', the codebreaker has

no way of working backwards from '2' to '11'; the original message could have been 2,5,8,11,14. . . The RSA system uses this principle, but with very large numbers. In my implementation, the modulus is not 11, but a number in excess of 2^{240} , or about 1.77×10^{72} . The text is divided into blocks of 30 ASCII characters, each block being enciphered as a unit. Thus if the message is: 'ABCDEF. . .', it would be expressed for encryption as the number:

$65 + 66 * 256 + 67 * 65536. . .$
 the final result being a number 240 bits (or 30 bytes) long. This is known as the plaintext number P.

The next step in the RSA system is to turn the plaintext number P into the ciphertext number C. This is done as follows:

$$C = P^E \text{ mod } N$$

Where E, the encryption exponent, and N, the modulus, are the public part of the key, E is usually a prime number less than 20, and N is a very large number, in my case greater than 2^{240} , which must be the product of two primes. The plaintext is thus multiplied by itself a number of times, and at each stage about half the number is thrown away. The result is the ciphertext. This is more or less equivalent to turning the message into alphabet soup, pouring it into a bucket, and then stirring it with a digital wooden spoon, spilling about half the soup with each stir. On the face of it, it would seem impossible to get back to the original message from the resulting mess of random-looking numbers. This is in fact true; it is impossible to work backwards to the original message, but it is possible to work forwards, using some mathematical trickery and the secret decryption exponent D. This can be illustrated by the simple example in Fig 1.

In this example, N is chosen to be 35, which is the product of 7 and 5, two primes. There are thus 35 possible 'messages', the numbers 0 and 34. The encryption exponent is chosen as 5, so each possible message is raised to the fifth power, being reduced modulo 35 at each multiplication. Some of the resulting ciphertext messages are unchanged, those adjacent or equal to exact multiples of 7, but the rest are thoroughly scrambled.

Decryption is then carried out according to the formula:

$$P = C^D \text{ mod } N$$

That is, the ciphertexts are raised to power D, the decryption exponent, also modulo N. In this simple example, D is also equal to 5. The result of this opera-

```

PRIMES CHOSEN: 5 AND 7 PRODUCT: 35
PHI(N)= 24
VALUES OF D=E SUCH THAT D*E MOD PHI(N)=1:
25 HAS FACTOR: 5 SUITABLE FOR ENCRYPTION EXPONENT
DECRYPTION EXPONENT IS: 5
ENCRYPTION OF 35 DIFFERENT CYPHERTEXTS:
POWER TEXTS ----->
1: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
2: 0 1 4 9 16 25 1 14 29 11 30 16 4 29 21 15 11 9 9 11 15 21 29 4 16 30 11 29 14 1 25 16 9 4 1
3: 0 1 8 27 29 20 6 28 22 29 20 1 13 27 14 15 1 13 22 34 20 21 8 22 34 15 6 13 7 29 15 6 8 27 34
4: 0 1 16 11 11 30 1 21 1 16 25 11 16 1 21 15 16 11 11 16 15 21 1 16 11 25 16 1 21 1 30 11 11 16 1
5: 0 1 32 33 9 10 6 7 8 4 5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26 2 3 34

CYPHERTEXTS:
0 1 32 33 9 10 6 7 8 4 5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26 2 3 34

DECRYPTING:
POWER TEXTS ----->
1: 0 1 32 33 9 10 6 7 8 4 5 16 17 13 14 15 11 12 23 24 20 21 22 18 19 30 31 27 28 29 25 26 2 3 34
2: 0 1 9 4 11 30 1 14 29 16 25 11 9 29 21 15 16 4 4 16 15 21 29 9 11 25 16 29 14 1 30 11 4 9 1
3: 0 1 8 27 29 20 6 28 22 29 20 1 13 27 14 15 1 13 22 34 20 21 8 22 34 15 6 13 7 29 15 6 8 27 34
4: 0 1 11 16 16 25 1 21 1 11 30 16 11 1 21 15 11 16 16 11 15 21 1 11 16 30 11 1 21 1 25 16 16 11 1
5: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
    
```

Fig 1

```

CODE FILENAME : RSACOD2
JGMJL HNFNH AFHKF AFCKO AELJN LNFAD FFFBO DMFLE DBBGE GODEP ELDIH KBALK
MBKBH KHAFK KGIPK JMFEA DARDI PHGAL JMNBA DHBLN OJAGM NNFAR DHBHL JFIFJ

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 1234567890

DETAILS OF CODE : RSACOD2 IN HEX NOTATION. SECURITY LEVEL: 4
MODULUS:
0001 0000 0000 0000 0000 0000 0000 0000 080A 1898 6E65 7453 0F10 A99D 9756 97F3
PUBLIC ENCIPHERING EXPONENT:
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0047
SECRET DECIPHERING EXPONENT:
0000 0398 0AD1 2073 615A 240E 6C2B 4481 CDA2 OFEB 8FA4 49D6 3FB8 61BF B0A1 A04F
    
```

Fig 2

tion is to restore the original messages 0 - 34.

This example is clearly trivial, but it illustrates how the original messages can be restored in spite of the modulo operation at each multiplication. All that needs to be done is to use the same principle for very large numbers, and then the system becomes a usable cipher.

Choice of exponents

In Fig 1, both encryption and decryption exponents were taken as equal to 5. These figures were arrived at by making use of one of the rules of modulo arithmetic. This states that when working modulo N, exponents are multiplied modulo phi(N), phi(N) being the Euler totient function of N. In normal arithmetic, for successive exponentiation, the exponents are simply multiplied. Thus:

$$(X^E)^D = X^{D \cdot E}$$

But in modulo arithmetic, the following rule applies:

$$(X^E \text{ mod } N)^D \text{ mod } N = X^{D \cdot E \text{ mod } \phi(N)}$$

where phi(N) is the fearsome-sounding Euler totient function of N. The function is in fact very simple; it is the number of integers not exceeding N which are relatively prime to it. For prime numbers, the only such number not relatively prime to N is N itself, so for primes phi(N)=N-1. It can be shown that if N is the product of two primes P1 and P2, then phi(N)=(P1-1)*(P2-1).

In the example of Fig 1, the primes are 7 and 5, and phi(N) is 24. Now it is a basic truth that any number raised to the power of 1 is the number itself. So to select the encryption and decryption exponents, we need to select E and D such that:-

$$D \cdot E \text{ mod } \phi(N) = 1$$

Possible values of D*E are:

25: equal to 5 * 5

49: equal to 7 * 7

73: prime

97: prime

121: equal to 11 * 11

145: equal to 5 * 29

169: equal to 13 * 13

etc.

Any of these pairs of factors would do for the encryption and decryption exponents. For demonstration, 5 and 5 were chosen, but in practice a small value for E and a large value for D would be chosen.

It will be seen that the exponents D and E are interchangeable, that is, you could equally well encrypt with the decryption exponent and decrypt with the encrypting one. This leads to another important feature of the RSA system, which is authentication of messages. Supposing our London office sends a message to their agent in Moscow, how can he be sure that it comes from London and not from Dzerzhinsky Square down the road? This is easily confirmed if the London office appends a block to the message which is encrypted using D, the secret decryption exponent. The man in Moscow can decrypt it using E, the public encryption exponent. If it makes sense, then he can be sure that the

message came from someone in possession of the secret exponent D, which can only be the London office.

Implementation of the system

The first requirement is for multiple-precision arithmetic routines, capable of handling very long numbers. Z80 routines were written, which can handle unsigned integers up to 2^{256} (over 10^{77}). Double this length is required for multiplications, so that each number occupies up to 64 bytes of memory. All the usual arithmetic functions are implemented, with the addition of 'powermod', used for evaluating the

expression:

$$Y = X^Q \text{ mod } N$$

When Q is very large, it is not practical to do this with successive multiplications. Instead, Q is expressed as a binary number, and X is squared mod N for each bit of Q; if the bit is 1, then the result Y is multiplied by X. Thus to evaluate X^{11} , $Y = X^1 * X^2 * X^8$.

With this system, decryption of a 30-byte cipher block takes about five minutes, using a bog-standard Z80 running at under 2 Mhz clock rate.

But before there can be any encryption and decryption, ciphers must be created. Two prime numbers must be found, whose product is in excess of 2^{40} , and

GOTO page 204

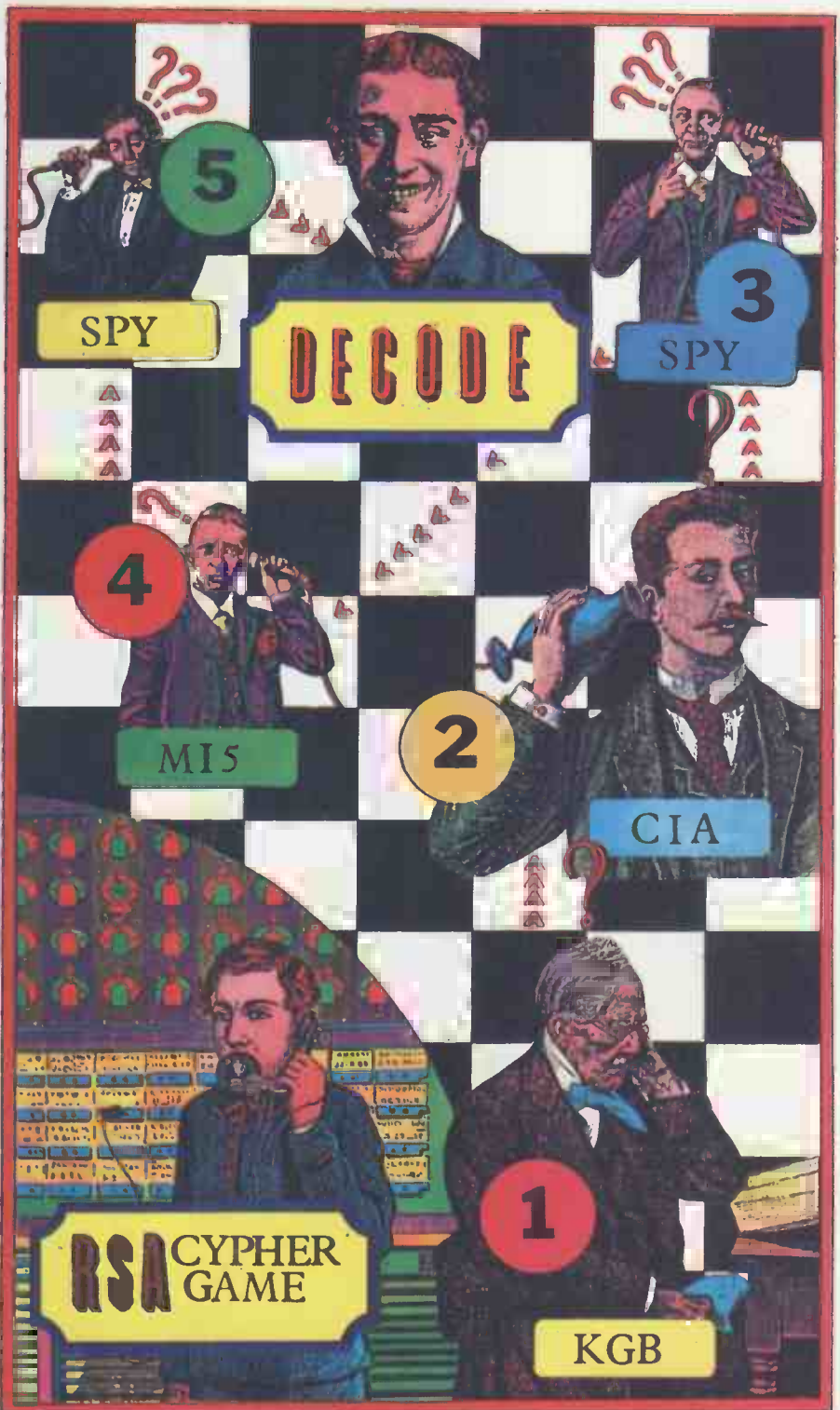


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Cardiff CF1 1EW. Tel: 0222 40118.

Sigma Systems Ltd., 266 North Road,
Cardiff CF4 3BL. Tel: 0222 34865/69.

SCOTLAND

Micro-Centre (Complete Microsystems) Ltd.,
30 Dundas Street, Edinburgh EH3 6JN.
Tel: 031-556 7354.

Micro Business Systems PLC,
Turnhouse Airport, Edinburgh.
Tel: 031-333 1000.

Pilgrim Business Machines Ltd.,
28 Walker Street, Edinburgh.
Tel: 031-226 5528.
(Solicitors)*

Pilgrim Business Machines Ltd.,
Northfield Place, Aberdeen. Tel: 0224 645104.

Rank Xerox (UK) Ltd., The Xerox Store,
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Tel: 041-333 0495.

NORTHERN IRELAND

Systems Plus Ltd., 19 Glengormley Park,
Newtownabbey, Northern Ireland.
Tel: 023-134 2117.

DIGITAL UK HEADQUARTERS

Digital Equipment Co. Limited, P.O. Box 110,
Reading RG2 0TR. Tel: 0734 868711.

*Vertical market application speciality.



1983 READER SURVEY

YOUR CHANCE TO WIN A SHARP MZ-711

Yes, once again it's time for the *PCW* Reader Survey, and once again we have a sparkling new micro to give away to the first name out of the hat! The star prize is a Sharp MZ-711 personal computer. It has 64k of RAM and it's one of the latest MZ-700 series announced by Sharp. A further ten lucky readers will receive a year's free subscription to the best micro mag on the market! Don't worry if you already have a subscription — we'll simply extend it for a further year.

The reason we have these annual surveys is to keep us in touch with what you want from the magazine. We do meet readers from time to time, of course, and obviously we receive a lot of letters, but this Survey gives us the chance to analyse the views of as many readers as possible. If there's anything you particularly love or hate about *PCW*, new ideas you'd like to see included or regular items you think we should drop like a hot brick, here's your chance to let us know.

The Survey is used to plan the future of *PCW*, so this is your chance to take an active part in choosing the direction we're going to be moving in over the next year or so. The prize draw will take place in mid-August so the questionnaire should be returned as quickly as possible. Our thanks to Sharp for providing the prize and to you for completing the questionnaire.

Please use **BLOCK CAPITALS** throughout and/or tick appropriate boxes

- Name: _____
- Address: _____

Did you buy this issue of *PCW*? Yes/No (delete where applicable).

- Age: Under 15 ¹ 15-18 ² 19-30 ³ 31-45 ⁴ 46-65 ⁵ over 65 ⁶
- Sex: M ¹ F ²
- Occupation: (*Please give precise title*) _____
- If you work full-time in the computer industry, please complete the following, otherwise GOTO question 8:
Please indicate your main area of involvement: Mainframes ¹ Minis ² Micros ³
- If you ticked 'micros' above, please complete the following, otherwise GOTO question 8:
Sales ¹ Servicing ² Support ³ Other ⁴ (*Please give details*) _____
- Which of the following publications do you read?

	Regularly	Sometimes	Please indicate which one you think is best		Regularly	Sometimes	Please indicate which one you think is best
Personal Computer World	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	What Micro?	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹¹
Practical Computing	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ²	Your Computer	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹²
Computing Today	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ³	Home Computing	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹³
Which Computer?	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁴	Weekly			
Computer Answers	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁵	Popular Computing	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁴
Computer & Video Games	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁶	Weekly			
Micro Decision	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁷	Computing	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁵
Personal Computing	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁸	Computer Weekly	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁶
Today				Datalink	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁷
Personal Computer News	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ⁹	Computer Talk	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁸
Which Micro? & Software	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁰	Infomatics	<input type="checkbox"/> ¹	<input type="checkbox"/> ²	<input type="checkbox"/> ¹⁹
Review				Other (<i>state which</i>)	_____		

- Please indicate your interest in the following sections of *PCW*: _____

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Newsprint	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	ACC News	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Communications	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Computer Town	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Banks' Statement	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Networks	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Computer Answers	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Diary Data	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
<i>PCW</i> Sub Set	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Programs	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹

1983 READER SURVEY

Portable Computer	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Leisure Lines	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
World					Chip Chat	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
TJ's Workshop	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Benchtests &	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Micro Chess	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Reviews				
Beginners Start	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Hardware Features	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Here					Software Features	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
In Store	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹	Advertisements	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹
Packages	<input type="checkbox"/> ⁴	<input type="checkbox"/> ³	<input type="checkbox"/> ²	<input type="checkbox"/> ¹					

9a Is there any feature which, if removed, would stop you buying *PCW*? _____

10. What other topics would you like to see in *PCW*? _____

11. What topics would you like to see deleted? _____

12. What other comments (if any) would you like to make about *PCW*? _____

13. Do you own a microcomputer?
Yes ¹ No ² If yes, which make and model? _____

14. Do you own disk drive(s)?
Yes ¹ No ² If yes, which make? _____

15. Do you own a printer?
Yes ¹ No ² If yes, which make & model? _____

16. Do you intend buying a microcomputer in the next 12 months?
Yes ¹ No ² If yes, which make and model is your current choice? _____

17. Do you intend buying separate disk drive(s) in the next 12 months?
Yes ¹ No ² If yes, which make & model? _____

18. Do you intend buying a printer in the next 12 months?
Yes ¹ No ² If yes, which make and model? _____

19. What is your intended total budget for the above purchases?
Under £199 ¹ £200-£499 ² £500-£999 ³ £1000-£1999 ⁴
£2000-£2999 ⁵ £3000-£3999 ⁶ £4000-£4999 ⁷ £5000-£10,000 ⁸
over £10,000 ⁹

20. Do you intend to buy software?
Yes ¹ No ²
What type of software do you intend to buy?
Games ¹ Business ² Education ³ Systems ⁴ Software ⁵
What operating system(s) do you use?
CP/M Family ¹ MS-DOS ² Other (state which) _____

21. What is your total budget for software?
up to £24 ¹ £25-£49 ² £50-£99 ³ £100-£249 ⁴ £250-£499 ⁵
£500-£999 ⁶ over £1000 ⁷

22. Do you intend to buy blank cassettes during the next 12 months?
Yes ¹ No ² How many? _____

23. Do you intend to buy disks?
Yes ¹ No ² How many? _____

24. Do you intend to buy computer stationery?
Yes ¹ No ² Value? _____

25. Do you buy computer books?
Regularly ¹ Occasionally ² None ³

26. What do you use your micro for (please tick the main use only)?
Home use/games ¹ Business ² Scientific/Engineering ³ Education ⁴ System
Development ⁵ Other (state which) _____

27. Apart from yourself, how many other people read your copy of *PCW*? _____

28. Do you object to your name and address being placed on a mailing list:
For *PCW* use only? Yes ¹ No ²
For other commercial users? Yes ¹ No ²

Moore on Kuma



Forth First

Kuma believes it is the first in the world to offer a 68000 based Forth which includes an assembler.

This professional software product is written by Kuma and we fully support it all the way. It comes complete with a floating point package and an assembler for £385 plus VAT, for the Sage II.

Forth is a high level language particularly suited for machine control. Its "self-extending" facility allows you to custom build your own language by permanently embedding routines in the software.

Having mastered the Sage Forth we are interested in implementing this on other 68000 based machines.

Forth on MSDOS

With the trend away from CP/M 86 to MSDOS, has meant that we have now implemented our Forth for Sirius 1 on MSDOS.

Centronics Interface

A special interface is available from Kuma to convert the RS232C serial interface on the NewBrain to Centronics. So if you have a Centronics printer, you can now interface it with the NewBrain without any problems. Price is £99.50 plus VAT.

Similar interfaces (serial to Centronics) for other machines are in the pipeline and will be announced shortly.

Sage & CBM64 Franchises

Kuma is now a franchised dealer for the 68000 based Sage and the Commodore CBM64. Now you can not only buy the hardware from us but look forward to the high level of software support we give all our machines.

Sharp Colours

For just over £2000 plus VAT, Kuma can offer you the exciting MZ3541 colour machine. A twin disk, CP/M computer with 128K of main memory and a large spread sheet calculator capability. It's every bit as good as you expect from Sharp.

Pascal Update

HiSoft Pascal for Sharp MZ80A is up to version 1.5 with the notable inclusion of printer drivers. To update your existing cassette-based Pascal compiler return to us with a cheque or P.O. for £3 plus VAT.

News Bits

- * An assembler written in machine code is available from Kuma for the NewBrain.
- * Our June NewBrain catalogue is ready. It's free and contains details on the new assembler and other utilities.
- * The popular 4D game has been computerised for the Sharp. More details in our new MZ80A brochure.
- * We have a very useful program called TX for transferring CP/M files. It runs under CP/M on Sirius 1, Osborne 1 and MZ80B.
- * MZ80A and B users can have the new Kuma dual port RS232 interface card for £130 plus VAT.

HX-20 User Graphics

Special characters for mathematical and scientific symbols, foreign letters, etc, can now be defined by the Epson HX-20 user easily and quickly with a £17.50 (plus VAT) package from Kuma.

After defining, the characters can be directly used or saved to tape for transfer to other programs.

Low Cost Word Processor

Kuma's WDPRO word processing package continues to be our top selling program for the Sharp MZ80A. For £39.50 or £79.95 plus VAT respectively for the cassette and disk versions, you have a superb low cost word processor. And the recent addition of MAILPRO means names and addresses can be merged with WDPRO created documents.

New for HX20

Get our new programs in the DESK MASTER series.

They are a Data Base (16K or 32K versions), Mailing List, and Labelling packages.

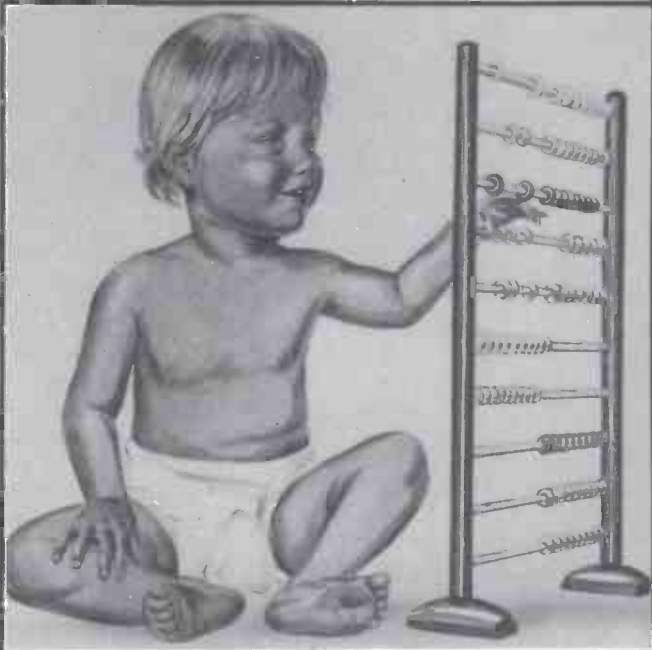
Other items in the successful DESK MASTER series are a Spreadsheet Calculator and Word Processing Packages (both of which are now market leaders for this machine); Office Aid; Friendly Terminal; and Decision Maker. The last is a selection aid where multi-parameters with different weightings are applied, eg in staff selection.

Last but not least, there is the DESK MASTER editing terminal on the HX20. We are now leading Electronic Mail Box proponents so if you want to talk to us digitally, dial up "KUMA" on the BL Comet service and we can't fail to listen.

Kuma Computers Limited



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<input type="checkbox"/> SIRIUS-1	<input type="checkbox"/>	<input type="checkbox"/> COMMODORE 64	<input type="checkbox"/>
<input type="checkbox"/> SHARP A	<input type="checkbox"/>	PRINTERS:	
<input type="checkbox"/> OSBORNE-1	<input type="checkbox"/>	<input type="checkbox"/> MATRIX	
<input type="checkbox"/> EPSON HX-20	<input type="checkbox"/>	<input type="checkbox"/> DAISY WHEEL	

NAME

ADDRESS

POST CODE

IBM COMES FORTH

An exclusive review of PolyForth as presented by Dick Olney

As the popularity of Forth among micro users increases so, too, does the number of compilers available. The problem is that either they are cassette-based or they run under one of the standard operating systems, both of which situations disguise the language's full potential.

PolyForth, from Forth Inc of California, is unique in providing a stand-alone multi-tasking operating system and an overwhelming selection of extensions and utilities for a mere £250. It was designed to run on an IBM PC with at least one single-sided disk drive. A conversion utility is included which allowed me quickly to reconfigure the software and make full use of the dual 320k drives installed in the machine I was using.

The PC automatically boots up the PolyForth when it's switched on, whereupon a title and date appear in the top left-hand corner of the screen together with the word 'HI'. At this point the Forth 'nucleus', that is, those words which are precompiled on the system disk, is already in place and most of the major features have been loaded (like any good Forth all the non-standard extensions are supplied as source). Typing 'HI' at this stage loads a further selection of utilities and displays a help screen containing brief details of a selection of useful commands.

MS-DOS users might be rather disturbed at this point to find the cursor and edit controls on the numeric pad completely disabled (the keys always echo their number value). This is because these functions — like the rest of the keyboard — are dealt with in software. In fact the Forth has a keyboard interpretation chart residing in block 0 of the system disk. The version I used was still configured to a US keyboard. The " and @ symbols were reversed and the £ returned a #. Comsol, the European distributor of this product, is working on a UK conversion utility to be included in the package. It is possible to use all of the special keys but you'll need to develop your own routines to handle their functions. The ten keys labelled F1 to F10 can be attached to a word simply by naming it with the legend on the key as in: F1." This is Function F1"; which will cause the embedded text to print out whenever the F1 key is depressed. For other keys, however, such as CTRL and ALT you'll need to test for ASCII values in a special input routine.

The basic system includes most standard Forth words and much more besides. One omission which might surprise Fig Forth users is VLIST (giving a listing of the dictionary). It's easy to test for the

existence of a word and the command LOCATE will automatically display the source of any word loaded from disk not contained in the object nucleus — an invaluable debugging aid. A full selection of 32-bit maths operators is included as well as an 8088 assembler — written in Forth — and a standard line editor.

As is usual the assembler and editor words are held in discrete vocabularies which must be declared before they are used. A further 5 user vocabularies can be added. The system keeps track of these using an array called GOLDEN which contains the start (or end, depending on how you look at it) of the dictionary lists. At any one time up to four vocabularies can be current, with the compiler following a pre-specified search sequence determined by the contents of the variable CURRENT. Used in conjunction with the turnkey compiler (see below) this enables the programmer to create a self-loading application where the user can only access an appropriate selection of high level commands.

A copy of the GOLDEN array, called CONTEXT, has its link addresses updated as new words are added to the various vocabularies. The word EMPTY copies the contents of GOLDEN into CONTEXT, thereby erasing from the dictionary any entries compiled since its previous execution. The source for this reads GOLDEN CONTEXT 20 MOVE. The reversed phrase CONTEXT GOLDEN 20 MOVE re-initialises GOLDEN thus protecting all currently compiled words from the use of EMPTY. In this way applications can be efficiently re-compiled during development and protected after successful debugging using a technique which is much more controlled than the traditional FORGET.

All dates in the system, including today's, are held as 16-bit numbers described as 'modified Julian dates' giving the number of days which have elapsed since 1 January, 1900. They use a compact representation which allows arithmetic to be performed on the date directly. Two formats are provided for input and output of which examples are 14 MAY 1983 or 5/14/83. Little effort has been put into conversion for the British market though it would be no problem to develop your own routines using the existing low level words.

Multi-tasking

Multi-tasking is probably the most exciting feature of PolyForth not least

because of its ease of use. It relies upon a tiny (25 bytes) core routine called PAUSE. When executed in a program this word passes control to an idle loop which runs around a circular chain of addresses called a 'round robin' searching for the next task ready to be activated. New background tasks are created using three programmer-supplied values. The first of these represents the 'user area' in which key variables may be protected from other tasks. Such variables are defined in the format:

offset USER name

where the offset is added to the task's base address to give the address of the variable. Each task maintains its own parameter and return stack, and the other two values represent the byte sizes of these. To define a background task the command is:

user parameter return BACKGROUND name

which constructs a table to be used when the task is initialised with the word BUILD, whereupon it is linked into the round robin.

Once a task has been defined and created it can be activated by any program using the following convention:

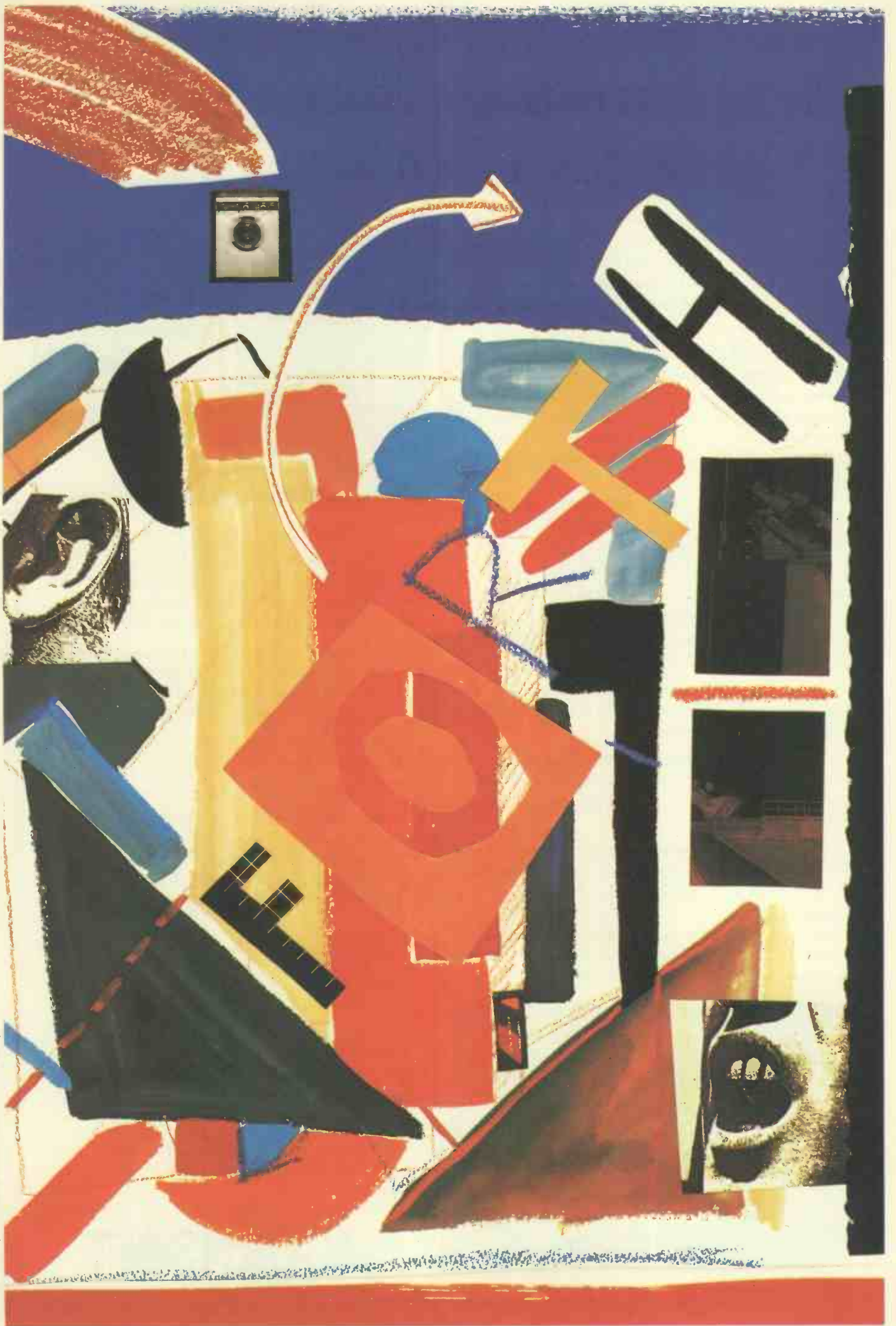
word task-name ACTIVATE (words executed by task);

There are, however a number of vital restrictions of which the programmer must be aware if this is to be successful. First a background task cannot perform terminal I/O and is thus unable to issue error messages, so if anything goes wrong the whole system will crash. A similar effect occurs if the task is allowed to reach the semi-colon, and it must therefore be explicitly terminated with the word STOP.

The reason that a background task cannot perform terminal I/O is that such a potential demands the ability to vector to unique routines when executing words like TYPE and CR. It is possible to overcome this by moving text directly into screen memory, but you'll need to develop your own routines in assembler to access memory above 64k. The two predefined tasks called OPERATOR and TYPISIT are, of course, capable of terminal I/O since they control screen and printer respectively. This means that screen activity remains relatively unaffected when the printer is active.

Although the multi-tasking facility is simple and effective much of its operation depends on the programmer. Remember that in reality only one task is actually active at any one time, and it is therefore essential in both foreground and back-

Illustration by Donna Muir and Su Huntley



Announcing more exciting programs for the BBC.

Acornsoft is the software division of Acorn Computers, the company that designed and built the BBC Microcomputer. Here are four more exciting programs, all designed to get the most from your BBC Micro.

Starship Command (£9.95) is a demanding high-resolution graphics game in which you command a starship against attacking alien ships. You control the forward drive and rotational thrust of your ship, which is equipped with shields, long and short-range scanners and a sector display of the stars and alien ships.

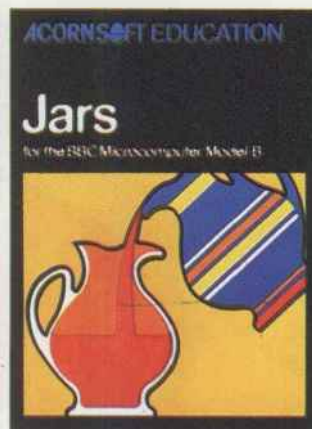
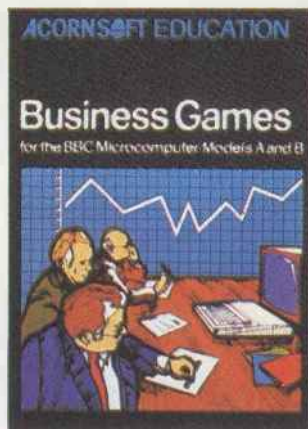
Countdown to Doom (£9.95) is a race against time as you strive to repair your damaged space ship in the corrosive atmosphere on the planet Doomawangara (Doom). Beat the clock or resign yourself to a life in the wilderness of Doom.

Business Games (£9.95) is a cassette containing two games designed for economics, business or general studies teaching.

In **Stokmark**, up to eight players compete in buying and selling shares aided by a screen display of relevant market information.

In **Telemark**, players compete to dominate in the manufacture and sale of televisions. The winner is the one who makes the largest profit or controls over half the total market.

Jars (£11.90) is an educational cassette suitable for 7-13 year olds. The objective of the program is to present, what are usually thought of as purely numerical problems, in a visual way. Jars of liquid are used to visualise volume estimation and fraction problems. Success, partial success or failure is noted by a scoring system and suitable comments.



How to get Acornsoft programs.

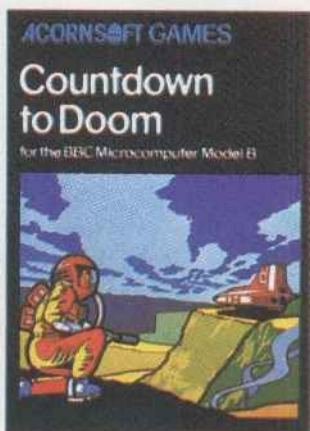
If you're a credit card holder and would like to buy cassettes of the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the cassettes directly by sending off the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Also use this form if you would like to receive the current free Acornsoft catalogue.

Please allow 28 days for delivery.

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Starship Command	£9.95			SBG22
Countdown to Doom	£9.95			SBG19
Business Games	£9.95			SBE03
Jars	£11.90			SBE15
TOTAL				

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ACORNSOFT

IBM COMES FORTH

ground tasks to use PAUSE in a fashion most appropriate to the application. In addition the use of any shared resources, such as the disk buffers, must be carefully monitored and, if necessary, controlled using special routines. Note that, once built into the round robin task, definitions cannot be erased from the memory by EMPTY or FORGET and any attempt to do so has dire consequences.

Despite the vulnerability of the PolyForth multi-tasking, it does give this system an immediate lead over most of the more conventional operating systems currently available. Used properly with careful and extensive debugging it could provide the basis for many impressive applications.

Programmer Utilities

The initialisation of diskettes and the manipulation of data on them is fundamental to any disk-based operating system.

In this system these functions are grouped in a utility dubbed 'Disking'. All the standard commands are provided including initialisation, backup, and block copying as well as disk diagnostics. One command that is particularly useful is MATCHES, which is not used to activate an optional cigarette lighter, but to compare the contents of two specified ranges of blocks and report any discrepancies.

The most common criticism of Forth is that the source is unreadable to anyone but the originator. Forth Inc has attempted to counter this with a facility called 'shadow documentation'. Two disks are supplied with the package, the system disk which resides in drive 0, and a documentation disk for use in drive 1. The documentation or shadow disk contains brief descriptions of all the words existing as source on the system disk. To access the shadow blocks you must first LIST the relevant source; at this point the command Q will toggle the display between the source and its associated documentation. This idea is that shadow documentation is written at the same time as the source to assist in any future modification or debugging.

The printing utility makes use of the shadow documentation by allowing double-sided printing. With careful positioning of the paper the source and shadow blocks can be printed so as to appear opposite each other when filed in an A4 binder. Alternatively, source without shadow documentation can be laid out with alternate pages on different sides of the paper to give a similar effect.

Printing is initialised by preceding any valid words with the command PRINT. This literally sends the rest of the input stream to the TYPIST terminal task. Because of its mode of operation, however, this word cannot be used inside colon definitions, where TYPIST ACTIVATE performs a similar function. The system gives full support for the standard IBM (Epson) parallel printer, though you need to write your own control functions using EMIT and the ASCII values

given in the IBM Guide to Operations.

Additional Options

To complete the image of this package as a powerful software development tool, a number of additional support features have been included. One of the most exciting of these, especially bearing in mind the multi-tasking capability, is the colour graphics option. Unfortunately, I do not have access to a colour display so I was unable to use this facility, though I did see a demonstration on one of IBM's machines which drew some fairly convincing square spirals. The option allows basic point plotting in medium-resolution (200 x 320) colour mode. From the manual I would guess it's fairly primitive but, like the rest of this system, I'm sure it could be extended into a powerful vocabulary.

Another option is the screen editor, which uses all the IBM function keys, and which I used to write this review. It's better than using my old typewriter but lines do not run on, neither do blocks, so it's hardly a word processor. Nevertheless it serves its purpose and perusal of the source reveals an interesting definition of a word named :K which reads: :K (k) : LAST @ @ CFA 2+ SWAP 'FUNCTION ;

The colon within this definition means that upon execution :K will itself cause a new word to be compiled from the input stream, and it is at this time that the colon is presented with a matching semi-colon. When :K encounters the latter compilation ceases and the rest of the code is executed. The technique is used here to place the execution address of a colon definition into a function table at the time it is compiled, thereby facilitating vectored execution. The word :K expects the offset in the table for the new word to be on the stack. An example of its use is: 71 :K HOME 0 C# ! 0 L# !; where HOME places the cursor at the first position on a block by zeroing the column and line counts.

Although IBM apparently does not support it, there is a spare socket on the system board for an 8087 maths processor, and the PolyForth manual gives full instructions for installation and details of an extensive supporting vocabulary. The conditions of sale from IBM, however, suggest that such a modification would render the warranty invalid, so I resisted the temptation to test out this option.

If applications are to be written in Forth, then sooner or later they are bound to be presented with files created under PC DOS, and the next option on the list is PC DOS file handler. All this really does is to take care of the DOS sectoring and provide for basic file manipulation. Actually to access data in applications you'd need to extend considerably the vocabulary. Still, the basis of it is there and it would be fairly easy to impose your own data structures over the DOS format.

Last, but not least, is the turnkey compiler which allows self-booting application disks to be created. This is achieved by first EMPTYing the dictionary then loading up your applications, followed by the

turnkey utility. At this point a controlling application word to be executed on entry can be specified together with any blocks to be loaded from disk at that time. The word PROGRAM then transfers a custom bootstrap dictionary to an initialised diskette in drive 1 (instructions are also provided for generating turnkey diskettes on single drive machines). Applications, using a startup program in conjunction with sealed vocabularies or closed program loops, can effectively deny a user access to the Forth itself, even though the core code is resident in the application. If Forth Inc is convinced that you've done this properly then the company won't claim for any copyright payments.

Benchmark timings

magnifier	1.7
do-loop	5.8
literal	6.6
literal-store	11.3
variable	7.4
variable-fetch	9.6
constant	7.8
dup	9.6
increment	9.4
test>	12.7
test<	12.7
while-loop	14.4
until-loop	13.4
dictionary-search	5.7
arithmetic	4.1
mixed maths	5.3

I timed the PolyForth using the Forth benchmark programs published in the January issue of PCW. To do this I had to write an assembler routine to reset the stack pointer, which luckily turned out to be very simple (my assembler is limited to say the least!) and my version of SP! reads:

```
CODE (SP!) S POP NEXT
: SP! SO @ 2 - (SP!) ;
```

Having checked the reliability of the system clock I decided to let the machine time itself and printed out the contents of the system variable TICKS at the beginning and end of the multiplier routine. Remember that the timing for this word is subtracted from the other values to give the true figure so it doesn't matter that my version takes slightly longer.

The results are the fastest recorded Forth benchmarks, particularly the arithmetic program which this system runs four times faster than its nearest competitor. An additional test of my own, using double-number and mixed operators, ran almost as fast as the original arithmetic program. There's no doubt that if it's speed you're after then this is the package for you. (For 'mixed maths' benchmarks, see below.)

Mixed maths benchmarks

```
1
2: mixed-maths .TICKS 1000 1D0
3 900 900 M* 9 M/ 0 90000 D+
90000 D-
4 SP! LOOP .TICKS ;
```

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IBM COMES FORTH

Documentation

Very sensibly Forth Inc has used the superb *Starting Forth* as one of the manuals for its PolyForth. This book has become the Forth programmer's bible, providing the beginner with a detailed overview of the language and many useful examples. The other manual supplied with the package, held in a solid foam-backed binder, contains general details of specific features, though really to understand how everything works you'll need to read the shadow documentation as well. Everything is covered and the manual includes an excellent index and glossary, as well as full source and shadow listings.

Expandability

Level 2 PolyForth is at the bottom end

of a range of three products. Level 3, which costs £490, includes a database system and support for multi-terminal tasking and networking. It also includes a much more detailed manual. The most expensive system, Level 4, adds a target compiler and carries full source listings of all words. It costs £2750, but this buys you certain rights of reproduction as well. Unfortunately, you get no discount on Level 3 if you've already got a Level 2, though full discount is offered when upgrading from Level 3 to Level 4. It is, however, possible to write most of the features included in Level 3 with the facilities available in Level 2.

Conclusion

As you may have guessed, I was extremely impressed with this package. Forth remains (in this country at least) relatively unexploited as a serious software development tool, partly because

many of the compilers available are simply not suitable for this purpose. Level 2 PolyForth is a quality product aimed at the professional or semi-professional programmer (at a price that should present no problem to anyone who can afford an IBM PC!). How successful it is in competing with the mainstream languages and operating systems will depend to some extent on the marketing, an area about which Comsol is still hazy, though it has been submitted to IBM for approval. I do know that the company plans to go all out in the autumn, and is looking for big sales to make the venture worthwhile.

Enquiries should be directed to: Computer Solutions Ltd, Treway House, Hanworth Lane, Chertsey, Surrey KT16 9LA. Tel: Chertsey (09328) 65292.

END

TOP SECRET

continued from page 191

the exponents E and D selected. Primes are found using the so-called probabilistic prime test, which can find a suitable pair in the region of 2^{120} in an hour or two. Exponents E and D are then selected according to the procedure outlined above. Fig 2 gives details of one cipher, RSACOD2. The ciphertext is in alphahex code, where the letters A-P represent the numbers 0-15; two letters of ciphertext corresponding to one ASCII symbol of plaintext. Thus a 30-byte block of plaintext enciphers as 12 five-letter alphahex groups. The plaintext may include carriage-returns and other control characters.

Security aspects

To break an RSA code, it is necessary to find the factors of the public-key modulus, N. When the factors are known, the Euler totient function $\phi(N)$ can be calculated, and the decryption exponent D. Finding the factors of very large numbers is extremely time-consuming if there are only two large factors. By comparison, finding large primes is very easy. Thus the present system can find primes in the region of 10^{34} in an hour or so, yet it took over 48 hours to find the factors of a number in the region of 10^{21} using the efficient Monte Carlo method.

As the numbers get larger, the difficulty of finding factors increases as the 0.25th power of the number, but the difficulty of finding primes only as much as the cube of the log of the number.

So, the longer the numbers, the greater becomes the difference in computing power needed between creating a code and breaking it. Hellman has estimated that with N in the region of 200 decimal digits, the best computers in the world would take over a billion years to break it. The present Z80-based system could easily be adapted to accommodate numbers that length, at a cost of a 30-fold increase in encryption and decryption times.

There is also the brute-force approach to breaking the code, which consists of trying every possible plaintext input and seeing which one gives the known ciphertext output. Even with the present system, trying 10^{12} plaintexts per second would take about 10^{52} years to work through all possible combinations. Despite intensive world-wide efforts, no easy way of cracking RSA ciphers has been found, and it seems unlikely that one will ever be found.

There has recently been controversy as to how unbreakable this code really is. PCW would be interested to hear actual experiences of breaking it.

Applications

Up until the present, the use of ciphers has been confined to military and

diplomatic circles but, as Hellman points out, the proliferation of electronic communications has led to more and more confidential information being transmitted over insecure channels. It is easier to tap into a telephone line than to open a sealed letter without detection. Due to this, it is likely that more and more private individuals and organisations will resort to the use of ciphers, and if this happens then RSA ciphers and microcomputers will be sure to play a large part.

Acknowledgement

I am greatly indebted to Robert Macmillan of the University Mathematical Laboratory, Cambridge for helpful advice and for having sent me a draft copy of his dissertation.

References

- Hawker, Pat. *Electronic Cryptography. Wireless World*, Sept 1980.
- Hellman, Martin E. *Mathematics of public-key cryptography. Scientific American*, Aug 1979.
- Macmillan, Robert J. *The implementation of a program which factorises large integers on the IBM 370/165. Cambridge University dissertation (in preparation).*

END

PCW SUBSET

continued from page 189

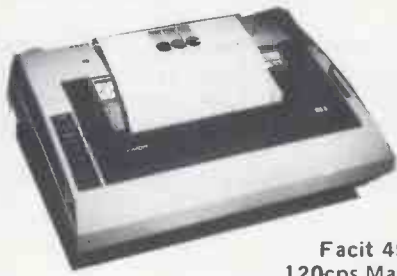
Andrew suggests that the routine CASTXT might be improved by replacing the POP DE immediately prior to DONE with a POP BC. This gets rid of the old value of DE

(the first byte of the test string) and DE then passes the address of the byte following the string where there may be parameters for use by the associated action.

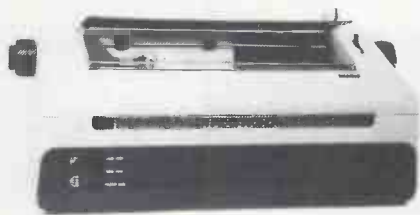
END

	LD	B,A	;else move length to B and pointer	47
	INC	HL	;to 1st byte of key string	23
	PUSH	DE	;save test string pointer	D5
CPSTR:	LD	A,(DE)	;compare test byte against	1A
	CP	(HL)	;key string byte	BE
	JR	NZ,NEXT	;go next key if no match	20 09
	INC	DE	;else increment both pointers	13
	INC	HL	;to next bytes and repeat until	23
	DJNZ	CPSTR	;end of string or no match	10 F8
	POP	DE	;matched, so restore pointer	D1
DONE:	POP	HL	;HL = required routine address	E1
	POP	AF	;restore registers	F1
	POP	BC	;putting address of required	C1
	EX	(SP),HL	;action on stack	E3
	RET		;and "return" to it	C9
NEXT:	LD	C,B	;BC = string bytes left	48

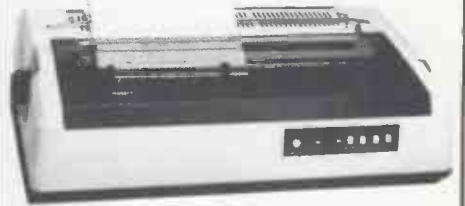
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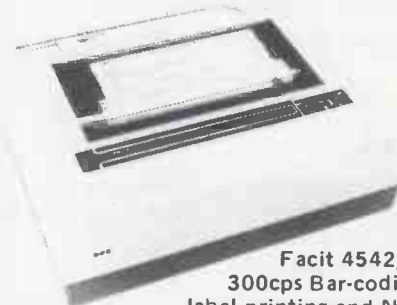
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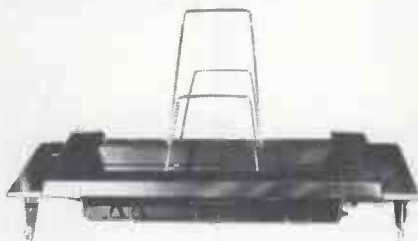
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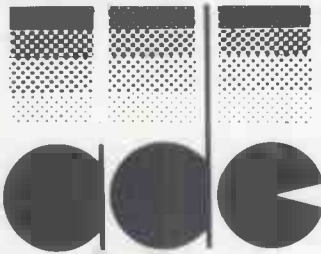


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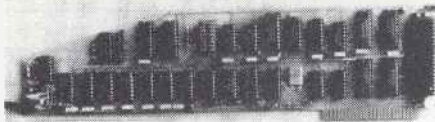
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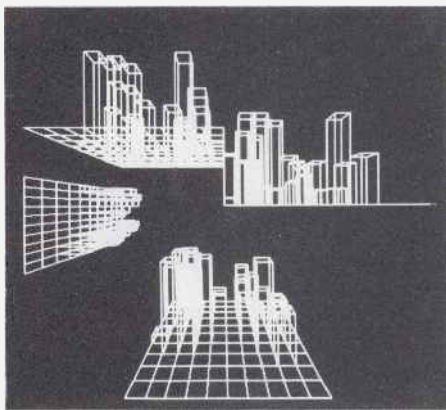
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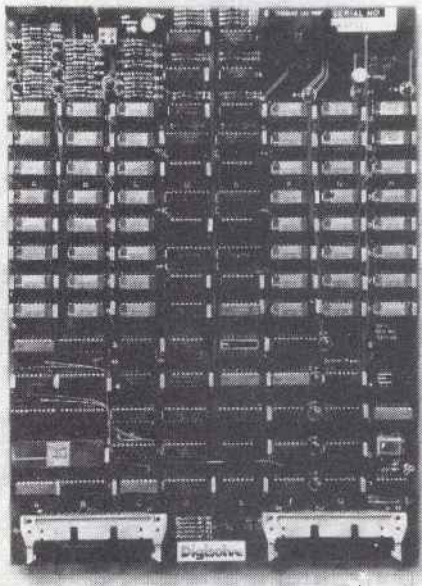
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A PSYCHOLOGICAL APPROACH?

Paul Overaa introduces a four-part series on programming with an analysis of the more modern ideas and approaches in problem-solving.

There are so many methodologies scattered around under the terms 'structured approaches to problem solving' or 'structured programming techniques' that we are all apt to look upon new ideas and thoughts on how we should program with a certain amount of contempt. Frequently such contempt is justified because writers often rehash the work of others using a different terminology, or an alternative name simply for the sake of doing so. When I first thought of preparing this series I was motivated primarily by the desire to collect together some of the more important ideas that have appeared over the last few years. It is my opinion that there is not enough emphasis placed on how these newer techniques are evolving to form a consistent framework within which many of the older concepts are finding new life.

There is always a tendency for ideas, once useful, to be pushed both theoretically and practically to their limit. This is a good thing at times but I suspect that very often the initial simplicity of an idea becomes 'clouded'. People unfamiliar with the original thoughts have difficulty working out the basic concepts. In programming, and computing in general, this constitutes a major obstacle. So it is appropriate to take stock of the various developments in a way that can provide a general picture.

We can start by examining some very general points that are closely related to the field of computer programming. They are concerned with how we think and solve problems. More importantly they give some clues about how we react or behave when we encounter difficulties.

Solving problems

Motivation is one key to accomplishment. Another way to learn about any new subject is to 'break it up into manageable pieces'. Each piece is then far less formidable and consequently far easier to get to grips with.

Inherent in this idea is the implication that an ordered or 'structured' approach exists that enables our understanding of the lesser problems to be integrated into our understanding of the original, more complex, ideas and problems.

The microcomputer has brought us sophisticated computing power. No longer are computers the 'gods in the sky' to be admired with awe. The computer is now a readily available tool that can be used by all of us irrespective of our professions. It can save us time, increase our productivity or

allow us to indulge our own creativity 'just for the fun of it'.

So you have a computer, or access to one; you have instruction manuals and books that explain how you physically program your computer; you start learning by 'hands on' experience — writing programs and experimenting with problems and uses that interest you. Gradually you come to terms with the vocabulary of the subject and you become aware of what a powerful tool you are working with. Such awareness serves to increase your desire to learn, to increase your motivation to master a seemingly complex subject.

As you start to tackle larger problems you will have become aware that difficulties arise. These difficulties are solved with much effort and diligence (yes, it is quiet in the early hours of the morning). As frequently as not you find yourself looking over large amounts of coding in an attempt to locate a 'bug' that is preventing your program from working. If you are examining a program that you wrote some time ago, the problem is even more exasperating — especially if you did not document it properly. In more unfortunate cases you get involved with trying to understand programs that have been written by other peo-

'People unfamiliar with the original thoughts have difficulty working out the basic concepts.'

ple. I'm sure that many of you will have come to the conclusion either that every programmer is a latent masochist or that there must a better approach to use.

Emphasis on 'structured programming' is an important step in the right direction but it is not in itself the complete solution. This is owing to a serious fundamental error continually made by both professional and amateur programmers alike. The difficulties in programming a computer to solve a particular problem consist of two very distinctly different parts.

Failure to appreciate the difference between the inherent logical basis of the problem, and the completely separate problem of how to code it, is one of the major causes of bad programming. It is one of the reasons why so many people run into problems as they start to tackle larger projects.

The point made in the previous paragraph has a clear corollary:

Any envisaged use of computers to solve a problem requires that you find a logically correct solution before you make any attempt to involve yourself with the problems of actually coding your computer solution, that is, you should not try to solve the quite separate difficulties together.

It has consistently been found easier to tackle each part in turn. The isolation of a logical program design produces a logical solution that is portable. It is independent from the computer hardware and software on which it will be implemented.

My concern then is about the techniques of solving problems and designing the logical solutions needed to produce efficient and well structured programs in any language you care to name. If you are a newcomer to microcomputing, then take heart. Although some of the ideas may take a certain amount of time to digest, they are fundamentally simple. Be patient and think about the concepts. Apply them to problems of your own choosing and you will achieve a real and useful understanding.

Iconic modelling

The way in which we approach a problem plays an important role in determining how successful or not our solution will be. In the last twenty years much work has been done by psychologists to try and discover the basic mechanisms we use when we solve a problem. In general, what mechanisms do we use to come to terms with our intellectual and physical environment?

Jerome Bruner has attempted to describe and characterise the ways in which young children react when confronted with a problem. He was able to identify three broad stages in the problem-solving experience. The words used by Bruner — *enactive*, *iconic* and *symbolic* — can be thought of as keywords for a basic problem-solving framework. This framework is applicable to adult as well as children's patterns of thought.

Enactive: relates to the use of physical models and the ability and confidence to manipulate them. One of the characteristics of this enactive level is an inability to describe the situation — that is, the inability to communicate effectively without resorting to actual demonstration.

Iconic: the second recognisable stage is the use of diagrams or pictures to represent the 'enactive elements' of the problem. This has been called the iconic stage and is sometimes seen as the initial stage of abstraction, that is, separating the physical or real problem into a 'modelling situation'.

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A PSYCHOLOGICAL APPROACH?

It is to be hoped that such a model will embody all the enactive elements of the problem in a form that is easier to translate into totally abstract form.

Symbolic: the use of signs and symbols, previously defined to produce an abstract version of the problem. This characterises the symbolic level of confidence in problem solving.

Mathematics is typical of symbolic abstraction, and it is commonly recognised that difficulties associated with learning and understanding mathematics frequently stem from a lack of confidence in symbol manipulation.

In children these stages can be identified by the way that simple problems are tackled. Of equal importance is how the approach changes as a child gets older:- Given a dozen bricks a very young child, if asked how many he would get if he had to share his bricks with two other children, will resort to physically sharing the bricks. At a later stage he might solve such a problem by drawing three boxes and placing dots in them to represent bricks. He will be able to deduce from his iconic model that each child will receive four bricks. Later still, developing his confidence at the symbolic level will enable him to write $12 \div 3 = 4$ without hesitation.

'The way in which we approach a problem plays an important role in determining how successful or not our solution will be.'

In many situations these three levels of confidence occur simultaneously; they should not therefore be thought of as being physically distinct. The distinction to make is that the stages are conceptually different. We will often be able to look at particular lines of reasoning and identify areas that are causing problems as being symbolic as opposed to iconic or enactive.

This framework is equally recognisable in adult thinking, and the various levels of confidence can often be identified. An important point is that, when we have difficulties in tackling a problem, we frequently fall back to a lower level of problem representation in an attempt to achieve a better understanding.

Think how many times you have been presented with a mathematical problem to solve in which you plunged straight in with some symbolic argument only to find you got 'stuck' and rapidly resorted to a graph or diagram, that is, an iconic model, in order to get a better understanding of the problem itself.

These ideas produce some interesting generalities which have implications of particular benefit to us in our quest for better methods of designing and writing computer programs. It would appear, for instance, that most of us benefit by having an iconic

model to fall back on while we are coming to grips with difficult or unusual problems. Some people are able to work at a symbolic level almost immediately. Such confidence is rare and those who can do this often have great difficulty in explaining to others how they arrived at a particular approach or why it was obvious to them but not to others.

So, there are two key points. Firstly, when you solve programming problems you are frequently solving other people's problems. You may very often need to explain your solutions and your lines of reasoning to others. There is a need to ensure proper communication of your ideas (often to non-technical people). Secondly, the problems you examine will often be ill or imprecisely defined. Frequently, restrictions will be

the logical from the practical difficulties. In addition to this the diagrams provide an iconic level with which to examine a problem. In an earlier article (*PCW* January 1983) you will have seen that it is easy to cope with changes even when you are in the middle of a solution. The very nature of the technique enables us to split a problem 'as we go' into easily handled sections while maintaining a coherence between these sections.

Next month I shall discuss the implications of regarding programming as a means of operating on 'sets' of data. This, and the concept of 'Normalisation' of a data set, provides a useful approach that enables us to avoid some of the pitfalls that have been found to cause many problems in real life applications.

The following references will be of use for people who would like to examine some of the published works related to the work of Jean Dominique Warnier:

Logical Construction of Systems by Jean Dominique Warnier. Pub. Van Nostrand Reinhold Company. ISBN 0-442-22556-3.

Logical Construction of Programs by Jean Dominique Warnier. 3rd edition trans. B M Flanagan. Pub. Van Nostrand Reinhold Company.

Practical LCP by Albert C Gardner. Pub. McGraw Hill Book Co (UK) Ltd. ISBN 0-07-084561-1. This is useful but Gardner's description tends to deviate from Warnier's in what appears to be an unnecessary way. The diagrammatic notation is not as clear as the original Warnier method. This disturbs the clarity of an otherwise good interpretation.

Structured Systems Development by Keneth T Orr. Pub. Youden Press New York. ISBN 0917072-06-5. A good non-theoretical introduction. Ken Orr's works are always very readable and he knows a lot about the practical uses of Warnier's work.

Structured Requirements Definition by Keneth T Orr. Pub. Ken Orr & Associates Inc, Topeka, Kansas. Again this is useful as an introduction. It contains many of the fundamental definitions that one comes across with the newer approaches to programming.

Personal Computer Word

* October 1981 issue contains a short introduction describing in simple terms some of the main advantages and some fundamental conventions that are used.

* April 1982 issue contains a Microsoft Basic implementation of a screen-form program. The use of the Warnier approach for program design is illustrated. This program was actually written as a 'halfway stage' before a full 8085 assembler version was prepared.

* January 1983 issue contains an 8085 assembly language program called DUMP. The complete design and implementation technique is given.

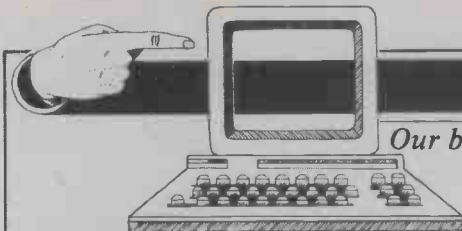
Byte Magazine. Various authors.

added to the problem while you are in the middle of finding a solution ie, the problem will change. During this time you will regularly come across quite severe difficulties. If you are working at a purely symbolic level you may conclude that some particular difficulty is insurmountable. Providing you have an 'iconic model' to fall back on you are more likely to come to terms with the new restraints.

The way, or ways, in which we describe a problem becomes important as we attempt to conceptualise and solve problems. It is also important because of the ease or difficulty with which we can convey our ideas and thoughts to others.

One of the techniques that capitalises on the above ideas is the 'Warnier diagram'. The power of using such diagrams to design programs is due in part to the separation of





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Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 26 (£4500)	AI 09237-70578(19)	64k RAM: Z80A: dual 8" F/D (2.3Mb): 12", 24 x 80 VDU: 2 x RS232 ports: 3 x P/P	CP/M: <i>MP/M Basic:</i> <i>Cobol: Fortran: Pascal.</i>	Options: 10Mb H/D £4000. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12", 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM): <i>Fortran: Pascal: A:</i> <i>Multi user Basic.</i>	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5 1/4" F/D (320k) £895: dual 8" F/D (2 Mb). BT 1/80. (I)
Acclaim (£3650)	Country Computers 0527 29826	64k RAM: Z80: 24x80 VDU: single 5 1/4" F/D (140k): 5 MB H/D: RS232 port. Option: P/P	CP/M: <i>Basic: Cobol:</i> <i>Fortran: Pascal</i>	Various integral H/D options up to 21MB (£4450)
ACT Sirius I (£2395)	ACT 021 501 2284 (50)	128-512k RAM: 8088: dual 5 1/4" F/D (1.2M): 12", 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: <i>Basic 86</i> <i>Cobol: Fortran: Pascal</i>	High res graphics. Options: 10 Mb H/D: dual 5 1/4" F/D (2.4 M) BT 2/82.(S)
Adler Alphatronic (£1895)	Adler 01-250 1717	48-64k RAM: 8085A: dual 5 1/4" F/D (1Mb): 12", 24 x 80 VDU: S/P: P/P	CP/M: <i>Basic: CBasic:</i> <i>Fortran: Cobol</i>	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Altos ACS 800-2 (£2995)	logitek: 0257 426644 (33)	64k RAM: Z80A: dual 8" F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: <i>Basic: CBasic:</i> <i>Cobol.</i>	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 800-10 (£6675)	As above.	280k RAM: Z80A: single 8" F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: <i>MP/M: Basi:</i> <i>Cobol: Fortran: APL:</i> <i>Pascal.</i>	Multi-user/multi tasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5 1/4" F/D (380k): 2 x RS232 ports.	CP/M: <i>APL: Basic: U:</i> <i>Fortran: Cobol: Algol:</i> <i>Forth</i>	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Apple (UK) 0442 60244 (200 +)	16-48k, RAM: 6502: 8 I/O slots.	OS: <i>Basic: Pascal:</i> <i>Fortran: Cobol: Pilot</i>	280 x 192 high resolution graphics: Option: single 5 1/4" F/D (116k) £349.
Apple III (£2496)	As above	128-256k RAM: 6502B: dual 5 1/4" F/D (286k): 12", 24x80 VDU: RS232 port: P/P.	SOS: <i>Basic: Pascal:</i>	Options: single 5 1/4" F/D (143k) £384: 5Mb H/D £2256. (E) BT 5/82
Atari 400 (£200 inc VAT)	Atari UK: Slough 33344	16k RAM: 6502: C int: cartridge slot: 24 x 40 TV int: touchpad k/b: Opt: C £50	OS (10k ROM): <i>Basic (8k ROM).</i> <i>Pilot: A:</i>	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£500 inc VAT)	As above.	16-48k RAM: 6502: C int: 2 x cartridge slots: 24 x 40 TV int: Opt: single 5 1/4" F/D (90k) £300: 16k RAM £65.	OS(10k ROM) Basic (8k ROM): <i>Pilot</i> <i>A: Forth: MBasic</i> (I/B).	As above. Software & RAM on cartridge modules. Up to 4 disk drives RS232C int £135. BT 10/80.
Atom (£120)	Acorn: 0223 245200 (160)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S: <i>Lisp:</i> <i>Forth</i>	High resolution graphics on bigger model: Single 5 1/4" F/D £297 B/ 7/80 (B)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM: 2xZ80A: 3 x 5 1/4" F/D (480k): 12", 24 x 80 VDU: RS232 port: P/P	DOS: <i>(OASIS) Ex Basic:</i> <i>Cobol U. A: CP/M</i>	H/D available. Also 7125 with 960k F/D £4900 and 7130 with single F/D (430k) & 5Mb H/D £6300. Disk controller has own Z80A. BT 9/80
BBC Micro (£299 inc VAT)	BBC Micro Systems 0933 79300	16-32k RAM: 32k ROM 6502: C int: TV int: RS423 port: P/P: Option: single 5 1/4" F/D (100k) £230	MOS: <i>Basic A: Pascal</i> <i>Logo: Forth: Lisp</i>	Video text & second processor int. 32k model with Econet and disk interface £399. BT 1/82 (I)
Bonsai SM3000 (£1995)	Bonsai 01-580 0902	64k RAM: Z80: dual 5 1/4" F/D (700k): 12", 24x80 VDU: RS232 port: P/P	CP/M: <i>Basic: Cobol:</i> <i>Pascal: Fortran</i>	Many floppy and hard disk option Applications software avail. from Bonsai.
Computers Lynx (£225 inc VAT)	Computers Ltd 0223 315063 (TBA)	48-192k RAM: Z80A: 24x40 TV int: C int: RS232 port	Basic	248 x 256 colour graphics (8 colour). CP/M compatible 5 1/4" F/D & printer avail soon. (B)
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5 1/4" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: <i>Basic: A.</i> <i>Cobol: Pascal</i>	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5 1/4" F/D (640k) £1500.
Canon CX-1 (£2500)	As above.	32k RAM: 6809: dual 5 1/4" F/D (640k): 12", 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: <i>Basic: A: Cobol:</i> <i>Pascal</i>	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1450)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Cleno Pronto (£2825)	Cleno Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: <i>CBasic-2:</i> <i>Pearl 1: U Fortran:</i> <i>Cobol: Pascal</i>	With 2.4Mb F/D £3105. Also H/D systems with 5-20 Mb H/D & tape drive £5430.

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk

G/C Graphics card
H Hardware
H/D Hard disk
I Introductory
Int Interface

M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port

S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

Please note: Software items listed in *italics* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Cleno Table Top 525 (£1750)	As above	64k RAM; Z80 dual 5 1/4" F/D; 2xS/P	CP/M; MBasic; W/P	Wordstar & Logicalc included in price. Many options
Colour Genie (£200 inc VAT)	Lowe Electronics 0629 2430 (100+)	16-32k RAM; Z80; 16k ROM; C int: 24x40 TV int; Audio port; RS232 port; P/P	ExBasic	160x96 colour graphics. 16k RAM £30. Many options inc joysticks and light pen. F/D avail soon. (B)
Columbia PC (£2800)	Icarus 01 485 5574 (50)	128k RAM; 8088; dual 5 1/4" F/D (640k); 24x80 VDU; 2xRS232 ports; P/P; 8 expansion slots	MS-DOS; CP/M 86; Basic; Cobol; Fortran; Pascal	IBM PC compatible. With integral H/D (5 Mb) £4200 or (10 Mb) £4550 (S)
Comart Communicator (£1895)	Comart 0480 215005 (25)	64k RAM; Z80A; dual 5 1/4" F/D (780k); 2 S/P; P/P.	CP/M; MP/M Basic; Cobol; Fortran; Pascal	With 1.5 Mb F/D £2195. With 4.8 Mb H/D & 790k F/D £2995. Option: 18 Mb H/D. £3895 Also CP100 range with 8086 & 128k-1Mb RAM from £2295. Expandable to multiuser/multitasking. (S).
Commodore PET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM; 6502; C: 12" 25x40 VDU; IEEE-488 port; Options: dual 5 1/4" F/D (343k) £695; same but (1018k) £895	O/S: Basic (in 8k ROM); Forth; Pilot; Pascal; Comal; Lisp; A	CBM 8032 with 80-col screen (32-96k) BT 12/80. £895 Field service avail. (1).
Commodore Vic 20 (£200 inc VAT)	Commodore: 0753 79292 (150)	5-32k RAM; 6502; Cint: 22 x 23 TV int; S/P; P/P; Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5 1/4" F/D (170k). BT 9/81(S).
Commodore 500 Series (From £659)	As above	128-896k RAM; 6509; 25x40 TV int; P/P	O/S: Basic; CP/M; Pascal; Forth; Cobol; Fortran	High res. 16-colour graphics. Second processor option: Prestel facility avail.
Commodore 700 Series (From £995)	As above	128-896k RAM; 6509; 24x80 VDU; Option: dual 5 1/4" F/D (1Mb); IEEE-488 port; RS232C port.	As above	8088 or 280 second processor option Tilt and swivel screen.
Commodore 64 (£299)	As above	64k RAM; 6509; 25x40 TV int; C int; RS232 port; P/P	Basic	Second processor option. 320x200 colour graphics. Option: Joystick; Light pen
Compucorp 625 (£6000)	Compucorp: 01-907 0198 (17)	48-60k RAM; Z80; dual 5 1/4" F/D (630k); 9". 16x80 VDU; 40 col printer; RS232 port; P/P.	Basic; A; Fortran; Pascal; U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/665/675/685 (from £5050)	As above	60k RAM; Z80; Up to 4x5 1/4" F/D (160k-2.4 Mb); 9", 20x80 or 12" 20x80 or 20" 60x80 VDU; 40-col printer; RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£1975/£3095/£4495/£6585).	Datron: 0742 585490. Comart: 0480 215005 (25) MicroCentre: 031-556 7354 (18)	64k RAM; Z80; dual 5 1/4" F/D (390k) on System Zero, System 2 & Z2H; dual 8" F/D (1.2 Mb) on Sys 3; 10 Mb H/D on Z2H; S/P; P/P.	CDOS; Basic; Cobol; Fortran; RPG II; Lisp; A; W/P; Multi-user Basic; Cromix; CP/M	System 2 & 3 expandable to Multi-user (max 7) Also 'D' series with 6800/ Z80A dual processor from £3620. Options: dual 8" F/D (996k); 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM; 8080; C int; 24x60 VDU int; RS232 port; over 20 industrial fints. option: dual 5 1/4" F/D £595	Basic (ROM); U	Colour graphics up to 255 x 335; 3 notes & noise generator; PAL O/P to TV; Paddle int; H maths option. (1). BT 10/80.
Diablo 3000 (£6250)	Business Computers Ltd: 01-207 3344	32k RAM; 8085; dual 8" F/D (1.3 Mb); 12", 24x80 b&w VDU; 45 cps printer.	DOS; Basic; DACL; A; U.	Selection of business packages included (S).
Digital Microsystems DMS-3 (£3530)	Digital Microsystems 0734 343885 (14)	64k RAM; Z80A; dual 8" F/D (1.14Mb); 3xRS232 ports; 1xRS422 port; P/P.	CP/M; CBasic; Cobol; Fortran; Pascal; PL/I	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Microsystems DMS-4 (£4395)	As above	128-512k RAM; Z80A; single 8" F/D (500k); 11 Mb H/D; 4x RS232 ports; P/P.	CP/M; Basic-E; CBasic; Cobol; Fortran; Pascal.	Port expander to enable up to 10 workstations under M/PM. Options: 128k RAM £1295; up to 96Mb H/D. (H).
Dragon 32 (£200 inc VAT)	Dragon Data 0792 580651 (50+)	32-64k RAM; 6809E; 16x32 TV int; C int; P/P	Basic	9 colour 256x192 high resolution graphics. Option: Joysticks BT 8/82
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM; 8085; dual 5 1/4" F/D (1 Mb); 9", 16x64 green VDU; 132 col 165 cps printer; N/P.	O/S; D Basic; CP/M; CBasic; Micro Cobol.	Up to 5 work stations; fully integrated system. Options: additional dual 5 1/4" F/D (1 Mb); 12-24 Mb H/D.(S).
Eagle II, III and IV (from £2350)	Mediatech Bus Syst 01 903 4372	64k RAM; Z80A; dual 5 1/4" F/D (768k and 1.5Mb) or single 5 1/4" F/D (784k) with 10Mb H/D; 2xRS232 ports; 2 x P/P	CP/M; CBasic; Cobol; Pascal; Fortran	Many different configurations available. Full range of applications software
Epson HX20 (£402)	Epson	16-32k RAM; 32k ROM; Twin 6301 CPU; 20x4 LCD; RS232 port; Micro dot matrix printer	E Basic	Display gives 120 x 32 dot graphics. Options: TV int; micro-cassette drive; expansion module. BT 12/82
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM; Z80; 10 Mb-1200 Mb H/D; 6xS/P; 1 P/P.	CP/M; CBasic; Cobol; Fortran.	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Fortune 32:16 (£4375)	Fortune Systems 01 938 1721	256-512k RAM; MC 68000; dual 5 1/4" F/D (800k); 12", 25x80 VDU; S/P; P/P	FOS; CP/M; Basic; Pascal; Cobol; Fortran; C	Expandable to full multi-user system. High res colour graphics
Gecac 64/2 (£3305)	Gecac Micros 01 629 3758	64k RAM; Z80A; dual 8" F/D (2.4 Mb); S100 bus.	CP/M; Cobol; Basic Pascal Fortran	Up to 4.8 Mb F/D. Expandable to multi-user/multitasking system.

List of Abbreviations

A Assembler	G/C Graphics card	M/A Macro assembler	S Software
BT Bench Tested	H Hardware	N/A Not available	S/P Serial port
C Cassette	H/D Hard disk	N/P Numeric pad	T/E Text editor
E Extensive	I Introductory	O/S Operating system	TBA To be announced
F/D Floppy disk	Int Interface	P/P Parallel port	U Utility

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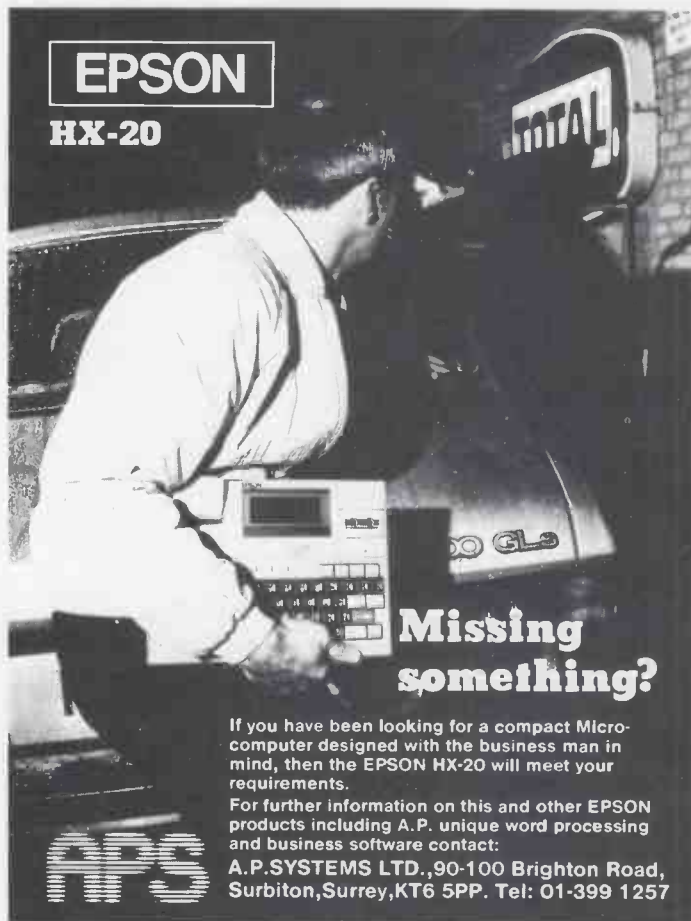
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Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5 1/4" F/D £690.	CP/M: <i>Basic Cobol: Pascal Fortran AP/L:</i>	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).
Gemini Galaxy 2 (£1495)	As above	64k RAM: Z80A: dual 5 1/4" F/D (800k): 12", 25x80 VDU: RS232 port: P/P: C int	CPM: <i>Basic: Cobol: Fortran: Pascal: AP/L: A</i>	Options: dual 5 1/4" FD (800k): dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5 1/4" F/D (500k): 2xRS232 ports.	OS-9: <i>Flex Basic: Pascal: A: Dis A: T/E: U</i>	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Genie I (£299)	Lowe Electronics: 0629 2430 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): <i>Pascal: A M/A: Fortran</i>	Options: single 5 1/4" F/D (184k) £220; dual 5 1/4" F/D (368k) £375 (I) Also Genie II with numeric keypad and function keys but no cassette (same price as I).
Genie III (£1900)	As above (26)	64k RAM: Z80A: dual 5 1/4" F/D (1.25 Mb): 24x80 VDU: RS232 port: P/P	NewDOS 80: <i>CP/MZ: Basic: Cobol: Fortran Pascal</i>	System complete with business applications software, maintenance contract and choice of printer £3250 (S).
Grundy 8200 (£1850)	M-Tech Comp Serv: 0603 870620	64-256k RAM: Z80A: dual 8" F/D (2MB): 24x80 VDU: RS232 port: P/P	CP/M: <i>Basic: Cobol: Fortran: Pascal: Forth: PL/I: Ada</i>	Various hard disk options up to 26MB
Haywood 9000 Composite (£1795)	Haywood: 01-428 0111. (TBA)	64-192k RAM: Z80A: dual 5 1/4" F/D (640k): RS232 port: P/P: 15" 28x80 VDU.	CP/M: <i>Basic: Cobol: Fortran: Pascal: W/P.</i>	Graphics avail. Expandable to 18 Mb H/D. Networking version planned (H&S)
Haywood Hinet (£7500)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 11Mb H/D: RS232 port: RS422 port: P/P: 24x80 VDU	CP/M: <i>HiNet: Basic: Cobol: Fortran: Pascal</i>	Local area network, up to 32 users. Range of H/D avail. Local disks & printers if required. Work station £2050 (H&S)
HP 75C (£728)	As above	16-24k RAM: 48k ROM: CPU: 32 char display: mag card reader	Basic	8k RAM £142. Video interface £221. Thermal printer £371. (E) BT 11/82
HP 85 (£2013)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5", 16x32 VDU: C(200k). 64 cps printer: 4 P/P. Options: dual 5 1/4" F/D (540k) £1610: fusi 8" F/D (2.4 Mb) £4108.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £142. (S).
HP86 (£1314)	As above	80k RAM: C.P.U.: 48k ROM. Options: 12", 24x80 VDU £238: 9", 16x80 VDU £216: 5 1/4" F/D(207k) £622	ExBasic	Many expansion possibilities including CP/M module (£362), RS232 port (£289) and up to 576k user RAM. 400x240 graphics. BT 10/82 (E)
HP 125 (£2479)	As above	64k RAM: 2xZ80A: 12", 24x80 VDU 2xRS232 ports: HP-1B port. Options: dual 5 1/4" F/D(500k) £1693	CP/M: <i>Basic: Cobol: Fortran: Pascal</i>	Integral thermal printer £629. Also available with dual 8" F/D (2 Mb). (S). BT 3/82
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5 1/4" F/D (320k): 2xS/P: 1 P/P:	CP/M: <i>C/Basic: Cobol, Fortran.</i>	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8" F/D (1 Mb): 2xS/P: 1 P/P	CP/M: <i>CBasic: Cobol: Fortran: MicroCobol.</i>	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Jupiter Ace (£90 inc VAT)	Jupiter Contab,	3k RAM: 8k ROM: Z80A; 24x32 TV int; C int: loudspeaker.	Forth	Has 140 Forth words defined in ROM.
Kemitron K2000 E (£2300)	Kemitron 0244 21817 (3)	64k RAM: Z80A: single 5 1/4" F/D (150k): 12", 24x80 VDU: 2xS/P: P/P	CP/M: <i>Basic: Cobol: Fortran Pascal: A</i>	Extensive range of support cards and industrial interfaces.
Kemitron K3000 E (£3300)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 2xS/P: P/P	CP/M: <i>MP/M: Basic: Cobol: Fortran: Pascal: A</i>	Up to four screens and four printers can be attached. Options: 10Mb H/D.
LSI M-Two (£6000)	LSI Computers 04862 23411 (20)	64-128k RAM: 8085A: dual 8" F/D (1.2 Mb): 12", 24x80 VDU: 60 cps printer	Elsie: <i>CP/M: Basic: Cobol: Fortran: Pascal: A: U</i>	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
LSI M-Three (£1700)	As above	64k RAM: Z80A: dual 5 1/4" F/D (350k): 12", 24x80 VDU: RS232 port: P/P	CP/M: <i>Basic: Cobol: Fortran: Pascal: A</i>	Option: Dual 8" F/D, 10 Mb H/D (E)
LSI M-four (£2175)	As above	128-256k RAM: Z80B: 8088: dual 5 1/4" or 8" F/D 3xRS232 ports: RS422 port: P/P 12", 24x80 VDU	MS-DOS: <i>CP/M-86 Basic: Cobol: Fortran: Pascal: MP/M-86</i>	Operates on either 8-bit or 16-bit applications software. Option: 10 Mb H/D
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8" F/D (1 Mb): 4xRS232 ports.	CP/M: <i>APL: U: Basic: Fortran: Cobol: Word-2star Algo: Pascal: Forth.</i>	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Marinchip M9900 (£4990)	Microprocessor Eng. 0703 775482	128k RAM: 9900: dual 8" F/D (2Mb): 4xRS232 ports.	NOS: <i>Basic: Pascal: W/P: SPL: Forth: Meta</i>	Multi-user/multi-tasking OS. Options: H/D up to 120 Mb.
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10" 16x24 VDU: 2xC int: Opt: dual 5 1/4" F/D (160k) £595: 8k RAM £17.	Basic: <i>Pascal: PL/M: W/P</i>	SS50-based system. Graphics avail. Int card with real time clock £17. (I).
Millbank Sys 10 (£2395)	Millbank: 01-891 4691(6).	65k RAM: Z80: dual 5 1/4" F/D (700k): 12", 24x80 VDU: 2x RS232 ports: RS449 port: P/P.	CP/M: <i>Basic: Cobol: Fortran: Pascal: PLI: W/P.</i>	12-month warranty. Main-frame comm. package. Maintenance contracts. Options: 1.6 Mb F/D. 5-50 Mb H/D. (S&H)
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 5 1/4" F/D (320k): 3xRS232 ports: P/P	Munroe Multitasking System: <i>CP/M: Basic: Cobol: Fortran: Pascal</i>	High res colour graphics. Option: single 5 + " F/D. (320k). £495

List of Abbreviations

A Assembler	G/C Graphics card	M/A Macro assembler	S Software
BT Bench Tested	H Hardware	N/A Not available	S/P Serial port
C Cassette	H/D Hard disk	N/P Numeric pad	T/E Text editor
E Extensive	I Introductory	O/S Operating system	TBA To be announced
F/D Floppy disk	Int Interface	P/P Parallel port	U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Munroe OC8820 (£2990)	As above	128k RAM: Z80A: dual 5 1/4" F/D (640k): 9", 24x80 VDU: 3xRS232 ports: P/P	As above	5MB H/D avail soon. BT 4/82.
Nascom 3 (£549)	Lucas Logic 0926 59411	48-60k RAM: Z80: dual 5 1/4" F/D (700k): RS232 port: P/P.	Basic: <i>Pascal: A: CP/M: Cobol Fortran</i>	Options dual 5 1/4" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5 1/4" F/D (326k) £699	Basic N: (24k ROM) <i>CP/M: Fortran: Cobol: Pascal.</i>	Colour monitor £359 (low res) or £579 (high res) both 12", 25x80 many expansion units avail. (E) BT 6/81
Newbrain Model A (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (29k ROM): A.	Graphics. Battery or mains. Options: 1/2 Mb RAM £450. Also Model AD £299. (E).
North Star Horizon (£1975)	Comart: 0480 215005. (25) Trader Comp. 01-328 3484 (60)	32-64k RAM: Z80A: dual 5 1/4" F/D (360k): 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: <i>Cobol: Fortran: Pascal.</i>	Options: 5-18 Mb H/D, Multi-user.
North Star Advantage (£2195)	As above	64k RAM: Z80A: dual 5 1/4" F/D (720k): 12", 24 x 80 VDU: S/P.	GDOS: CP/M: <i>CBasic: MBasic: Fortran: Cobol: Pascal</i>	Price includes business graphics & demo software.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5 1/4" F/D (768k): 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: <i>CP/M: Cobol: Fortran:</i>	Fully integral unit. Graphics. Options: dual 5 1/4" F/D (560k): RS232 port: PP. (1). BT 10/81
Olivetti M20 (£2395)	Olivetti 01 785 6666	128k-512k RAM: Z8001: 2-8k ROM: dual 5 1/4" F/D (640k): RS232 port: P/P	Basic: <i>PCOS: A</i>	Alternative 8086 processor board to run CP/M86 & MS-DOS. Options: 11 Mb H/D (integral): printer £738. (S) B/T 9/82
Onyx C8000 (£6875)	Onyx Dist Ltd. 09066-5432 (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: <i>MP/M Oasis: Unix: Fortran: Pascal: W/P</i>	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis. (E) BT 3/81.
Oric 1 (£100 inc VAT)	Oric Products Int 0990 27641	16-48k RAM: 6502A: 28x40 TV int: C int: S/P: P/P: Loudspeaker	Basic (16k ROM): <i>Forth</i>	With 48k RAM and Forth on cassette £170 inc VAT. 240x200 colour graphics. Micro disk and modem avail soon. Viewdata compatible.
Osborne 1 (£1250)	Osborne 0908 615274(40)	64k RAM: Z80A: dual 5 1/4" F/D (200k): 5", 24x52 VDU: RS232 port: P/P	CP/M: W/P: <i>Cobol: Fortran: Pascal: CBasic: MBasic: Wordstar: Mailmerge: Supercalc: Forth</i>	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5 1/4" F/D (400k). BT 11/81.
Oscar (£2560)	JDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 1/4" F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: <i>Basic: Pascal: Fortran: Cobol: W/P: A</i>	Also avail. with dual 5" F/D (1.6Mb) £2905 and 8 1/2" F/D (2 Mb) £3380. Advanced video board. S&H)
Panasonic JD 800M, JD850M (£3300, £4350)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	64k RAM: 8085A: 4k PROM: dual 8" F/D JD800M (500k): JD850M (2 Mb): 12", 24x80 VDU: 3xRS323 ports. P/P	CP/M: Basic: A <i>Micro-Cobol.</i>	Options: 8.4 Mb H/D £2725 (up two). BT 3/80(S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£1900)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: <i>Basic: Cobol: Fortran: Pascal: A: W/P: U</i>	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5 1/4" F/D (140k): 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: <i>Pascal: Basic Fortran: A.</i>	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Position 900 (£1950)	Position Comp. 09252 29741 (10)	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C: dual 5 1/4" F/D (720k)	OS-9: Basic 09: <i>Pascal: C: A: Cobol: U FLEX O/S</i>	Supports 4 users, expandable to 8. Networking allows 28 users on 7. Options dual: 5 1/4" F/D (1.4 Mb): 5-40 Mb H/D (E)
Position 9000 (£1536)	As above	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C.	OS-9: Basic 09: <i>Pascal C: A: Cobol: U</i>	240x240 high res colour graphics. Viewdata compatible. Disk options as above. Supports 5 users. Networking allows 35 users on 7 systems (E) BT 10/82.
Prince (£3045)	Digico: 04626 78172 (50)	64k RAM: 3xZ80A: dual 5 1/4" F/D (800k): 2xRS232 port: P/P/A2", 25x80 VDU	CP/M: <i>Basic: Pascal: Fortran: Cobol: W/P: A: T/E: U</i>	High res graphics. Options: single 5 1/4" F/D (400k) £600: dual 8" F/D (2 Mb) £2000 5-10Mb H/D. Rentals avail. (S).
Quantum 2000 (£2250)	Quantum Comp Sys 0532 458877	64k RAM: Z80A: dual 8" F/D (2.4Mb): 12", 24x80 VDU. C int: P/P	CP/M <i>Basic: Cobol: Fortran: Pascal: A</i>	Many expansion boards avail inc high res colour graphics. Option: 5-10Mb H/D.
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5 1/4" F/D (500k): 6 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£1867)	Research Machines: 0865 249866 (N/A)	32-56k RAM: Z80A: dual 5 1/4" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: <i>CP/M: Fortran: Cobol: Algol: Pascal.</i>	High res colour graphics. Many possible systems. With 56k RAM & dual 8" FD (1 Mb) £3347.
Research Machines Link 480Z (£560)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: T/E	High res colour graphics. Network station.

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk

G/C Graphics card
H Hardware
H/D Hard disk
I Introductory
Int Interface

M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port

S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Sage II (£2870)	TDI 0272 742796	128-512K RAM: 68000: single 5¼" F/D (320k); VDU int: RS232 port: P/P	UCSD p-System: Pascal Basic: Fortran: M/A	Price includes 1 year service. With 512k RAM and dual 5¼" F/D (1MB) £4594 BT 2/83
SEED System 1 (£1900)	Strumech: 05433 78151 (5)	32-56k RAM: 6800: various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS: Basic: M/A: CBasic: A: T/E	Graphics. PROM programmer Also system 19 multi-user (£3000). (E).
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic, A. CP/M: Pascal: Fortran: Forth	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ80A (£549)	Sharp Electronics (UK) Ltd 061 205 2333 (22)	48k RAM: Z80: 25x40 VDU: C: P/P. Options: single 5¼" F/D £400: dual 5 + " F/D £590: RS232 port	Basic: CP/M: A: Pascal: Fortran: Cobol	Expansion unit needed for disks (£100) Low res (80x50) graphics. Loudspeaker Numeric pad (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: A: Pascal: FDOS	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC1500 (£150)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD:	Basic	Full system with dual cassette int. and miniature four colour plotter £375. RS232 port avail. soon. (B) BT 6/82
Sharp PC3201 (£2995)	As above CP/M: Cobol	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 lpm printer.	DOS: U: Basic: CP/M: Cobol.	Various expansion cards avail. BT 7/81 (I&B)
Sharp PC1251 (£80)	As Above	3k RAM: 8-bit CPU: 24 char LCD	Basic (24k ROM)	Portable. Printer/cassette unit £100 BT 2/83
Sig/Net 100ZS (£1299)	Shelton 01 278 6273 (5)	64k RAM: Z80A: dual 5¼" F/D (400k): 2xRS232 ports	CP/M: Basic: Cobol: Fortran: Pascal	Various disk options, up to 16 Mb H/D
Sinclair ZX81 (£50 inc VAT)	Sinclair: 0276 66104 (300 +)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. BT 6/81
Sinclair ZX Spectrum (£125 inc VAT)	Sinclair: 0276 685311	16-48k RAM: Z80A: 16k ROM: T.V. int: C int	Basic	Options: 32k RAM £60. RS232 port and microdrive disks avail soon BT 6/82
Smoke Signal Chiefan (£1800)	Windrush 0692 405189: (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: 68/FLEX: Basic: Fortran: Cobol: A: Disc A: Pascal: U.	With dual 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Sorcerer (£790)	EMG 0293 519211 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector: 30x64 VDU int. N/P.	O/S: Basic (ROM): A: Algol: Fortran: MBasic: ExBasic: 80. Pascal: W/P.	High-resolution graphics capability: user programmable character set, Option: single 5¼" F/D (316k) £600 Video disk unit (1.5Mb) £1890
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 07917 64686 (10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: A: Fortran: Pascal.	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	O/S: Ex Basic: CBasic: Multi-User Basic: Fortran: Cobol	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3140)	Digital Data: 01-573 8854	96-1056k RAM: 8085 A-2: dual 5¼" F/D (280k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: Up to 106 Mb H/D	Mikados, Comal: Pascal: A.	Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1750)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: Basic: Cobol: Fortran: APL: Pascal	Limited graphis, Mainframe int avail. With 676k F/D £2090, 1.5Mb £2345. With 5Mb H/D & single 338k F/D £3950. BT 8/80. (S&H)
SWTPc/09 (£3850)	SWTP Ltd 0733 234433	64k RAM: 6809: dual 5¼" F/D (1.5MB) 2 S/P: P/P: 12", 24 x 80 VDU	Flex O/S: Basic: A: T/E	Expandable to 768k RAM
SWTPc S/09 (£7000)	As Above	128k RAM: 6809: dual 8" F/D (2.5MB) 2 S/P: 1 P/P	Uniflex O/S: Cobol: Basic: Fortran: C. Pascal: A: Pilot: Forth.	Up to 80MB H/D. Multi-user, multi-tasking, up to 18 users
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: Basic: Fortran: Pascal: Cobol: PL/1: W/P	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
Tandberg EC10 (£3250)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) Multi-user Basic: Pascal: Cobol: A: U:	Up to 7 terminals. Includes V28 comms port. (S&H)
Tandy PC-2 (£179 inc VAT)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD	Basic:	System with dual cassette int. and miniature four colour plotter £338 inc VAT. RS232 port avail. soon. (B)
Tandy TRS-80 Model I (£174)	Tandy: 0922 648181 (200)	16-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (12k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £260. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic M/A Fortran: Cobol 3-32 Mb H/D	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4). 8-32Mb H/D
Tandy TRS 80 Model 3 (£434-£1477)	As above	See Model I Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Tandy TRS-80 Colour (£209)	As above	16-32k RAM: 6809; 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £261 (I). BT 9/81.
Tandy TRS-80 Model 16 (£3651)	As above	128-512k RAM: Z80A 68000: dual 8" F/D (1-2Mb): P/P: 2xRS232 port.	TRSDOS: A: <i>Cobol</i> <i>Basic</i>	Will run all Model II software. System with single 5/4" F/D (600k) and 8Mb H/D £5911. Options: 8Mb H/D £2173 (up to four): 640x240 high res graphics: Multi-user system avail. soon. (S)
Tele Video TS800 (£3100)	Colt 01-577 2686	64k RAM: Z80A: dual 5/4" F/D (700k): P/P: S/P: 24x80 VDU: 80 cps printer.	CP/M: <i>Basic: Cobol:</i> <i>Fortran: Pascal</i>	Fully expandable to local area network with 16 users. 8 and 16 bit versions avail. and full set of application software. (S)
Terodec PBM-1000 (£4020)	Terodec: 0734 664343 (40)	80k RAM: Z80A: single 5/4" F/D (819k): 6Mb H/D: 2xS/P: P/P	CP/M CP/Net CBasic: <i>Fortran: Pascal: Cobol</i>	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
TI 99/4A (£199 inc VAT)	TI: 0234 67466 (TBA)	16-48k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: <i>Basic.</i>	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5/4" F/D (92k each): Speech Synthesiser.
Torch (£12795)	Torch Comp. 0223 841000 (30)	64k RAM: Z80A: dual 5/4" F/D (800k): 12", 24x80 colour VDU: RS232 port: P/P: Modem	CPN: BBC Basic:	O/S is CP/M compatible. With 21MB HD and single F/D £5495. B/T 1/83
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5/4" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: <i>Basic: Fortran:</i> <i>Pascal: Cobol:</i>	Options: single 5/4" F/D (190k) £155: single 5/4" F/D (370k) £285: 16k RAM £162: 3 Mb H/D £1450: 20 Mb H/D £2970 (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM: Z80A: dual 5/4" F/D (630k): 3 S/P: 2 P/P.	CP/M: <i>Basic: Algol:</i> <i>Cobol: Pascal: Fortran:</i> <i>Coral: CBasic: A.</i>	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM: 3k ROM: Z80B: single 5/4" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: <i>Basic: forttran:</i> <i>Cobol: Pascal: A.</i>	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT2/81
Windrush 6809 (£2418)	Windrush 0692 405189	56k non-volatile CMOS RAM: 6809: 2xRS232 port. 2xP/P: dual 5/4" F/D (700k)	OS-9: <i>Flex: Uniflex</i> <i>Basic: A: PL9: SPLM:</i> <i>Cobol: Fortran: Pascal</i>	Designed as development system for industrial control/computer station for commercial OEM's. With dual 8" F/D (2 Mb) £2953. (E)
Xerox 820 (£1845)	Business Comp Sys 01 207 3344	64k RAM: Z80: single 5/4" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: <i>CP/M: Basic:</i> <i>Cobol: Fortran: Pascal.</i>	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S + H)
Zenith WH-11A (£2673)	Zenith Data Systems 0452 29451 (TBA)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	O/S: <i>Basic, Fortran:</i> A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5/4" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	<i>Basic: A: HDOS:</i> CP/M: <i>MBasic:</i> CBasic: <i>Fortran.</i>	3 x 5/4" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: <i>Cobol:</i> <i>Basic: Fortran: Pascal:</i> M/A: U.	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).

TRANSACTION FILE

Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for cooperating.



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- Sharp MZ80-P5 printer, as new condition £215. Sharp MZ80B, FDOS, Pascal and double precision Basic. £50. Parish 2, Collyers Close, Hurworth, Darlington, Co Durham DL2 2ES. Letters only.
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- TRS80 Model I, Level II, drive 26-1160 £175. TRSDos drive 26-1161, £150. Montiro £65, 32k expansion int £150. Microsoft editor, assembler + £15. Owner upgrading. Tel 0268 743967 after 6.
- S100 Z80 complete system, Midas cable, CP/M Dos, with many available extras. A bargain at £900 (but no VDU). Offers accepted. Tel: 0829 70737 eve or w/ends please. Ted.
- Microintel Prestel television adaptor. Almost new, complete and with built in microcomputer interface socket, documentation and Apple II interface software, on diskette. £95 ono. Tel 0829 70737 eve please. Ted.
- PET 3032 with cassette, toolkit, superchip, arrowchip, sound including music monitor, light pen, reset button, books and 50 cassettes inc, Chess, Drafts, Papermate, Adventure games. £375. Tel: Gresford 2741.
- Commodore system comprising PET 3032, 3040 disk drive, 3022 printer. £1500 ono. Sunbury (09327) 87846.
- Atari 400 16k + recorder + J/ sticks + paddles worth £250+. Cartridge, cassette s/ware worth £500+. Books worth £90+. All £500 ono. Tel: Jeff, 0903 64783, eve except Monday, Wednesday, Friday. Free TI59 included.
- TRS80, model III, level II, 48k, built in VDU, 1 year old. Light hobby use only, £550. Tel: Poulton (Glos) 421.
- Double sided, double density, 2 megabyte Z/80 CPM2.2 + E&bit screen, Micromation Z-plus computer. New in 1980. Cost £4,500. Accept £1,500. Tel: Brandon Solicitor 603-5545 or 603 5955.
- Sharp MZ80B 64k with expansion unit, extension graphics and printer interface, £550 ono. Also selection MZ80B disk software, cheap. Tel: Reading 664559. Can deliver.
- Sharp MK-80A 48k + Basic interpreter, manuals, education, games (10), Home Finance, Basic Tutorial, Database, cassette programs, + Peeking and Poking manual, all 3 months old. Accept £475 ono. Lancing 767702.
- UK101 cased 8k RAM with Cegmon and Basic 5 300/600 baud cassette interface. Manuals, Assembler and games tapes included £100. Tel: 0455 30186.
- Nascom 2, power supply and 48k memory board with 16k RAM. Includes graphics ROM, Sargon, Chess, Games and Assembler. £200 ono. Tel: 061 969 7065.
- Apple II Z80-card. 80-column card, CP/M system disk, the lot for £195. Printer (Centronic) interface card and cable, £65 ono. Osborne I computer £850 ono. Tel: Anthony 01-440 2403 or 01-690 6871.
- Probably the only building, small works estimating programme around. Including bill head. Printout designed for Apple but easily adaptable for most micros £300. Tel: Reading 0734 663026 after 6.
- Newbrain. Wordprocessor, Options include save/load to tape, paged organisation, directory look-up, full error detection, efficient text packing, most normal W/P functions, manual cassette, £5. K. Polston, 19 Marshalls Drive, Romford, Essex RM1 4JR.

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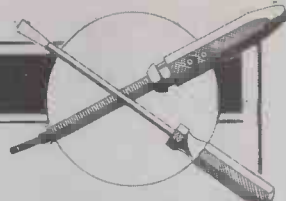
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ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.



The ACC club bulk membership scheme has been revised, in order to tailor it more accurately to the requirements of local clubs.

The members of ACC, who can take part in the election of the committee, come from two sources: direct members who have paid the subscription fee to ACC, (currently £5 or £2.50 for under 16s and OAPs), and club affiliate members, who belong as a result of their membership of a local computer club.

This is how you go about starting a bulk membership of your club. Get together the members of your club who require ACC membership, and send their names to me, with a fee calculated as follows:

Each of the first 50 members (minimum: 10 members): £3
Each of the next 50: £2.75
Each subsequent member: £2.50

There are lots of things you can do with this scheme; perhaps your local club would like to beef up its regular news sheet by distributing ACCumulator as well (this is usually cheaper than producing a similar news sheet yourselves). Alternatively, ACC membership could be an optional part of your club subscription.

Clubs

I have had a letter from the Society of Genealogists, which is very interested in the application of computers in genealogy. So if your family tree is so complicated that you need a computer to unravel it, then you should contact David Hawgood of 26 Cloister Road, London W3 ODE who is setting up a genealogy club.

A chap called Chris

Wallwork tells of a 'Tonbridge Wells Area Computer Society', which meets twice per month, on the first and third Thursdays. Give him a ring on Tonbridge Wells 37682. If you can't get through, try Colin Turner on Ton Wells 21120.

Also around here is the SOBAT computer club, its aims, according to the Chairman, Mr T Kayani, are to provide an opportunity for micro owners to discuss their problems, exchange wants and exchange (public-domain) software. It is also building up a growing library of games and educational programs for the use of its members. The club caters for East London, mainly Leyton, Ilford and East Ham. Contact: Mr T Kayani, Berridge House, Hillfield Road, London NW6 or phone (weekends) 01-556 5423.

Over to the west of town, Steve Ward of 28 Brodie Road, Enfield EN2 OEU writes to tell me of the 'Brigadier Computer Club'. This meets monthly on the first and third Monday from 7.30 to 10pm at the Brigadier Youth Centre, Brigadier Hill, Enfield. The subscription is £2, with a meeting fee of 25p. It is a general club, catering for novice and expert alike.

Mr Ken Ward of 45 Coleburn Road, Lakenham, Norwich NR1 2NZ writes to tell me of his proposed club in Norwich — he seems to be mainly Atari based, but if you have another system or interest, do contact him.

Dashing a few hundred furlongs to Newmarket, we meet 'Newbyte' — a catchy acronym. The secretary, John Smyth of 5 New River Green, Exning, Newmarket, Suffolk

CB8 7HS writes to tell me that it is a general club with a range of different machines. Most of the members are fairly new to micros, so there is no need to be intimidated — just race to the telephone and get John on Exning 8100.

Down on Canvey Island, I have had letters from two club contacts, namely Paul Sida of 3 Tewkes Road, Canvey Island, Essex and Dean Williams of 17 Mornington Road, Canvey Island, Essex SS8 8AT. The latter club is for any machine, although it has a minimum age of 14 for its members. As to whether these two clubs are actually the same, 'I'm sorry, I haven't a clue...'

Remaining in island vein, there is the Jersey Computer Association. The man to contact is Michael Murphy, PO Box 441, St Helier, Jersey, Channel Islands (I wonder what it's like to live in a PO box — pretty rough I imagine). You can also phone him in working hours on (0534) 78399. Anyway, the Jersey Computer Association is a general group with many machine interests, including both business and home applications. The subscription varies from £2 to £16 depending on who you are.

Meanwhile, up in sunny Merseyside, we have the Liverpool BBC and Atom Group, which now meets twice monthly, on the first Thursday of the month at the Old Swan Technical College (Rm C33) and on the third Thursday at Birkenhead College. For more info, contact Nik Kelly on 051-525 2934.

Also in the Liverpool area, a Mr Gary Metcalfe of 24 Marlston Avenue, Irby,

Wirral, Merseyside L61 3XU writes to tell me of his new computer club. This will be a general club, including Atari, VIC, Commodore 64, BBC, Spectrum and Dragon users — with more on the way.

Going east I find Ian White, who tells me of the South Trafford Microcomputer Club (South Manchester). This group has been running for almost two years and meets once a fortnight. The members possess a wide range of micros, and they publish a monthly newsletter, including teaching material in Basic and machine code. Contact Ian on 061-969 2080 or write to him at 16 Leicester Avenue, Timperley, Altrincham WA15 6HR.

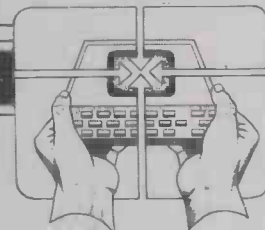
Further east still, I find James Bridson of Barnsley Co-Operative Computer Club, 39 Keresforth Hall Road, Kingstone, Barnsley, S Yorks S70 6NF. It holds its meetings on co-op premises which are provided free (hence the name of the club). So if you're clubless of Barnsley, you know who to talk to.

And finally, a Mr Illegible writes from Italy to tell me of its ZX users club. It calls itself Sinclair Club, and its address is: /o Arrigo Bomdi, via Molino Vecchio 10/F, 40026 Imola, Italy. So if you want to brush up your Italian, while learning about the fantastico ZX81, then you know what to do.

* For more information on the ACC, Club Spot 800, or any of the points mentioned above, contact: Rupert Steele, St John's College, Oxford OX1 3JP or phone (0865) 512811. Please note that this address and phone number will be changing shortly.

CTUK! CONTACTS

For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #



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NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ)
Tel: 0482 859169, System operator:
Frederick Brown. International
electronic mail, library for
up/down-loading software.
Forum-80 Users Group, Pet Users
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7 days a week midnight to 8.00am,
Tues/Thurs 7.00pm to 10.00pm
Sat/Sun 1.00pm to 10.00pm

Forum-80 London ... Tel: 01-747
3191. System operator: Leon Jay.
Electric Mail, library for
downloading. System hours:
Tues-Fri/Sun 7.00pm to 11.00pm.

Forum-80 Holland ... Operator:
Nico Karssemeyer, Tel: 01/313 512
533. Facilities: electronic mail,
program up/downloading,
shopping list. Hours; Tues-Sat
1800-0700 nightly, continuous from
1800 Sat-0700 Tues

CBBS London ... Operator: Peter
Goldman, Tel: 01-399 2136.
Facilities: electronic mail, program
downloading. Hours: Wed
0700-0930 & 1900-2200, Fri
1900-2200, Sun 1600-2200.

Forum-80 Milton ... (TRS-80
Users Group 80-Nett) Tel: 0908

566660. System operators: Leon
Heller and Brian Pain. Electronic
mail, library, newsletter, TRS-80
information system hours: 7 days a
week 7.00pm to 10.00pm.

Mailbox-80 Liverpool ... 051-428
8924. System operator: Peter
Toothill, Electronic mail, down-
loading TRS-80 information.

ACC ... members bulletin board,
Peter Whittle (0908 44262).

ABC-80 ... Stockholm (Sweden).
Tel: 010-468 190522.

University Research Computer ...
Sweden. Tel: 010-468 23660, guests
use password "66,66" for access.

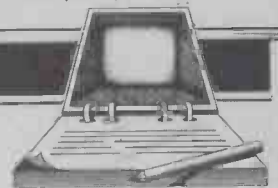
Elfa ... Sweden 010-468 7300 706.

Tree Tradet ... Sweden 010-468
190522.

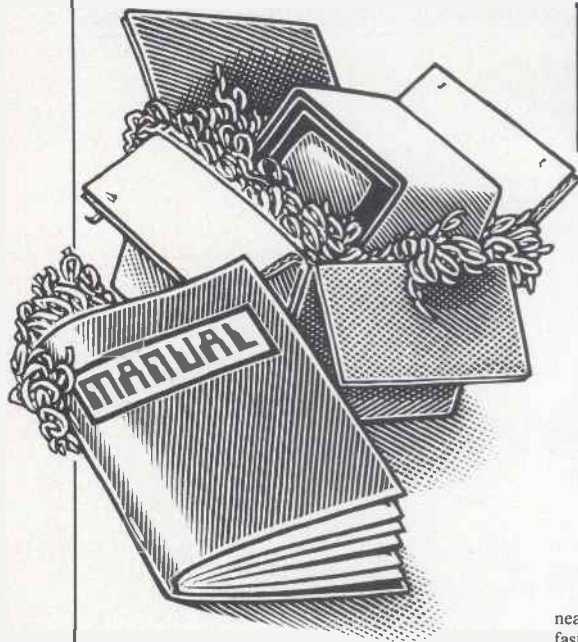
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DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.



London	(Earls Court) Computer Fair. Contact: Reed Exbns, 01-643 8040	16-19 June
Manchester	(Belle Vue) Compec, Comp Professionals Exbn. Contact: Reed Exbns, 01-643 8040	21-23 June
Leeds	(John Taylor Teachers Centre) Educational Computing & S/W Fair. Contact: Mr Creighton, 53 Headingley Lane, LS6 1AA	22 June
Cologne	Mini Comp show for Office, Home, Hobby. Contact: German Chamber of Industry & Commerce, 01-930 7251	23-26 June
London	(Barbican) Times & Sunday Times Business to Business Exbn. Contact: Silver Collins & Co Ltd, 01-729 0677	26-29 June
London	(West Centre Hotel) DeXPO Europe, Digital Equip H/W + S/W. Contact: Interco Bus Consultants Ltd, 01-948 3111	29 June-1 July
London	(Wembley Conf Centre) IBM Users Conf & Exbn. Contact: Online Publications Ltd, 09274 28211	12-14 July
London	(Royal Lancaster Hotel) Nat Conf & Exbn of Computers in Personnel. Contact: Peter Mirrington Exbns, 0277 232030	12-14 July



NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, PCW will be publishing this guide — every month.

We'll start by considering the microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, processing it, storing the results or sending them elsewhere. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary**. Binary is a system of numbering which uses base 2 instead of the more familiar decimal — or, to be more accurate, denary-system of base 10. In binary notation there are only two digits — 0 and 1 — which the computer recognises as the absence or presence of an electric current. The easiest way to visualise this is to think of each binary digit (**bit**) as being a switch which can be either off or on. Each binary digit stands for a power of 2. The right-most digit, the least significant, is $2^0=1$, the next $2^1=2$, then $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, $2^8=256$. So decimal 24, for example, is represented in binary as 00011000. A set of eight bits is known as a **byte** and, to make things easier for humans, a third system of numbering, **hexadecimal** or **hex** for short, is used as a sort of 'halfway house' between binary and denary. Hex uses numbers to base 16, with denary numbers between 9 and 16 represented by the letters A-F. The hex equivalent of a byte is obtained by giving each half a single character code: 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 ... E=1110 and F=1111. Our example of 24 is therefore 18 in hex.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). This allocates a numerical code to each digit and letter. For example, the number 5 is given the ASCII code 35 hex, 53 decimal, whereas a capital A is represented by ASCII 41 hex, 65 decimal.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the

closer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an **interpreter**, which is usually built into the machine's ROM (see later paragraph on this page). The interpreter picks up each Basic instruction, translates it into machine code and then feeds it to the **processor** for execution. It has to do this each time the same instruction has to be executed. A much faster method is to use a **compiler**, which accepts each instruction in turn, waits until the program has been entered, then turns each instruction into machine code before running the program. This means that each instruction has to be translated once only — consequently the speed of execution is considerably improved.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit (**CPU**), a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board (**PCB**) or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of

audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface, and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit (**VDU**), which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record (**hard copy**) of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output (**I/O**) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone system, allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



Software News



**INNOVATIVE
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from the professionals

£250 REWARD

Below you will find described a new program entitled Enigma. It is a true simulation of the German wartime cypher machine of that name. It will encipher messages which may be communicated to third parties by any means who, assuming they have the key, will be able to use their Enigma program to decipher.

We will pay the sum of £250 to anyone [who has purchased the program] who can demonstrate an infallible method of deciphering the coded message supplied in the program's instructions. We consider Enigma to be the best program of its kind on the U.K. or U.S. market; contestants may therefore use any orthodox means to crack the code, including microcomputer programs other than Enigma.

The original message and keys will be lodged with our Solicitors for safe keeping in a sealed envelope. In the [hopefully] unlikely event that the code is cracked by more than one person, the reward will be paid to the first customer who demonstrates to us that he has succeeded.

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During the 1939/45 war the German Army and Intelligence used a deciphering machine called Enigma. It was a fascinating machine and the stories that have surrounded it are equally interesting. There have been some four or five books written about the machine, and with regard to the way in which the British counter intelligence managed to crack the code.

That they did so was the culmination of some fortuitous circumstances, a lot of luck, but mainly it was due to the fact that the people who did it were extremely clever mathematicians. The fact that it took so much brain power, plus a rudimentary type of computer and a specimen of the machine in order to crack the code is an indication of how complex that code is.

The Enigma microcomputer program that we are selling is a simulation of the original machine, together with one or two improvements which were suggested by Gordon Welchman, who wrote the book "The Hut Six Story" last year and was also the leader of the team that cracked the code.

Although the machine and, therefore, the program is so complicated, its use is amazingly simple. One simply inputs a key and a message and the code is supplied. To decipher, the message is input again with the key and if the key is correct then the decoded message is displayed. With the cassette version it is necessary to input from the keyboard but with disks both inputs and outputs may be to disk files if required. A printer is of course supported.

The code may be transmitted in any way which the written word can be transmitted. Companies who wish to fully protect their communications will no doubt have the program generate the code and then tap it into a telex. Tape users will have to send either the output from their printer or write down the code direct from the screen.

Enigma is a fascinating program designed, not only for those people who are interested in encryption professionally or as a hobby, but also for companies or private persons who wish to communicate with others in an entirely secure manner. As is shown by the above Reward Notice, we have great faith in the powers of this piece of software.

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PROGRAMS

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs to PCW please include the following:-

- (a) A cassette or disk of the program
- (b) A listing on plain, white paper (typewritten if no printer available).
- (c) Comprehensive but brief documentation.
- (d) A suitable sae if you would like your materials to be returned after use.

Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime phone number. All programs must, please, be fully debugged. Programs are paid for at the rate of £40 per page of published listing, plus a £100 bonus for the Program of the Month. Send contributions to: Surya, PCW Programs, 62 Oxford Street, London W1A 2HG.

I'll do my best to acknowledge receipt of programs as quickly as possible, but following this acknowledgement it will usually be some time before a decision can be made, so please be patient! Generally speaking, programs which are rejected for any reason are returned fairly quickly, so 'no news ...'

Note: Due to industrial action at Rathbone Place Sorting Office, London, W1, programs — along with all our other mail — are subject to delay.

Oric 1 owners will, by now, be tearing out their hair and banging their heads against the nearest wall ... the corrections to the corrections to the errors in the 'Bug Eater' listing are included in this month's 'Bludners'. This program will now work (he says confidently). Could A Roe, author of 'BBC Balloons', please give me a ring — I've lost your address. And lastly, authors will be pleased to note that the new Programs rate is £40 per page with a £100 bonus for the author of Program of the Month. And now to this month's contributions ...

BBC TV Test

by Q A Rice

For someone with the necessary technical knowhow, TV Test should provide all the information needed to set up a tv or monitor correctly. The program makes use of the BBC's high-resolution graphics to simulate a pattern generator, offering a crosshatch, dot pattern, colour bar, colour matrix, focus grid and test card. I don't know enough about pattern generators to comment on the quality, but our

referee (a lecturer in physics who presumably *does* know about pattern generators) seemed suitably impressed. You'd be hard-pressed to find a pattern generator selling at much below the price of a BBC Model A — besides, you can't play PAC-MAN on a pattern generator. The program runs on either model, and is menu-driven. Pressing the space bar returns you to the menu.

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10MODE7
20VDU23,224,85,170,85,170,85,170,85,170
30VDU23,225,51,51,204,204,51,51,204,204
40VDU23,226,15,15,15,15,240,240,240,240
50VDU23,227,85,87,80,95,64,127,0,255
60VDU23,228,85,213,21,245,5,253,1,255
70VDU23,229,0,127,64,95,80,87,84,85
80VDU23,230,1,253,5,245,21,213,85,85
90VDU23,231,0,255,0,255,0,255,0,255
100VDU23,232,85,85,85,85,85,85,85,85
110MODE7:PRINT""T.V. TEST PATTERNS""1.CROSSHATCH""2.DOT PATTERN""3.COLOUR
BARS<1>""4.COLOUR BARS<2>""5.FOCUS GRID""6.TEST CARD"
120PRINT""TO RETURN TO MENU HIT ANY KEY""
130INPUT"ENTER CHOICE "CH
140NCH GOTO150,180,280,290,300ELSEGOTO130
150MODE4:FOR I=0TO1200 STEP 64:MOVEI,0:DRAWI,1024:NEXT
160FOR I=0TO1024 STEP 64:MOVE0,I:DRAW1200,I:NEXT
170GOTO390
180MODE4:FORI=0TO1270:PRINT":NEXT
190GOTO390
200MODE2:FORI=0TO1120STEP160:READK
210GCOLOR,K:MOVEI,0:MOVEI,1024:PLOT85,I+160,1024:MOVEI,0:PLOT85,I+160,0:NEXT
220RESTORE:GOTO390
230MODE2:FORI=0TO1120STEP160:READK
240GCOLOR,K:MOVEI,0:MOVEI,1024:PLOT85,I+160,1024:MOVEI,0:PLOT85,I+160,0:NEXT
250RESTORE:FORI=0TO896STEP128:READK:GCOLOR,K
260MOVE0,I:MOVEI200,I:PLOT85,1200,I+64:MOVE0,I:PLOT85,0,I+64:NEXT:RESTORE
270GOTO390
280MODE5:FORI=0TO639:PRINTCHR<225>:NEXT
290GOTO390
300MODE2:PROCPRINT<1,10,1,30,226>
310PROCPRINT<3,16,6,25,225>
320PROCPRINT<6,13,11,20,224>
330T=0:FORX=-4TO4:W=X*8
340PROCPRINT<1,10,15,16,231>
350PROCPRINT<9,10,3,28,232>
360PRINTTAB<9,15>:CHR<228>:PRINTTAB<10,15>:CHR<227>:PRINTTAB<9,16>:CHR<230>
:PRINTTAB<10,16>:CHR<229>
370FORI=0TO7:READK:COLOUR120+K:FORJ=0TO1:PRINTTAB<I*2+J,J>:"":PRINTTAB<I*2+
2,30+J>:"":NEXTJ,I:RESTORE
380FORI=0TO7:READK:COLOUR120+K:FORJ=0TO2:PRINTTAB<0,I*3+J+4>:"":PRINTTAB<10,
I*3+J+4>:"":NEXTJ,I:RESTORE
390VDU30:X=GET:GOTO40
400DEFPROCPRINT<A,B,C,D,E>
410FORI=A TO B:FORJ=C TO D
420PRINT TAB<I,J>:CHR<E>:NEXTJ,I
430ENDPROC
440DATA0,4,1,5,2,6,3,7
    
```

Atom Four-stroke Cycle

by Jonathan Empson

'Four-stroke Cycle' is a simple graphical demonstration of the workings of a four-stroke internal combustion engine. The program, intended for use as a visual aid in a physics or general science lesson, shows the movement of the piston

together with the operation of the inlet and exhaust valves. The display freezes after each cycle and waits for a key press before continuing. This program requires the Ross utility ROM.

```

10 LINK 44992
20 CLEAR4
30 R=40
40 FOR A=1 TO 2
50 MOVE 87,55
60 FOR X=-40 TO 40 S.4
70 Y=SQR(R+R*X*X)
80 IF A=2 Y=-Y
90 DRAW (127+X),(55+Y)
100 N.
110 N.
120 *RES.470
130 *READ B,C
140 MOVE B,C
150 DO
160 *READ B,C:IF B=-1 G.190
170 IF B=-2 G.210
180 DRAW B,C
190 U. B=-1
200 G.130
210 *STRG 20,170,"Intake valve"
220 *STRG 160,170,"Exhaust valve"
230 *STRG 110,190,"Spark"
    
```

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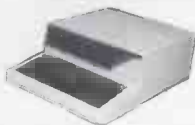
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PROGRAMS

```

240 *BLOCK 1 105,86,45,30
250 *STRG 110,182,"plus"
260 G=1:H=1:*#140="COMPRESSION"
270 GOS.a:GOS.u
280 #140=" Ignition "
290 GOS.a
300 *STRG 124,155,"*"
310 #140=" POWER "
320 GOS.a:*STRG 124,155," ":GOS.d
330 G=3:*#140=" EXHAUST "
340 GOS.a:GOS.u
350 G=1:H=3:*#140=" INTAKE "
360 GOS.a:GOS.d
370 G.260
380 LINK #FFE3
390 *BLOCK G 145,150,4,5
400 *BLOCK H 105,150,4,5
410 *BSTRG 1,95
420 IF G=1:*STRG 160,160,"SHUT"
430 IF G=3:*STRG 160,160,"OPEN"
440 IF H=1:*STRG 20,160,"SHUT"
450 IF H=3:*STRG 20,160,"OPEN"
460 RET.
470 *DATA 103,86,103,150,105,150,105,170,-1,-1
480 *DATA 110,170,110,150,120,150,120,155,124,155,124,170
490 *DATA 130,170,130,155
500 *DATA 130,170,130,155
510 *DATA 134,155,134,150,144,150,144,170,-1,-1
520 *DATA 149,170,149,150,151,150,151,86,-2,-2
530 uFOR F=86 TO 117
540 MOVE 105,F:PLOT 3,44,0
550 MOVE 105,(F-30):PLOT 1,44,0
560 IF G=1 PLOT 13,(A.R.*44+105),(A.R.*30+117)
570 N.:R.
580 uFOR F=147 TO 116 S.-1
590 MOVE 105,F:PLOT 3,44,0
600 MOVE 105,(F-30):PLOT 1,44,0
610 IF H=3 PLOT 13,(A.R.*44+105),(A.R.*30+117)
620 N.:R.
    
```

ZX81 Spectrum Least Squares

by Neil J Marshall

'Least Squares' is a linear regression fitting program for the 16k ZX81, and either Spectrum. Given a set of (x,y) coordinates, the program uses the method of least squares to calculate the equation of the best straight line through the given points. It uses a parallelogram of errors to calculate the expected errors in gradient and constant, as well as giving two widely-spaced coordinates to facilitate easy plotting of the line.

Subject to the amount of memory

available, the program will allow any number of coordinates to be entered, although it must obviously be given a minimum of two. The coordinates may be entered in any order and the program does work for a perfectly straight line. For those of you who get some kind of perverse pleasure out of confusing poor, defenceless micros, you can defeat this one by entering coordinates of either the x or y axis: the only cases where the program falls down.

```

100 PRINT "THIS PROGRAM WILL GI
VE THE EQUATION OF THE BEST
STRAIGHT LINE THROUGH ANY SET
OF POINTS USING THE LEAST SQUA
RES METHOD."
110 PRINT
120 PRINT "THE POINTS MAY BE EN
TERED IN ANY ORDER. THE COMP
UTER WILL ALSO GIVE THE COORDI
NATES OF TWO WELL SEPARATED POINT
S ON THIS BEST STRAIGHT LINE T
O FACILITATE PLOTTING THIS STRAIG
HT LINE ON A GRAPH. THE COMPUTER
ALSO GIVES THE STANDARDISED ERR
ORS IN BOTH THE GRADIENT OF THE
GRAPH AND IN THE CONSTANT, PROVID
ED THAT THESE ERRORS ARE NOT
ZERO."
130 PRINT
140 PRINT "PRESS ANY KEY TO CON
TINUE."
150 IF INKEY$="" THEN GOTO 150
160 CLS
170 PRINT "HOW MANY PAIRS OF PO
INTS ? ";
180 INPUT N
190 IF N<=1 THEN GOTO 180
200 PRINT N
210 DIM X(N)
220 DIM Y(N)
    
```

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PROGRAMS

```

230 PRINT
240 LET L=2
250 FOR I=1 TO N
260 PRINT "POINT ";I;TAB 10;"X-
COORDINATE ? ";
270 INPUT X(I)
280 PRINT X(I)
290 PRINT TAB 10;"Y-COORDINATE
? ";
300 INPUT Y(I)
310 PRINT Y(I)
320 PRINT
330 LET L=L+3
340 IF L<=18 THEN GOTO 370
350 CLS
360 LET L=0
370 NEXT I
380 LET SX=0
390 LET SY=0
400 LET SXY=0
410 LET SX2=0
420 LET SY2=0
430 FOR I=1 TO N
440 LET SX=SX+X(I)
450 LET SY=SY+Y(I)
460 LET SXY=SXY+X(I)*Y(I)
470 LET SX2=SX2+X(I)*X(I)
480 LET SY2=SY2+Y(I)*Y(I)
490 NEXT I
500 LET S=N
510 LET MX=((SX*SY)-(S*SXY))/((
SX*SX)-(S*SX2))
520 LET CY=((SY*SXY)-(S*SY2))/
((SX*SX)-(S*SX2))
530 LET MY=((SX*SY)-(S*SXY))/((
SY*SY)-(S*SY2))
540 LET CX=((SY*SXY)-(S*SY2))/
((SY*SY)-(S*SY2))
550 LET CY=-CY/MY
560 LET MY=1/MY
570 LET M=(MX+MY)/2
580 LET C=(CX+CY)/2
590 LET L=1E10
600 LET L2=1E10
610 LET B=-1E10
620 LET B2=-1E10
630 LET R=-1E10
640 FOR I=1 TO N
650 IF X(I)<L THEN LET L2=Y(I)
660 IF X(I)<L THEN LET L=X(I)
670 IF X(I)>B THEN LET B2=Y(I)
680 IF X(I)>B THEN LET B=X(I)
690 IF ABS (Y(I)-(M*X(I)+C))>R
THEN LET R=ABS (Y(I)-(M*X(I)+C))
700 NEXT I
710 LET L1=M*L+C
720 LET B1=M*B+C
730 LET DM=0
740 LET DC=0
750 IF N<=2 THEN GOTO 780
760 LET DM=(ABS (((B2-L2+2*R)/(
B-L))-M))/SQRT (N-2)
770 LET DC=R/SQRT (N-2)
780 CLS
790 PRINT "THE EQUATION OF THE
BEST STRAIGHT LINE THROUG
H ALL THE POINTS IS
",,"Y=";
800 IF M<>1 THEN PRINT M;
810 PRINT "X";
820 IF C<0 THEN PRINT "-";ABS C
830 IF C>0 THEN PRINT "+";C
840 IF C=0 THEN PRINT
850 IF DM=0 THEN GOTO 870
860 PRINT ", "THE STANDARDISED E
RROR IN THE GRADIENT IS +/-";D
M
870 IF DC=0 THEN GOTO 890
880 PRINT ", "THE STANDARDISED E
RROR IN THE CONSTANT IS +/-";D
C
890 PRINT ", "TWO POINTS ON THIS
LINE ARE X=";L,"Y=";L1,"X="
;B,"Y=";B1
900 STOP

```

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by Q A Rice

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explains the author. Let it be known that there's an inverse relationship between the number of puns of that quality and your chances of getting paid, Mr Rice.

```

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20VDU19,0,4;0;19,2,0;9;:PROCRAYS
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40PROCCIRC(650,750,150,2)
50PROCCIRC(1050,550,150,2)
60PROCCIRC(570,470,100,3)
70PROCCIRC(700,440,100,3)
80PROCCIRC(820,300,100,3)

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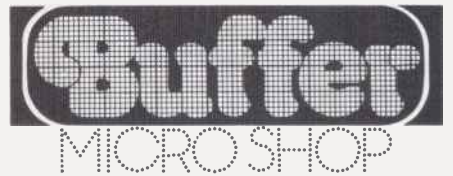
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PROGRAMS

```

90GCOL1,0:FORI=2.6 TO 5.5 STEP .2
100MOVE700,400:PLOT85,700+COS(I)*250,400+(SIN(I)*250):GCOL0,3:NEXT
110PROCCIRC(670,250,120,3)
120PROCCIRC(670,250,100,2)
130PROCELL(450,300,200,-.2,130,3)
140GCOL1,0:FORI=4 TO 6 STEP .1
150MOVE550,450:PLOT85,550+COS(I)*250,450+(SIN(I)*250):GCOL0,3:NEXT
160PROCELL(270,450,90,-.5,90,2)
170PROCELL(230,500,20,-.5,20,3)
180PROCELL(530,400,40,.3,60,2)
190PROCELL(660,450,50,.4,60,2)
200PROCELL(670,210,25,.6,25,1)
210PROCELL(710,210,25,.6,25,1)
220PROCELL(600,200,40,0,25,1)
230PROCELL(670,210,10,.6,10,3)
240PROCELL(710,210,10,.6,10,3)
250GCOL0,3:MOVE530,400:MOVE600,500:PLOT85,600,460
260GCOL0,3:MOVE660,450:MOVE720,470:PLOT85,720,430
265PROCHAIT(200)
270PRINTTAB(3,2);"MICKEY MOUSE MICROS PRESENTS....."
275PROCHAIT(400)
280T=6:REPEAT READ A$:PROCHAIT(50):PRINT TAB(1+RND(3),T);A$:T=T+1
290UNTIL T=22
300VDU30
310END
320DEFPROCCIRC(A,B,C,D)
330GCOL1,0:FORI=0TO2.1*PI STEPPI/10
340MOVEA,B
350PLOT85,A+COS(I)*C,B+(SIN(I)*C)
360GCOL0,D:NEXT:ENDPROC
370DEFPROCELL(A,B,C,D,E,F)
380GCOL1,0:FORI=0TO2.1*PI STEPPI/10
390MOVEA,B
400PLOT85,A+COS(I)*C,B+(SIN(I)*D)*E)
410GCOL0,F:NEXT:ENDPROC
420DEFPROCHAIT(X)
430TIME=0:REPEATUNTILTIME>X:ENDPROC
440DEFPROCRAYS
450GCOL0,1:FORI=1TO3*PI STEPPI/40
460MOVESIN(I)*100+700,COS(I)*100+400
470 DRAW SIN(I)*1500+600,COS(I)*1500+500
480NEXT:ENDPROC
490DATAK,R,A,Z,Y, ,K,O,M,P,U,T,E,R,S,I
    
```

Genie SLC-2

by E F Grimes

The Video Genie's ability to load from and save to an external cassette-player is primarily intended for file-handling, but can also come in useful when a cassette refuses to load from the built-in unit. There is, however, no facility for loading SYSTEM tapes from an external cassette-player, hence this routine.

Once entered into the computer, the routine is available to the user even after typing new since it is stored above user-RAM. To load a SYSTEM tape from an

external cassette-unit, type 'LOAD'. This will give you a modified system prompt, namely 'SYSTEM LOAD -2-'. The filename is now entered in the usual way.

SLC-2 is stored in the communications area of RAM normally used by the disk operating system. This means that the routine is incompatible with disk-based Genies, but since it is specifically designed to overcome cassette loading problems, this is of no consequence.

```

100 CLEAR 100
110 POKE 16866,195 : POKE 16867,62 : POKE 16868,64
120 POKE 16776,195 : POKE 16777,62 : POKE 16778,64
130 CLS:PRINT TAB(7);"SLC2 - TO LOAD SYSTEM TAPES FROM CASSETTE £-2."
140 PRINT TAB(7) STRING$(46,61)
150 PRINT
160 PRINT"THE PROMPT IS MODIFIED TO READ :-";STRING$(10,32);"SYSTEM LOAD £-2"
170 PRINT STRING$(43,32);" *? ";CHR$(95)
180 PRINT
190 PRINT"IT SHOULD BE ANSWERED BY THE FILENAME IN THE USUAL WAY.THE TAPE"
200 PRINT "WILL THEN LOAD FROM CASSETTE £-2."
210 PRINT "ONCE LOADED, SLC2 MAY BE RE-ENTERED FROM BASIC AT ANY TIME BY"
220 PRINT "TYPING 'LOAD' & THEN 'NEW LINE'."
230 PRINT"(SLC2 RESIDES IN A SECTION OF MEMORY UNUSED BY LEVEL II, SO A"
240 PRINT"SYSTEM TAPE CAN BE LOADED ANYWHERE IN FREE MEMORY).":PRINT CHR$(10)
250 FOR N=0 TO 65
260 READ D : POKE 16446+N,D
270 NEXT N
280 SYSTEM
290 DATA62,201,50,226,65,33,110,64,205,117,43,49,136,66,205,254,32,62,42,205,42
300 DATA3,205,179,27,218,204,6,215,202,151,25,254,47,202,29,3,62,17,205,18,2,205
310 DATA150,2,195,209,2,83,89,83,84,69,77,32,76,79,65,68,32,35,45,50,0,0,0
    
```

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PROGRAMS

MZ-80k Forth Interpreter

by J C Lea

This Sharp MZ-80k program requires 'Basic Extensions' or a similar extended Basic supporting full string comparisons: it will *not* run under the Basic SP-5025 supplied with the machine (cf *PCW*, March 83, pp 178-181).

The program is a simple Forth 'pseudo-interpreter' written in Basic. Although slow and somewhat limited, the interpreter does provide an effective introduction to the language. The following keywords and functions are supported:

+ , * /
> , > = , = , < > , < , = < (operators)
DUP , SWAP , OVER , ROT , DROP , UP (stack manipulators)
DEF , VARIABLE , ! , @ , FORGET (assignment)
IF-ELSE-ENDIF , DO-LOOP , REPEAT-UNTIL , BEGIN-WHILE-AGAIN (control structures)
, , CLEAR , INPUT , PEEK , POKE , RAND , LIST , EXAM (general)

LIST is used to display dictionary entries — either a single named entry or, in default, the whole dictionary. EXAM lists the values of the stack. Note that 'DEF' is used in place of ':' since we cannot include a colon as part of a

DATA statement in the Basic program.

Once you've typed in the interpreter, try the following simple Forth program:

```
4 6 * .
DEF SQUARE DUP * ;
4 SQUARE .
VARIABLE SHARP
8 SHARP !
DEF CUBE DUP SQUARE * ;
SHARP @ CUBE .
20 1 DO DUP . LOOP
FORGET CUBE
5 CUBE .
DEF DEC SHARP @ 1 - SHARP ! ;
REPEAT SHARP @ . DEC SHARP
@ 1 UNTIL
BEGIN 10 RAND DUP . 5 WHILE .
'TESTING' CR AGAIN
```

'Forth Interpreter' doesn't in any way set out to teach Forth, so you'll need some kind of introductory text if you're new to the language. There are plenty of books around, and your local computer shop and/or library should be able to help. The program does allow you to gain hands-on experience of the language to enable you to judge whether it's to your taste before spending your hard-earned cash on a fully-fledged interpreter.

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PROGRAMS

```

400 D=C*(D)=C*(D)+E":N=N0:S(N)=0:S(N+1)=0:L1=L0
410 C=S(N):D=S(N+1)
420 C=C+1:V$=MID$(D$(D),C,1):IFV$="E"THEN500
430 IFV$="I"THEN$1=S1+1:S(S1)=VAL(MID$(D$(D),C+1,2)):C=C+2:GOTO420
440 IFV$="H"THEN$1=S1+1:S(S1)=VAL(MID$(D$(D),C+1,5)):C=C+5:GOTO420
450 IFV$="R"THEN$1=VAL(MID$(D$(D),C+1,2)):C=C+2:GOTO1000*X*100
455 REM GOTD DEFINED WORD AFTER SAVING LAST POINT ON STACK
460 IFV$="D"THEN$1=VAL(MID$(D$(D),C+1,2)):C=C+2:S(N)=C:S(N+1)=D:N=N+2:GOTO480
470 PRINT"ERROR":GOTO100
480 D=X:IC=VAL(LEFT$(D$(D),1))+3:GOTO420
495 REM TEST FOR END OF INSTRUCTIONS
500 H=H-2:IFH<N0THEN900
505 PEM DROP BACK TO PREVIOUS WORD
510 GOTO410
900 PRINT"O.K.":GOTO100
990 IF$1<50THENPRINT"STACK UNDERFLOW ABORT":GOTO900
1000 GOTO420
1099 PEM "/
1100 IFMID$(D$(D),C+1,1)="/"THEN1120
1110 X=S(S1):S1=S1-1:PRINTX:GOTO990
1120 C=C+1
1130 C=C+1:V$=MID$(D$(D),C,1):IFV$="/"THEN1000
1140 PRINTV$:GOTO1130
1199 REM "+
1200 X=S(S1)+S(S1-1)
1209 REM REPLACE OPERANDS WITH RESULT
1210 S1=S1-1:S(S1)=X:GOTO990
1299 REM "-
1300 X=S(S1-1)-S(S1):GOTO1210
1399 REM "*"
1400 X=S(S1)*S(S1-1):GOTO1210
1499 REM "/"
1500 X=INT(S(S1-1)/S(S1)):GOTO1210
1599 REM "<"
1600 X=(S(S1-1)>S(S1)):GOTO1210
1699 REM ">"
1700 X=(S(S1-1)<S(S1)):GOTO1210
1799 REM "<="
1800 X=(S(S1-1)<=S(S1)):GOTO1210
1899 REM ">="
1900 X=(S(S1-1)=S(S1)):GOTO1210
1999 REM "<>"
2000 X=(S(S1-1)<>S(S1)):GOTO1210
2099 REM "="
2100 X=(S(S1-1)=S(S1)):GOTO1210
2199 REM "DUP"
2200 X=S(S1)
2209 REM PUTS RESULT ON TOP OF STACK
2210 S1=S1+1:S(S1)=X:GOTO990
2299 REM "SWAP"
2300 X=S(S1-1):S(S1-1)=S(S1):S(S1)=X:GOTO120
2399 REM "OVER"
2400 X=S(S1-1):GOTO2210
2499 REM "ROT"
2500 X=S(S1-2):S(S1-2)=S(S1-1):S(S1-1)=S(S1):S(S1)=X:GOTO120
2599 REM "DROP"
2600 S1=S1-1:GOTO990
2699 REM "UP"
2700 S1=S1+1:GOTO1000
2799 REM "EXAM"
2800 FORX=S0TOS1:PRINTS(X):NEXT:GOTO1000
2899 REM "CLEAR"
2900 PRINT"0":GOTO1000
2999 REM DEFINE WORD
3000 V$="E"
3010 X$=MID$(D$(D),4,LEN(D$(D))-4)+V$
3020 FORX=1TO100:IFD$(X)="/"THEN3040
3030 NEXT:PRINT"WORD BUFFER FULL":GOTO900
3040 IFX<DWTENDW=X
3050 D$(X)=X$:GOTO900
3099 REM FORGET WORD AND WORDS USING WORD
3100 X$=MID$(D$(D),4,3):X=VAL(RIGHT$(X$,2)):D$(X)="" :FORX=1TODW
3110 L=LEN(D$(X)):FORV=1TOL-4:IFMID$(D$(X),V,3)=X$THEND$(X)="" :V=L
3120 NEXTV,X:GOTO900
3130 NEXTV
3150 NEXTX:GOTO900
3199 REM DEFINE VARIABLE
3200 V$="00000":GOTO3010
3299 REM STORE
3300 V$=STR$(S(S1-1)):X=LEN(V$)
3310 IFX<STHENFORV=XTO4:V$="0"+V$:NEXT
3320 D$(S(S1))=LEFT$(D$(S(S1)),LEN(D$(S(S1)))-5)+V$:S1=S1-2:GOTO1000
3399 REM FETCH
3400 S(S1)=VAL(RIGHT$(D$(S(S1)),5)):GOTO1000
3499 REM INPUT
3500 INPUT X:IFINT(X)<>XTHENPRINT"INPUT NOT INTEGER":GOTO900
3510 AUTO2210
3600 PRINT:GOTO1000
3699 REM TEST IF
3700 V=S(S1)+S1=S1-1:IFXTHEN1000
3710 C=C+1:X$=MID$(D$(D),C,3):IF(X$="R29")+X$="R28")THENC=C+2:GOTO1000
3720 GOTO3710
3799 REM SKIP ELSE LOOP
3800 GOTO3710
    
```

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PROGRAMS

```

3899 REM SKIP ENDIF
3900 GOT01000
3999 REM SET UP DO LOOP
4000 L1=L1+2:S(L1)=C:S(L1+1)=D
4010 REM TEST END OF LOOP
4020 IFS(S1-1)=S(S1) THEN1000
4030 C=C+1:IFMID$(D$(D),C,3)="R31" THENC=C+2:L1=L1-2:S1=S1-2:GOT01000
4040 GOT04030
4099 REM LOOP BACK
4100 C=S(L1):D=S(L1+1):S(S1)=S(S1)+1:GOT04020
4199 REM REPEAT-UNTIL LOOP
4200 L1=L1+2:S(L1)=C:S(L1+1)=D:GOT01000
4299 REM UNTIL TEST
4300 S1=S1-1:IFS(S1+1) THENL1=L1-2:GOT01000
4310 C=S(L1):D=S(L1+1):GOT01000
4399 REM BEGIN-WHILE-AGAIN LOOP
4400 GOT04200
4499 REM WHILE TEST
4500 S1=S1-1:IFS(S1+1) THEN1000
4510 C=C+1:IFMID$(D$(D),C,3)="R36" THENC=C+2:L1=L1-2:GOT01000
4520 GOT04510
4599 REM LOOP FROM AGAIN
4600 GOT04310
4699 REM LIST DEFINED WORDS
4700 IFLen(D$(0))=4 THEN 4710
4705 X=VAL(MID$(D$(0),5,2)):GOSUB4750:GOT0900
4710 Y=-10
4715 Y=Y+10:FORX=Y+10:Y+10:IFX=DM THEN900
4720 PRINTX:" ":GOSUB4750:NEXT
4725 PRINT"MORE?"
4730 GETK$:IFK$="" THEN4730
4735 IFK$="Y" THEN4715
4740 IFK$="N" THEN900
4745 GOT04730
4749 REM DECODE FOR USER LISTING
4750 C=1
4755 C=C+1:V$=MID$(D$(X),C,1):PRINTV$":IFV$=" " THEN4765
4760 GOT04755
4765 C=C+1:V$=MID$(D$(X),C,1):IFV$="E" THENPRINT:RETURN
4770 IFV$="N" THENZ=VAL(MID$(D$(X),C+1,5)):PRINT"Z":Z:C=C+5:GOT04765
4775 IFV$="%" THENZ=VAL(MID$(D$(X),C+1,5)):PRINTZ:RETURN
4780 Z=VAL(MID$(D$(X),C+1,2)):C=C+2:IFV$="R" THENPRINTR$(Z):GOT04765
4785 Z=1:X$=D$(X)
4790 Z=Z+1:V$=MID$(X$,Z,1):PRINTV$":IFV$=" " THEN4765
4795 GOT04790
4799 REM PEEK
4800 S(S1)=PEEK(S(S1)):GOT0120
4899 REM POKE
4900 POKES(S1-1),S(S1):S1=S1-2:GOT0120
4999 REM RAND
5000 S(S1)=INT(RND(1)*S(S1))+1:GOT01000
9999 END
10000 DATA ., +, -, *, /, >, <, =, <, >, =, DUP, SWAP, OVER, ROT, DROP, UP, EXAM, CLEAR, DEF
10010 DATAFORGET, VARIABLE, !, @, INPUT, CR, IF, ELSE, ENDIF, DO, LOOP, REPEAT, UNTIL
10020 DATABEGIN, WHILE, AGAIN, LIST, PEEK, POKE, RAND
    
```

★★ Program of the month ★★

TRS-80/Video Genie Domain of the Djinn

by David Marsh

'Domain of the Djinn' is a well-written and thoroughly absorbing adventure game for a Video Genie/TRS.80 with at least 12k RAM.

The Domain is a six-storey building, each floor consisting of a maze of rooms and passages. Along with either one or two friends, your task is (surprise, surprise!) to find the treasure hidden in one of these rooms. To do this, you and your team wander through the Domain picking up the odd artefact along the way and generally being nosy.

The Domain, naturally enough, is inhabited by an assortment of zombies,

trolls, ogres, dragons and other dodgy types who make it their business to lurk in dark corners — doing whatever it is mythical monsters do in dark corners. On meeting one or more of the Domain's tenants, you have a number of options; including striking up a friendly conversation, and, very sensibly, getting the hell out of it! For braver souls, you also have the option to pick a fight in order to claim the contents of the room, but I should warn you that some of the occupants have distinctly violent tendencies. Also, you shouldn't be too surprised if the room turns out to be empty after

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- 6502 MACRO ASSEMBLER £5
This program is written in fig-FORTH and is a structured one-pass assembler. It will work on any fig-FORTH implementation with only one alteration. Control structures include: BEGIN, END, AGAIN, IF, THEN, ELSE, ENDF, REPEAT, UNTIL, WHILE.

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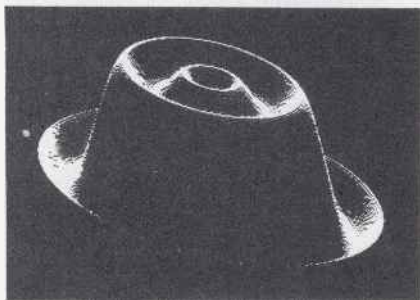
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PROGRAMS

you've gone your ten rounds with a hungry goblin.

Movement through the maze is by use of the N, S, E and W keys to represent the four points of the compass. When you come across some stairs, you can go either up (U) or down (D) (logical enough). It should be noted, however, that things can get distinctly hairy down in the lower regions.

Your chances of coming out of a confrontation with an irate centaur - with the same number of limbs as when you entered the room - depend on the relative strengths of your team and that of your opponent. These strengths are measured in terms of four factors: survival, battle, magic and communication. Initially, you have to choose your team to obtain what you feel to be the optimum combination of these factors. During your journey, the more fights you win, the more monster-types you manage to convert to your noble cause (getting rich quick), and the greater the area of the maze you manage to explore, the greater your party's strength.

Survival is a measure of fighting power. Running out of survival points is not recommended since your life runs out with them. Battle points are a measure of your fighting skills - the more points you have, the less likely your opponents are to see your body as a convenient place to stick their swords. Communication points measure your ability to sweet-talk yourself out of tricky situations ('there, there, nice dragon' - that sort of thing). Magic points measure, well, magic.

Game points are awarded for various reasons: the acquisition of gold,

platinum, jewels, artefacts and killing the Djinn who, incidentally, are neither poor nor defenceless - so don't waste any sympathy on them! The artefacts referred to include such things as Rhombs - handy-sized hyperspace units enabling you to jump from one place to another instantly.

However, they only work on the level you're on.

In dire emergency, you can effect a hasty exit by pressing the panic button. Since this key is noticeably lacking on the TRS-80 keyboard, SHIFTed E has to serve. This does get you out of whatever mess you've got yourself into, but at a price: you lose all your treasure to a hyperspace junkyard. You're also liable to end up just about anywhere and you can't rely on this feature too often.

Before you begin your epic voyage into the unknown, take a bit of time to choose your team carefully. Magicians rate highly on communication and magic, but they don't make particularly good 'minders'; fighters are good in battle but have the IQ of educationally sub-normal carrots. Our referee also recommends staying well clear of the lower levels until you have some strong fighters on your side!

In case all this sounds complicated, it is. It's not the sort of game you can master in ten minutes and wonder what to do next. The menus and input prompts are all quite straightforward, though, so you shouldn't have any problems running it. All in all, an addictive game - I'd certainly like to see more programs of this standard being submitted to PCW Programs. Now you're not going to take a challenge like that lying down, are you?

```

1 RANDOM:GOTO5000
10 E=INKEY$:RT=0:AR="" :FORU=1TOD500:NEXT:CLS:PRINT@60,L1:FORU=0T019:FORV=0T06:S=V
AL(RIGHT$(STR$(N(L,U,V)),2)):PRINT@U*3+V*12B,A(S):NEXTV,U
25 RU=RU-1:FORU=0T0119:RESE(U,0):RESE(U,41):NEXTV:FORV=0T041:RESE(0,V):RESE(
119,V):NEXTV:PRINT@896,CHR$(31):GOSUB200:ET="" :ET=INKEY$:IFET<>" "THEN30ELSEFORU
=1T030:FORV=X1*6+2T0X1*6+3:RESE(V,Y1*6+2):SET(V,Y1*6+2):NEXTV,U
30 PP=0:E=INKEY$:IFE="" "ANDE"="" THEN30ELSESEE=LEFT$(E+ET,1):PRINT@896,CHR$(31):IFE
=" "THEN3ELSEIFE="S" THEN40ELSEIFE="e" THEN160ELSEIFE="e" THEN45ELSEIFE="W" THEN50
ELSEIFE="A" THENPP=1:GOTO100ELSEIFE="U" THEN230ELSEIFE="D" THEN240ELSE30
35 IFY1=0THEN30ELSEIFPOINT(6*X1+2,6*Y1)=0THEN30ELSEIFN(L,X1,Y1-1)=0THENGOSUB70:N
(L,X1,Y1-1)=PQ
36 PRINT@X1*3+(Y1-1)*12B,A(VAL(RIGHT$(STR$(N(L,X1,Y1-1)),2))):IFPOINT(X1*6+2,6*
Y1-1)=0THENBOELSEX2=X1:Y2=Y1:L2=L:Y1=Y1-1:GOTO100
40 IFY1=19THEN30ELSEIFPOINT(X1*6+2,Y1*6+5)=0THEN30ELSEIFN(L,X1,Y1+1)=0THENGOSUB70
:N(L,X1,Y1+1)=PQ
41 PRINT@X1*3+(Y1+1)*12B,A(VAL(RIGHT$(STR$(N(L,X1,Y1+1)),2))):IFPOINT(X1*6+2,Y1
*6+6)=0THENBOELSEX2=X1:Y2=Y1:L2=L:Y1=Y1+1:GOTO100
45 IFX1=19THEN30ELSEIFPOINT(X1*6+5,Y1*6+2)=0THEN30ELSEIFN(L,X1+1,Y1)=0THENGOSUB7
0:N(L,X1+1,Y1)=PQ
46 PRINT@X1+1)*3+Y1*12B,A(VAL(RIGHT$(STR$(N(L,X1+1,Y1)),2))):IFPOINT(X1*6+6,Y1
*6+2)=0THENBOELSEX2=X1:Y2=Y1:L2=L:X1=X1+1:GOTO100
50 IFX1=0THEN30ELSEIFPOINT(X1*6,Y1*6+2)=0THEN30ELSEIFN(L,X1-1,Y1)=0THENGOSUB70:N
(L,X1-1,Y1)=PQ
51 PRINT@X1-1)*3+Y1*12B,A(VAL(RIGHT$(STR$(N(L,X1-1,Y1)),2))):IFPOINT(X1*6-1,Y1
*6+2)=0THENBOELSEX2=X1:Y2=Y1:L2=L:X1=X1-1:GOTO100
70 PQ=11*(RND(2)-1):IFRND(5)=1THENPQ=PQ+5RND(6)ELSEPQ=PQ+RND(5)
71 RETURN
    
```

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PROGRAMS

```

80 PRINT@B96,CHR$(31);:PRINT@B96,"DEAD END";:GOTO25
100 IFVAL(RIGHT$(STR$(N(L,X1,Y1)),2))>1THEN$O0ELSE25
200 MM=0:SX=VAL(RIGHT$(STR$(N(L,X1,Y1)),2)):IFS>11THEN$RETURNELSEIFN(L,X1,Y1)>10
0THENMM=INT(N(L,X1,Y1)/100):GOTO210ELSER=NRD(8):IFR=2ANDL=6THENMM=10ELSEIFR=1
THENMM=1ELSEIFR=2THENMM=2ELSEIFR=3THENMM=3ELSEMM=10
201 N(L,X1,Y1)=N(L,X1,Y1)+MM*100
210 IFMM=10THEN$RETURNELSEIFMM=11THENE="UP"ELSEIFMM=12THENE="DOWN"ELSEIFMM=13THEN
E="UP AND DOWN"
220 PRINT@B96,CHR$(31);:PRINT@B96,"STAIRS ";:E:RETURN
230 IFMK<11ANDMM<13THEN$O0ELSEMA=2:L2=L:X2=X1:Y2=Y1:L=L-1:IFL=0THEN$O0ELSEIFN(L,X1,Y1)=0THEN$OSUB70:N(L,X1,Y1)=PQ:IFPD>11THENRU=1
231 GOTO250
240 IFMK>12ANDMM<13ORL=6THEN$O0ELSEMA=1:L2=L:X2=X1:Y2=Y1:L=L+1:IFN(L,X1,Y1)=0TH
ENGOSUB70:N(L,X1,Y1)=PQ:IFPD>11THENRU=1
250 NA=N(L,X1,Y1):S=VAL(RIGHT$(STR$(NA),2)):IFS>11THEN$O0ELSEIFNA<99THENH(N,L,X1,Y1)
)=NA+100*(10+MA):GOTO10ELSEIFINT(NA/100)=10THENH(N,L,X1,Y1)=NA+MA:GOTO10ELSEN(L,X1,Y1)=1300+S:GOTO10
300 BRZ=0:TZ=INT(N(L,X1,Y1)/100):IFTZ=10ORRD(2)=2THENPRINT@B96,CHR$(31);:PRINT@
B96,"AN EMPTY ROOM";:N(L,X1,Y1)=N(L,X1,Y1)+1000*(1-TZ/10):GOTO25ELSER=NRD(15+L)
:IFRN=15THEN$GOTO6000
305 RA=NRD(10):TW=VAL(MID$(B(RA),9,1)):IFTW>LTHEN$O0ELSENEM=(L-TW+1)*NRD(3):IFNM=
OORNM>9THEN$O0ELSEEZ="":FORU=1TOB:E=MID$(B(RA),U,1):IFE<>"":THENEZ=E+*E:NEXTU
306 FORU=1TONM:FORV=1TO4:VL=VAL(MID$(B(RA),9+V,1)):Z(U,V)=NRD(2*(L-1)*VL)+2*(L-1)
)*(NRD(9)-1)*VL*(VL+1):NEXTV,U:SS=0:FORU=1TONM:SS=SS+Z(U,1):NEXTU
309 FORO=1TOR:FORO1=1TO4:H(O,O1)=0:NEXTO1,Q:GOSUB8000:GOSUB11000
330 MR=0:SR=0:FORU=1TONM:MR=MR+Z(U,3):SR=SR+Z(U,2):NEXTU:GOTO400
400 PRINT:PRINT"MAGIC ADJUSTMENTS":PRINT"YOUR PARTY LOSES A TOTAL OF"MR" MAGIC F
ACTORS":MS=INT(MR/R):FORU=1TOR:H(U,3)=G(U,3)-MS:NEXTU
401 FORU=1TOR:FORHJ=1TO4:IFHJ=3THEN$NEXTHJELSEH(U,HJ)=G(U,HJ)+H(U,HJ):NEXTHJ,U:GO
TO440
405 FORU=1TOR:IFH(U,3)<1THEN$GOTO430ELSEPRINT:PRINTC(U);:("";H(U,3));:FORV=1TO
R:PRINT"DO YOU WANT TO GIVE";C(V);" ANY FACTORS"(Y/N)";:GOSUB10000:IFE<>"Y"THEN
430
410 J=0:IFH(U,3)=0THEN$O0ELSEINPUT"S";:J:IFJ<0ORJ>H(U,3):GOSUB10ELSEH(V,1)=H(V,1)+
J:H(U,3)=H(U,3)-J+G(U,3)=G(U,3)-J:G(V,1)=G(V,1)+J
412 J=0:IFH(U,3)=0THEN$O0ELSEINPUT"B";:J:IFJ<0ORJ>H(U,3):GOSUB12ELSEH(V,2)=H(V,2)+
J:H(U,3)=H(U,3)-J
414 J=0:IFH(U,3)=0THEN$O0ELSEINPUT"C";:J:IFJ<0ORJ>H(U,3):GOSUB14ELSEH(V,4)=H(V,4)+
J:H(U,3)=H(U,3)-J
430 IFH(U,3)>0THEN$NEXTU,UELSE$NEXTU
440 IFPP=1THEN$O0ELSEFORNM=1TO699:NEXTNN:CLS:PRINTTAB(18)"YOUR OPTIONS:--":PRINT:P
RINT"1) ATTACK":PRINT"2) COMMUNICATE":PRINT"3) RUN":PRINT"4) USE AN ARTIFACT":PR
INT"5) REVIEW TROOPS":PRINT"6) SHARE MAGIC":PRINT"7) LOOK":PRINT:PRINT"WHICH?";
450 UD=NM:NM=7:GOSUB9000:J=UM:NM=UD:IFJ=7THEN$GOSUB11000:GOTO40ELSEJ=NRD(8000,60
0,700,1000,7000,405
460 IFZ(1,4)=0THEN$PRINT"COMMUNICATION IMPOSSIBLE":GOTO40ELSEFC=0:FORU=1TOR:FC=FC
+H(U,4):NEXTU:FD=0:FORU=1TONM:FD=FD+Z(U,4):NEXTU:IFNM>RDR2+R0<RNMTHENPRINT"TH
EY ATTACK":GOTO800ELSEIFFD+NRD(6)>FCTHENPRINT"THEY ATTACK":GOTO800
610 PRINT"THE ";EZ;:IFNM>1THENPRINT"S";
620 PRINT" WILL JOIN YOUR PARTY":FORU=1TONM:FORV=1TO4:G(R+U,V)=Z(U,V):NEXTV:G(R+
U,0)=RA+3:C(R+U)=E+STR$(U):NEXTU:R=R+NM:GOTO900
700 IFRU=0THENPRINT"RUNNING IS IMPOSSIBLE":GOTO40ELSEX1=X2:Y1=Y2:L=L2:GOTO10
800 WF=0:FORU=1TOR:P(U)=0:NEXTU:IFR=1THEN$O0ELSEPRINT"HOW MANY WILL FIGHT?":UD=NM
M:NM=R:GOSUB9000:UN=UM:NM=UD:IFUN=RTHEN$O0ELSEPRINT"NAME(S)":FORU=1TONM
805 INPUT:FORU=1TOR:IFC(V)=E+THEM(V)=1:NEXTU$ELSEXTV:PRINT"WHO";:GOTO805
808 CLS:FORU=1TONM:IFZ(U,1)<1THEN$NEXTU$ELSEPRINT#4*U,U;:NEXTU
810 FORU=1TOR:IFP(U)=0THEN$NEXTU:GOTO830ELSEU=0:FORV=1TO200-12*L:NEXTV:PRINT#640
,CHR$(31);:PRINT#640,C(U);" WHICH DO YOU ATTACK?";:GOSUB9000:HF=H(U,2)+NRD(4*INT
(L/2))-3*L:IFHF<Z(U,2)THENPRINT"MISS":NEXTU:GOTO830
811 PRINT" HIT":PL=L*(HF-Z(U,2)):PM=Z(PL-(PL-14))*SGN(INT(PL/14)):UY=NRD(PM-(PM-
32760))*SGN(INT(PM/32760)):Z(U,1)=Z(U,1)+PM:UY=IFZ(U,1)>0THEN$NEXTU:GOTO830ELSE
PRINT"DEAD":PRINT#4*U*U,"":IFEZ="DJINN"THENNDJ=1ELSEIFEZ="GIANT"THENFORWC=1TONM:
Z(WG,3)=0:NEXTW
820 FORU=1TO200:NEXTW:FORV=1TONM:IFZ(V,1)>0THEN$NEXTU$ELSEXTV:CLS:PRINT"YOU WIN"
:FORU=1TO4:SR=0:FORV=1TONM:SR=SR+Z(U,V):NEXTV:SR=SR/Z(L+1):R:FORV=1TOR:G(V,U)=G
(V,U)+SR*Z(L+1)*ABS(U-2ANDG(V,0)=1ORU=3ANDG(V,0)=2):NEXTU,U:GOTO900
830 FORU=1TONM
832 IFZ(U,1)<0THEN$NEXTU:GOTO840ELSER=NRD(R):IFP(RH)=0THEN$O0ELSEFORO=1TO200-(L
+NM)*S:NEXTO:PRINT#640,CHR$(31);:PRINT#640,EZ;:ATTACKS";:C(RH):HF=Z(U,2)+NRD(9
+4*INT(L/2)):IFHF<H(RH,2)THENPRINT"MISS":NEXTU:GOTO840ELSEPRINT" HIT":UY=2*NRD(HF
-H(RH,2))
834 H(RH,1)=H(RH,1)-UY:G(RH,1)=G(RH,1)-UY:IFH(RH,1)<1THENPRINTC(RH);" IS DEAD":G
OSUB4100ELSEPRINTC(RH);" HAS" H(RH,1)" S-FACTORS LEFT"
836 IFR>0THEN$O0ELSECLS:PRINT"YOUR TEAM IS ALL DEAD":PRINT:PRINT:PRINT"THE DJINN
HAS BEATEN YOU":PRINT:INPUT"DO YOU WANT ANOTHER GO (Y/N)";:E:IFE="N"THEN$ENDELSER
UN
838 FORU=1TOR:P(U)=1:NEXTU:GOTO808
840 FORU=1TO500-25*L:NEXTU:IFRU=0THEN$O0ELSEPRINT"DO YOU WANT TO RUN?":GOSUB1000
0:IFE="Y"THEN$O0ELSEIFU>NMTHEN$O0ELSE$NEXTU:GOTO808
900 SS=SS/Z(L+1):R:FORU=1TOR:G(U,1)=G(U,1)+SS:NEXTU:FORU=1TO500-20*L:NEXT:PRINT
:PRINT"TREASURE":PR:PRINT:TA=NRD(INT(L/2)+1):TY=NRD(15):IFTY<6THENPRINT"THE SACK
S ARE EMPTY":GOTO950ELSEIFTY=6THENAT="JEWELS"ELSEIFTY<13THENAT="GOLD"ELSEAT="PLA
TINUM"
910 PRINT"THE SACKS CONTAIN"AT;" UNIT";:IFTA>1THENPRINT"S";
920 PRINT" OF "AT:IFAR<>"":THENPRINT"YOU MAY ALSO TAKE THE "AR
930 PRINT:PRINT" WILL YOU TAKE ANYTHING?":GOSUB10000:IFE="N"THEN$O0ELSEGOSUB4500:
FORU=1TOR:PRINT:PRINTC(U);" HOW MUCH ";AT;"?";
940 GOSUB9100:IFTT=0THEN$NEXTU:GOTO944ELSEFORV=1TOT:TA=TA-1:IFTA<0THEN$O0ELSEIFA
T="JEWELS"THENCA(U)=CA(U)+CHR$(30):WB(U)=WB(U)+1
941 IFAT="GOLD"THENCA(U)=CA(U)+CHR$(28):WB(U)=WB(U)+1ELSEIFAT="PLATINUM"THENCA(U)
)=CA(U)+CHR$(29):WB(U)=WB(U)+1
942 IFAT<0THEN$944ELSEPRINTC(U)
944 PRINT:FORU=1TOR:MS=0:MP=0:MJ=0:IFWB(U)=1+INT(G(U,1)/3)THEN$944ELSEPRINTC(U)
;" IS OVERLOADED":FORV=1TOLEN(CA(U)):TH=ASC(MID$(CA(U),V,1)):IFTH=28THENMS=MS+1E
LSEIFTH=29THENMP=MP+1ELSEIFTH=30THENMJ=MJ+1
945 NEXTV:PRINTMS;"GOLD";:MP;"PLATINUM";:MJ;"JEWELS":PRINT"LOSE WHAT?(G/P/J)":G
OSUB9200:EL=E="":FORV=1TOLEN(CA(U)):WG=ASC(MID$(CA(U),V,1)):IFWG=28ANDH="G"O
RWG=29ANDH="P"ORWG=30ANDH="E"THEN$946ELSEXTV:PRINT"YOU HAVE NONE":GOTO944

```

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
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PROGRAMS

```

4)=0:FORU=1TOR:IFRND(18)>=3+LTHENNEXTUELSEST(U)=1:NEXTU
6062 CLS:FORU=1TOR:IFST(U)=0THENNEXTU:RETURNELSEPRINT"THE FOLLOWING ARE PETRIFIED
D":FORU=1TOR:IFST(U)=0THENNEXTU:PRINTC(U):NEXTU
6064 FORU=1TOR:FORV=1TOLEN(CA(U)):IFASC(MID$(CA(U),V,1))>13THENNEXTV,U:PRINT"YO
U ARE NOT CARRYING A CURE POTION,SO THEY ARE DEAD":FORU=1TO1900:NEXT:FORRH=1TOR
:IFST(RH)>1THENNEXTRH:RETURNELSESEGDSUB4100:NEXTRH
6066 INPUT"WHO WILL YOU SAVE WITH YOUR CURE POTION":AS:FORRH=1TOR:IFST(RH)=1ANDC
(RH)>ASTHENGOSSUB4100
6068 NEXTRH:FORU=1TOR:ST(U)=0:NEXTU:RETURN
6080 IFL<3ANDMJ=0THEN6000ELSEZ="GIANT":NM=RND((L+1)/2):FORU=1TONM:Z(U,1)=RND(2(
L-1)*30):Z(U,2)=RND(2((L-1)*30)):Z(U,3)=9999:Z(U,4)=0:NEXTU:RETURN
7000 CLS:PRINT"NAME":TAB(10)"S":TAB(20)"B":TAB(30)"M":TAB(40)"C":TAB(50)"TYPE":P
RINT:FORU=1TOR:PRINTC(U):FORV=1TO4:PRINTTAB(10*V)H(U,V):NEXTV:PRINTTAB(50)D(G
U,0):NEXTU:PRINT"PRESS ANY KEY TO CONTINUE"
7010 E=INKEY$:IFE=" "THEN7010ELSE440
8000 FORRH=1TOR:IFG(RH,1)<1THENGOSSUB4100
8100 NEXTRH:IFR=0THENRETURNELSECLS:GOTO836
9000 EY=INKEY$:IFEY=" "THEN9000ELSEIFASC(EY)<49ORASC(EY)>48+NMTHEN9000ELSEPRINT:U
M=VAL(EY):RETURN
9100 EY=INKEY$:IFEY=" "THEN9100ELSEIFASC(EY)<48ORASC(EY)>48+TATHEN9100ELSESET=VAL(
EY):RETURN
9200 EY=INKEY$:IFEY="DREY<>"B"ANDEY<>"P"ANDEY<>"J"THEN9200ELSEEY=RETURN
9300 EY=INKEY$:IFEY="DREY<>"B"ANDEY<>"D"THEN9300ELSEEY=RETURN
10000 ES=INKEY$:IFES="DRES<>"Y"ANDES<>"N"THEN10000ELSEEY=ES:RETURN
11000 CLS:PRINT"THE ROOM CONTAINS"NM;" ";E;
11010 IFNM>1THENPRINT"S";
11020 IFAR<>" "THENPRINT",A ";AR;
11030 PRINT" AND SOME SACKS":RETURN
    
```

BBC Cross-hair Cursor

by David Ingram

BBC graphics enthusiasts should find the following procedures a useful, if simple, addition to their library of subroutines. Both routines use a joystick to move a cross-hair cursor and will work with either BBC machine.

The first listing moves the cursor around the screen without adding anything to the display, while the second

allows the user to 'mark' points on the screen using the joystick button which the program then joins with a straight line.

Although intended for use with joysticks, the routines should be fairly straightforward to adapt for keyboard use.

```

1 REM CROSS-HAIR CURSOR (A)
10 MODE 1:GCOL 3,1
20 X=-20:Y=-20
30 PROCcursor
40 GOTO 30
6000 DEF PROCcursor
6010 LOCAL X1,Y1,F
6020 X1=(4095-ADVAL(1)/16)*(1279/4095)
6030 Y1=(ADVAL(2)/16)*(1023/4095)
6040 IF ABS(X-X1)<5 AND ABS(Y-Y1)<5 THEN ENDPROC
6050 FOR P=1 TO 2
6060 MOVE X-20,Y: PLOT 1,10,0
6070 MOVE X,Y-20: PLOT 1,0,10
6080 MOVE X+10,Y: PLOT 1,10,0
6090 MOVE X,Y+10: PLOT 1,0,10
6100 X=X1:Y=Y1
6110 NEXT P
6120 ENDPROC
    
```

```

1 REM CROSS-HAIR CURSOR (B)
10 MODE 1:GCOL 3,1
20 X=-20:Y=-20:CURFLAG=0
30 PROCcursor
40 IF (ADVAL0 AND 1)=1 AND CURFLAG=0 MOVE XN,YN: X2=XN: Y2=YN: CURFLAG=1
50 IF (ADVAL0 AND 1)=1 MOVE X2,Y2: DRAW XN,YN: X2=XN: Y2=YN
60 GOTO 30
6000 DEF PROCcursor
6010 LOCAL P
6020 XN=(4095-ADVAL1/16)*(1279/4095)
6030 YN=(ADVAL2/16)*(1023/4095)
6040 IF ABS(X-XN)<5 AND ABS(Y-YN)<5 THEN ENDPROC
6050 FOR P=1 TO 2
6060 MOVE X-20,Y: PLOT 1,10,0
6070 MOVE X,Y-20: PLOT 1,0,10
6080 MOVE X+10,Y: PLOT 1,10,0
6090 MOVE X,Y+10: PLOT 1,0,10
6100 X=XN:Y=YN
6110 NEXT P
6120 ENDPROC
    
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PROGRAMS

```

WRITELN(PTEXT, 'WRITELN:');
UNDERLINE:= '_____';
WRITELN(PTEXT, 'WRITE(' ,INVC, UNDERLINE, INVC, ');');
IF EIGHTY THEN WRITELN(PTEXT, 'WRITE(' ,INVC, UNDERLINE, INVC, ');');
END;

PROCEDURE SECOND;
BEGIN
WRITE(' NUMBER OF MENU CHOICES? ');
(* ALLOWS 1..9 CHOICES. IF MORE
DESIRED PATCH INPUT TO USE
READLN AND USE NUMERIC VARIABLE
INSTEAD OF CHARACTER. WITHOUT
ELABORATE ERROR CHECKING THIS
IS EASIER FOR USERS TO CRASH,
HOWEVER *)
READLN(CHOICES);
IF CHOICES>5 THEN GAP:=1 ELSE GAP:=2;
(* THIS LINE DOUBLE-SPACES
SMALL MENUS *)
WRITELN('ENTER THE TEXT YOU REQUIRE FOR');
WRITELN('EACH MENU CHOICE. ');
WRITELN;
(* NOW GET THE SCREEN TEXT FOR
EACH OPTION AND THE PROCEDURE
IN THE USER PROGRAM THAT WILL BE
CALLED IF THAT OPTION IS PRESSED *)
FOR X:=1 TO CHOICES DO BEGIN
WRITE(' CHOICE ' ,X, ' ->');
READLN(MENOPT(X));
WRITE(' PROCEDURE TO CALL FOR THIS CHOICE->');
READLN(PROCLIST(X))
END;

FOR X:=1 TO CHOICES DO BEGIN
MENOPT(X):=CONCAT('> ' ,MENOPT(X), INVC, ');');
WRITELN(PTEXT, 'GOTOXY(' ,LEFTMARGIN, ' ,',GAP*X+4, ');WRITELN(' ,X, MENOPT(X));
END;
END;

PROCEDURE THIRD;
(* COMPLETE THE FILE CREATION *)

BEGIN
WRITELN
(PTEXT, 'GOTOXY(' ,LEFTMARGIN, ', 22);WRITE(' ,INVC, 'PRESS SELECTION :');');
WRITELN(PTEXT, 'REPEAT');
WRITELN(PTEXT, 'READ(KEYBOARD, RESPONSE);');
WRITELN
(PTEXT, 'IF NOT ( RESPONSE IN {' ,1, ', INVC, ' ,..', INVC, CHOICES, INVC, '}) ');
WRITELN(PTEXT, 'THEN WRITE(CHR(7));');
WRITELN(PTEXT, 'UNTIL RESPONSE IN {' ,1, ', INVC, ' ,..', INVC, CHOICES, INVC, '});');
WRITELN(PTEXT, 'COUNT:=ORD(RESPONSE)-48;');
WRITELN(PTEXT, 'WRITELN;');
WRITELN(PTEXT, 'CASE COUNT OF');
FOR X:=1 TO CHOICES DO
WRITELN(PTEXT, ' ' ,X, ': ' ,PROCLIST(X), ');');
WRITELN(PTEXT, 'END;');
WRITELN(PTEXT, 'END;');
WRITELN(PTEXT, 'END;');
WRITELN(' MENU TEXT FILE CREATED');
CLOSE(PTEXT, LOCK);

END;

PROCEDURE TESTBED;
(* CREATE A DUMMY PROGRAM ON
THE BOOT DISK USING THE
MENU PROCEDURE AS AN INCLUDE
FILE. MUST BE COMPILED
AND THEN EXECUTED *)

BEGIN
REWRITE(PTEXT, 'TESTBED.TEXT');
WRITELN(PTEXT, 'PROGRAM TESTBED;');
WRITELN(PTEXT);
FOR X:=1 TO CHOICES DO
BEGIN
WRITELN(PTEXT);
WRITELN(PTEXT, 'PROCEDURE ' ,PROCLIST(X), ');');
WRITELN(PTEXT, 'BEGIN');
WRITELN(PTEXT, 'GOTOXY(' ,LEFTMARGIN+1, ' ,',GAP*X+4, ');');
WRITELN(PTEXT, 'END;');
END;
WRITELN(PTEXT, '(*$I', OUTFILENAME, '*');');
WRITELN(PTEXT, 'BEGIN');
WRITELN(PTEXT, 'PROCNAME');
WRITELN(PTEXT, 'END. ');
CLOSE(PTEXT, LOCK);
WRITELN; WRITELN;
WRITELN(' TO SEE THE MENU C(OMPILe TESTBED');
WRITELN(' TO TESTBED AND THEN X(ECUTE IT. ');
END;

BEGIN

```

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PROGRAMS

```

• FIRST;
• SECOND;
• THIRD;
• PAGE(OUTPUT);
• WRITE(' DO YOU WANT A TEST PROGRAM FOR THIS MENU? ');
• READ(KEYBOARD,CH);
• IF CH IN ['Y','y'] THEN TESTBED;
• WRITELN;
• WRITELN('FINISHED. ');
• END.
    
```

Oric 1 Word Scrambler Conversion

by Ian Collins

You may remember the TRS-80 Word Scrambler program published in the April issue (pp 229-230). Ian Collins has written in to say that only two lines need to be modified in order for the program

to run on an Oric. These are:-
10 CLS: CLEAR: DIM P\$(999): M=1:
N=1
200 R=INT(RND(1)*L+1)

BBC Quadsolve

by I Kingston

'Quadsolve' is a neat and straightforward program for solving quadratic equations.

The user enters the values of a, b and c in the equation $ax^2+bx+c=0$. The program attempts to solve the problem first, by factorising, and then — if this is not possible — by using the quadratics formula. Since each line of the working is displayed along with the final solution, the program makes a useful teaching aid as well as being ideal for doing your maths homework!

When entering the program, note that the ASCII character 'i' should be entered as '[' when typing in the listing: the lines to watch out for are 420, 540, 630, 770

and 820. Line 40 selects green as the text colour. Unless you have a monitor (as opposed to a tv set), this can look distinctly nauseating, so you may like to experiment with other colours (like white, perhaps?).

User-defined characters are used to provide the correct mathematical notation for square, square root, divided by, plus-or-minus and factorises to. For this reason, mode 6 is used rather than the usual mode 7 since the latter has no facility for non-standard characters.

The program requires a model B and was tested under the 1.2 OS.

```

10 REM"QUADSOLVE"
20 REM By Ian Kingston, Dec 1982.
30 MODE6
40 VDU19,1,2,0,0,0
50 VDU23,240,96,144,16,96,128,240,0,0
60 VDU23,241,16,8,252,0,252,8,16,0
70 VDU23,242,0,16,0,254,0,16,0,0
80 VDU23,243,16,16,124,16,16,0,124,0
90 VDU23,244,7,4,8,8,8,144,80,32
100 PRINT"TAB(15):"QUADSOLVE"
110 PRINT"This program will solve any quadratic equation entered in the form"
120 PRINTTAB(12);"ax";CHR$(240);"+bx+c=0""where a is the coefficient of x";CHR$(240);"
130 PRINTTAB(6);"b is the coefficient of x";TAB(2);"and c is a numerical constant."
140 PRINT"wherever possible the roots will be derived by factorising the equation."
150 PRINT"if this is impossible then the formula""x=-b";CHR$(243);CHR$(244);"b";CHR$(240);"
-4ac)"" will be used"
160 PRINTTAB(2);"-----"
170 PRINTTAB(7);"2a"
180 PRINT"TAB(5);"Press SHIFT KEY to continue"
190 REPEATUNTILINKEY(-1)
200 VDU12
210 PRINT"Coefficient of x";CHR$(240);:INPUTAX
220 INPUT"Coefficient of x";B%
230 INPUT"Value of constant";C%
240 PRINT
250 IFAX=0 THENVDU7:PRINT"Not a quadratic"";GOTO210
260 IFB%<=0 ANDC%<=0 THENVDU7:PRINT"Clever...0=0!!";GOTO210
270 PROCdisc%
280 PRINT"The equation you entered is:"
290 Q$=""
300 IF%>1 THENQ$=STR$(%)+(" "
310 IFSGN(AZ)=-1 THENQ$=Q$+"-"
320 IFABS(AZ)>1 THENQ$=Q$+STR$(ABS(AZ))
330 IF AZ THENQ$=Q$+"x"+CHR$(240)
340 IFB% THENQ$=Q$+CHR$(43-2*(SGN(BZ)=-1))
    
```



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PROGRAMS

```

350 IFABS(B%) > 1 THENQ=Q#+STR*(ABS(B%))
360 IFB% THENQ=Q#+X
370 IFC% THENQ=Q#+CHR*(43-2*(SGN(C%)-1))+STR*(ABS(C%))
380 IFF% > 1 THENQ=Q#+I
390 Q=Q#+0
400 PRINTTAB(22-LEN(Q));Q
410 IFF% > 1 THENQ=MID$(Q,3,LEN(Q)-5)+RIGHT$(Q,2)
420 IFF% > 1 THENPRINTCHR*(241);TAB(22-LEN(Q));Q;TAB(25);";";CHR*(242);" by ";F
430 CLEAR
440 Z=0
450 IFC% THENPROCfactorise ELSEK%=1:L%=0:M%=A%:N%=B%:Z=2
460 DNZ=1:BOT0800,470,700
470 Q="("
480 IFSN(K%)=-1 THENQ=Q#+ "-"
490 IFABS(K%) > 1 THENQ=Q#+STR*(K%)
500 Q=Q#+CHR*(43-2*(SGN(L%)-1))+STR*(ABS(L%))+") ("
510 IFSN(M%)=-1 THENQ=Q#+ "-"
520 IFABS(M%) > 1 THENQ=Q#+STR*(ABS(M%))
530 Q=Q#+CHR*(43-2*(SGN(N%)-1))+STR*(ABS(N%))+")"
540 PRINTCHR*(241);TAB(22-LEN(Q));Q;TAB(25);";";factorise
550 IFSN(K%)=-1 THENQ=""-ELSEQ="";IFABS(K%) > 1 THENQ=Q#+STR*(ABS(K%))
560 Q=Q#+CHR*(43-2*(SGN(L%)-1))+STR*(ABS(L%))+")"
570 IFSN(M%)=-1 THENQ=""-
580 IFABS(M%) > 1 THENQ=Q#+STR*(ABS(M%))
590 A=A#+CHR*(43-2*(SGN(N%)-1))+STR*(ABS(N%))+")"
600 PRINTCHR*(241);TAB(22-LEN(Q)+A);Q;TAB(25);";";A
610 Q="x"+STR*(LEN(Q)/SGN(K%))+")"
620 A="x"+STR*(LEN(Q)/SGN(M%))
630 PRINTCHR*(241);TAB(22-LEN(A)+Q);Q;TAB(22-LEN(A));A;TAB(25);";";solved
640 K%=ABS(K%);M%=ABS(M%)
650 IFC% > 1 THENPRINTTAB(22-LEN(A)-5);"-";
660 IFM% > 1 THENPRINTTAB(21);"-";
    
```

Newbrain GENIN

by S E H Fellowes

GENIN is an acronym for 'general input' routine and is intended to be used as a sub-routine in programs where a significant amount of input is required. The routine is designed to be completely crashproof (I said 'designed to be' — there are no prizes), rejecting invalid input while allowing the use of insert, delete and left and right cursor movement.

The routine checks that string length is less than or equal to the value of 1, and that each character within the string is within the ASCII range defined by i\$; these values to be set by the programmer earlier in the program. To accept only four letter

words, for example, 1 should be set to 4 and i\$ set to 'az'. In the listing given below, a sample calling routine is given in lines 10 and 20.

A carriage return returns the string without trailing spaces and CONTROL/CR pads the string with spaces to the string length set by 1. The input is returned as in\$. If you are dealing in numeric input, then add one further line: 925 in=val(in\$).

To date, this is the one and only Newbrain program I've received: Newbrain programmers, where are you? Haven't you noticed our new rates?

```

10 PUT31:PRINT"name [      ]"
20 l=8:i$=" z":PUT22,7,0:GOSUB500:PRINT:PRINTin$:END
500 REM ** genin **
510 IFLEN(i1$) < 2 THENPRINT"no i1$":RETURN
520 OPEN#5,5:PUT21:GET#1,y1:f1=0:f2=0:in$=""
530 l1=0:PUT6:l0=ASC(LEFT$(i1$,1)):hi=ASC(RIGHT$(i1$,1)):IFl0>hi THENRETURN
540 GET#5,s$:IFs$="" THEN540
550 s=ASC(s$)
560 IFS=13 THEN900
570 IFS=3 THENf2=1:GOTO900
580 IFS=8 THENf1=0:GOTO690
590 IFS=26 THENf1=0:GOTO670
600 IFS=17 THENf1=1:GOTO540
610 IFS=24 THEN800
620 IFS<32 THEN540
630 IFS<l0 ORs>hi THEN540
635 IFF1=1 THENGOSUB730:GOTO540
640 PRINTs$:l1=l1+1:IFl1=1 THENl1=11-1:PUT8
650 GOTO540
660 REM ** right cursor **
670 IFl1=1-D THEN540
680 GOTO640
690 REM ** left cursor **
700 IFl1=0 THEN540
710 l1=11-1:PUT8:GOTO540
    
```

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PROGRAMS

- 720 REM ** insert **
- 730 PUT7:FORs=x1+1-2TOx1+11STEP-1:PUT22,s,y1,20:GETch
- 740 PUT22,s+1,y1,ch:NEXTs:PUT22,s+1,y1,s:PUT8,6
- 750 RETURN
- 800 PUT7:IF11=0THEN850
- 810 fi=x1+1-1:FORs=x1+11TOfi:PUT22,s,y1,20:GETch
- 820 PUT22,s-1,y1,ch:NEXTs:11=11-1
- 830 PUT22,fi,y1,32:PUT22,x1+11,y1,6:GOTO540
- 850 FOR s=x1TOx1+1-2:PUT22,s+1,y1,20:GETch
- 860 PUT22,s,y1,ch:NEXTs:PUT22,x1+1-1,y1,32:
- 870 PUT22,x1,y1,6:GOTO540
- 900 PUT7:FORs=0TO1-1:PUT22,x1+s,y1,20:GETch:
in\$=in\$+CHR\$(ch):NEXTs
- 910 IFF2=1THEN930
- 920 IFRIGHT\$(in\$,1)=CHR\$(32)THEN1=1-1:in\$=LEFT\$(in\$,1):
GOTO920
- 930 CLOSE#5:RETURN

DISKOGRAPHY A BRIEF GUIDE TO FLOPPY DISKS

continued from page 162

purchasing. This is the number of tracks on the disk, ie, the number of concentric rings on the disk on which data may be recorded. On eight inch disks there are always 77 tracks but for five and a quarter inch disks, there is a choice of 35, 40 or 80 tracks. Both 35 and 40 track disks are recorded at 48 tracks per inch ("TPI") but 35 track recording uses less of the disk surface to write to

than 40 track recording. Therefore, a 40 track disk can be used on a 35 track drive but not the other way round. 80 track disks are recorded at 98 TPI (half the distance between tracks) and, although 80 track disks are sold, I have never had any problems reformatting double-density 40 track disks for use on an 80 track drive. Of course, 80 track disks can be reformatted as 40 track or 35 track disks if required.

That completes this summary of the physical differences between the various floppy disks on the market. Of course, data can be written to disks, even physically identical disks, in many different formats but that is another story. **END**

EPSON QX-10

continued from page 172

that all the important Basic commands are available at a single stroke. To display characters in a particular font, you'd use the command PRINT " with the machine's normal font and then select the new font by pressing the SF keys in the appropriate combination. You then type the words in the selected font, and go back to the standard font for the rest of the program line. SAVEing the program, LOADing it again and LISTing it reveals that the fancy font parts are always retained in their proper format — when you LKIST the program, there they are, in their special fonts, just as you typed them in.

Provided you have the correct type of Epson printer, you can also produce

these fonts on paper — see the listing and printout in Checkout. This is done automatically from MFBasic using the printer's bit image graphics facility and very nice it looks, too. It's certainly a fun way to liven up otherwise boring documents like invoices and grovelling letters to the bank manager.

MFBasic also provides good graphics capabilities to take advantage of the machine's excellent 640 x 400 display. A perusal of the demonstration program listing revealed that it is all easy and straightforward and programmers should have no difficulty in producing some very impressive business graphics packages with this Basic.

The benchmark timings show MF Basic

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to be respectably quick, putting the machine well into the upper third of our rankings table (see *PCW* November 1982).

Expansion and potential

The five expansion slots inside the machine indicate that a variety of interesting extras should be on their way and indeed they will be here shortly, most of them. These will include an IEEE-488 interface, an extra RS232 board, joysticks, a light pen, an acoustic coupler and a prototyping board. Local area networking capabilities will be catered for with an Omnet interface while for high-speed communications a fibre optic interface will also be available. At the time of writing, availability dates and prices had not been fixed by Epson (UK) for any of these.

The extra memory expansion will take the form of chips to plug into the spare sockets; it is expected that many customers will buy the machine already configured with the full 256k RAM but that dealers will be able to upgrade 192k machines for about £50 or so.

A colour display system, with the same 640 x 400 resolution as the monochrome display, is currently being evaluated by Epson (UK) and sounds very nice indeed. Again, availability and pricing had not been decided by the time this went to press and Epson was uncertain whether it would be offered as an upgrade to existing machines or in the form of a colour QX-10.

My single criticism of the machine concerns its disk capacity, although maybe, as a Sirius owner, I am a little spoilt in this respect. In any case, a hard disk option is a probability but there are no further details on this at the moment.

Documentation

The review machine came with a thick, just-smaller-than-A4, spiral bound QX-10 *Operations Manual*. This is properly typeset and well laid out, with an index, and covers a wide range of topics about the machine, from how to set it up and switch it on to handling disks carefully, through the intricacies of the fonts system to full details of all the CP/M system calls, both standard and extra. Full details are given of all the machine's features and a section contains careful instructions on using all the CP/M

utility programs, with plenty of screen pictures to show you what should happen. The manual is clearly and concisely written in flawless American English with none of the hilarious mistranslations which livened up some earlier examples of Japanese documentation. As mentioned earlier, I was not supplied with the MFBasic manual but I would confidently expect it to be to the same standard. The manual should be very useful for both the computer-naive business person and the experienced programmer looking for solid technical details.

Applications

The basic machine comes with no applications software at all. Epson (UK) has, however, done a deal with Peachtree so that all that company's accountancy and office productivity software, including the Peachtext (*nee* Magic Wand) word processor, a much nicer thing than the universal WordStar as far as I am concerned. Epson is also making Personal Pearl available and other third-party vendors are being encouraged to put their software onto the QX-10; certainly Caxton has made Cardbox available on the machine, and no doubt we'll be hearing of others joining in pretty quickly.

An American company has produced a system called Valdox based on the QX-10. I've heard wonderful things about this package: it's supposed to be a complete business system not unsimilar in some ways to Apple's Lisa software and includes what has been described to me as a very good word processor. But it won't run on a standard QX-10 as it requires considerably modified hardware and, although there is what Epson describes as a 'very good chance' that it will be sold here some day, this depends very much on pricing and whether or not the Valdox system is fully debugged — apparently it isn't yet.

Conclusions

This is the best 8-bit CP/M computer I've yet seen. It is beautifully and robustly made: a lot of careful thought has gone into the design of the system, in terms of the facilities put into it and into the production engineering aspect. It is intended as a serious business computer and has all the facilities built in to fulfil this role perfectly — within the constraints of CP/M, of course. The ergonomics are excellent (apart from the lack of screen tilting) and the keyboard is a joy to use.

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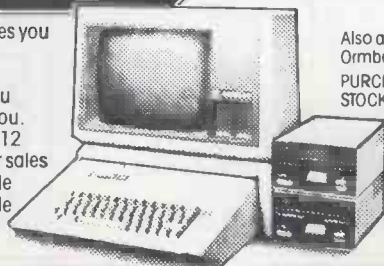
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the market, it may at first seem rather expensive. But of course the price does include a good-quality display and there are all those lovely frills. Epson has proved beyond all doubt that, just because there are lots of 16-bit microcomputers around, we shouldn't write off the 8-bit CP/M-80 machine as a dodo. Far from it: there's still a lot which can be done to make this type of machine a valuable and versatile business tool.

The time is fast approaching when I will have to buy a second 'grown-up' computer to supplement my Sirius. I had more or less resigned myself to buying an IBM on the grounds that, overpriced

though it undoubtedly is, the vast flood of software about to hit us from the States would make it more or less compulsory for someone in my line of work. Having now seen the QX-10, I have changed my mind. The Americans can damn well adapt their 16-bit software to the Sirius if they want it evaluated!

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MF card, MFBasic and manuals:

£1735.00 excl VAT

65k memory upgrade: £50 (estimated)

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OSBORNE EXECUTIVE

continued from page 179

Most users of the Osborne 1 queue up for a neat little patch to WordStar, which stops that program pretending that it is sending display characters down a serial line to a dumb terminal, and makes it print them direct on the screen.

WordStar normally sends cursor address signals to the screen handling routines of the Console Command Processor in CP/M, which then moves the cursor, then comes back for the character, then asks for the cursor position, and so on. Cut that out, and the result is that Osborne 1 WordStar is one of the quickest text editors you ever saw, because it can update a screen faster than you can see.

It also gave its users the option of a 128 column display (only 52 visible at any one time. If and when you produced a document that was over 79 columns wide, you could see it exactly as it would print out, whereas normal WordStar users would have to put up with lines that took two lines on screen).

For this version of WordStar, MicroPro spotted that this was daft, and produced a system of horizontal scrolling *exactly like the Osborne horizontal scroll* so that, as you typed across the screen, the whole screen moved to the left.

But it did this with cursor addressing, You can go mad, watching a horizontal scroll; but you can go mad in spades watching it happen, line by line, with cursor addressing.

If horizontal scrolling is bad, why use WordStar's latest version? And if it's good, why throw it away?

CP/M plus

Most changes from ordinary CP/M to CP/M Plus are ones which the user won't notice — bar one. There will be no more moments of 'Horrors, Bdos Error!' because it automatically logs onto a diskette as soon as it goes into the drive.

Most improvements to CP/M Plus lie in the speed and sophistication of diskette handling. This is not the moment for an explanation of what one means by 'hashed directory access', or 'least recently used sector buffering' or 'multi-sector 1/0 primitive', beyond saying that they can enormously speed up programs that use the disks a lot, and they are all features of CP/M Plus.

It can also speed up the way the system handles the screen, and the way programs and program overlays are loaded.

However, it is clear that programs designed for the larger memory space, better screen handling and faster disk abilities of this operating system, will absolutely walk over those that are built round CP/M 2.2. In particular, when hard disks are more available, the ability to have files of 32 megabytes on disks of up to 512 megabytes capacity will enormously improve database managers.

In the circumstances, I found it easy to agree to Osborne engineers' requests not to run the benchmarks. Their objections were on the grounds that the performance improvement in MBasic programs might not be shown on the final production machines, if somebody puts more 'wait states' into the circuit board. My objec-

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tions to the project were simpler: a) the MBasic interpreter is identical; b) there was obviously no change in the approximate speeds (a two per cent speed increase was indicated, which is not enough to write home about); and c) it would be a complete waste of an afternoon's hard graft with stopwatch and keyboard, because it totally ignored all the new go-faster features of the machine, in favour of testing a language which is very little used for commercial applications.

Overall impressions

This is the year of the IBM personal computer, 16-bit software, and MS-DOS.

As eight-bit systems go, the new Osborne — to be launched this month although shipping to the UK will not start until September — offers a lot of software for a reasonable price — and several performance improvements over standard CP/M systems. But it does remain disappointing in terms of what one might

have expected.

Quite what the 16-bit version will be like, only time will tell. All we know at the moment is that it will offer colour, probably an extra application package (like Lotus 123 or VisiOn) and two 16-bit operating systems. We also know that a company called Personal Computer Products has just announced a deal with Osborne, to design the 8088 co-processor card for the Executive II.

By the time that machine is ready, there will be more than one portable on the market capable of running IBM personal computer software. One of them may even be an IBM machine.

On the positive side, the machine answers most criticisms of the Osborne 1, and looks good value for money — the UK tag is expected to be £2000 or so. And Osborne is now established with enough dealers, and in enough corporate buying plans, that the upgrade will probably be a noticeable success.

All it needs, really, are double-sided diskettes, and a 132 column scrollable 'window' screen.

LEISURE LINES

by J J Clessa

Quickie

What gets longer the more you cut it at the ends?

Prize Puzzle

Susan's perfect man has black hair, brown eyes, and is tall and slim.

Susan knows four men — Arthur, Bill, Charles and Dave — only one of which has all the characteristics that Susan requires.

- 1 Arthur and Bill have the same colour eyes.
- 2 Only one of the men has both black hair and brown eyes.
- 3 Bill and Charles have the same colour hair.
- 4 Only two of the men are both tall and slim.
- 5 Charles and Dave have different builds.
- 6 Only two of the men are both tall and dark-haired.
- 7 Dave and Arthur are the same height.
- 8 Only three of the men are both slim and brown-eyed.

Which is Susan's perfect man?

April Prize Puzzle

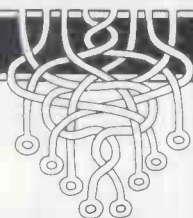
One hundred and twenty-eight entries — but since twenty-nine of these were not on postcards, they were immediately disqualified. This left 99 possibles — most of which contained the right answer.

The winning entry — selected at random — came from George Sassoon of Warminster, Wilts. Congratulations Mr Sassoon, your prize is on its way.

The answer is that 89 or 98 requires the greatest number of operations, 24 in all, before a palindromic number is reached.

Several of you have pointed out that we frequently omit the closing date for entries, and the address to which they should be sent. We will try to rectify this in future, but just for the record:-

Closing date for all entries is the last day of the month of the magazine issue. Mark your entries with the puzzle date, for example, 'Prize Puzzle (month) 83', and send them to Leisure Lines, PCW, VNU Publications, 62 Oxford St, London, W1, Keep puzzling.



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benchtest: Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/Generating screen forms/Comal/Logo/Brain Dump-New series/Calc Corner: Casio FP-10 printer/Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.



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Vol 5 No 9

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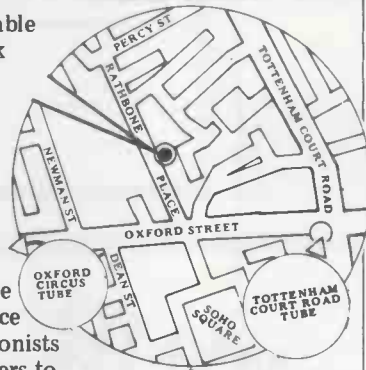
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 Molecular Weight/IK Adventure/
 Beebdump/TRS-80 Word Scrambler.



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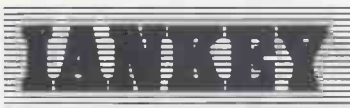
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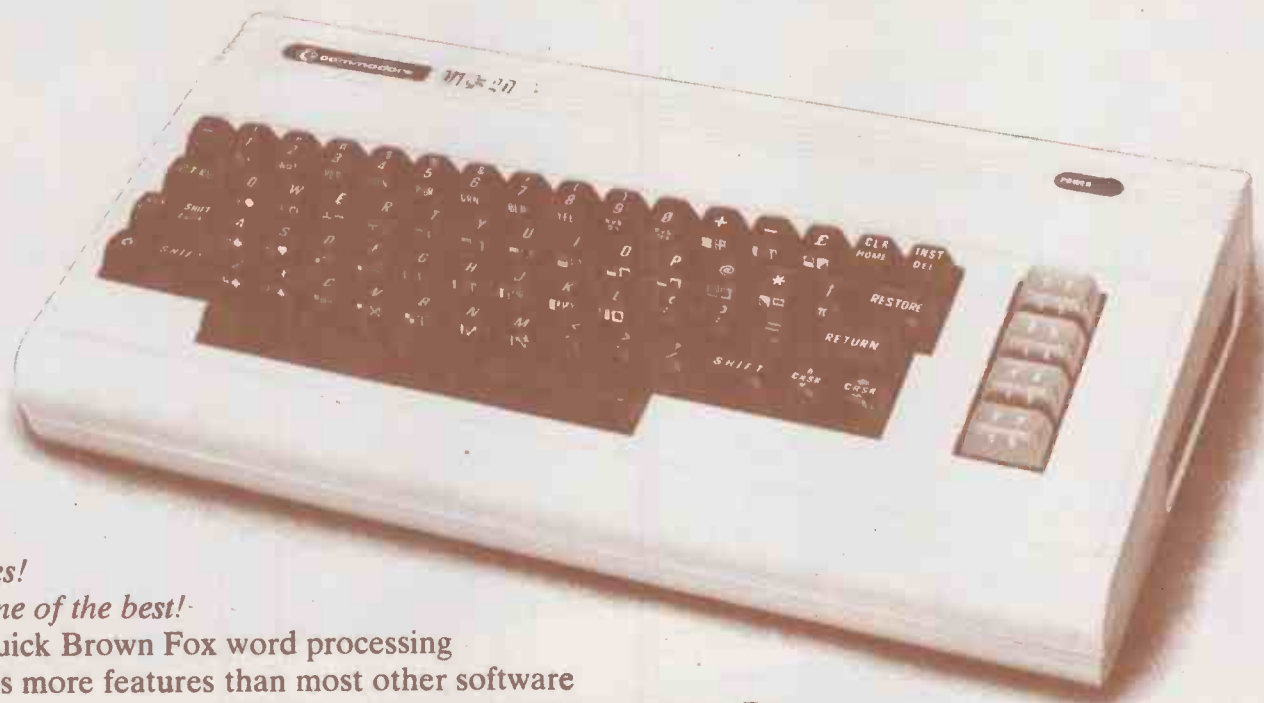
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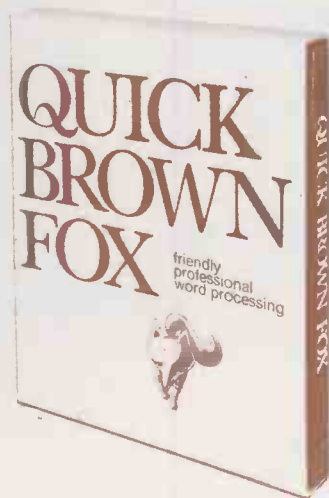
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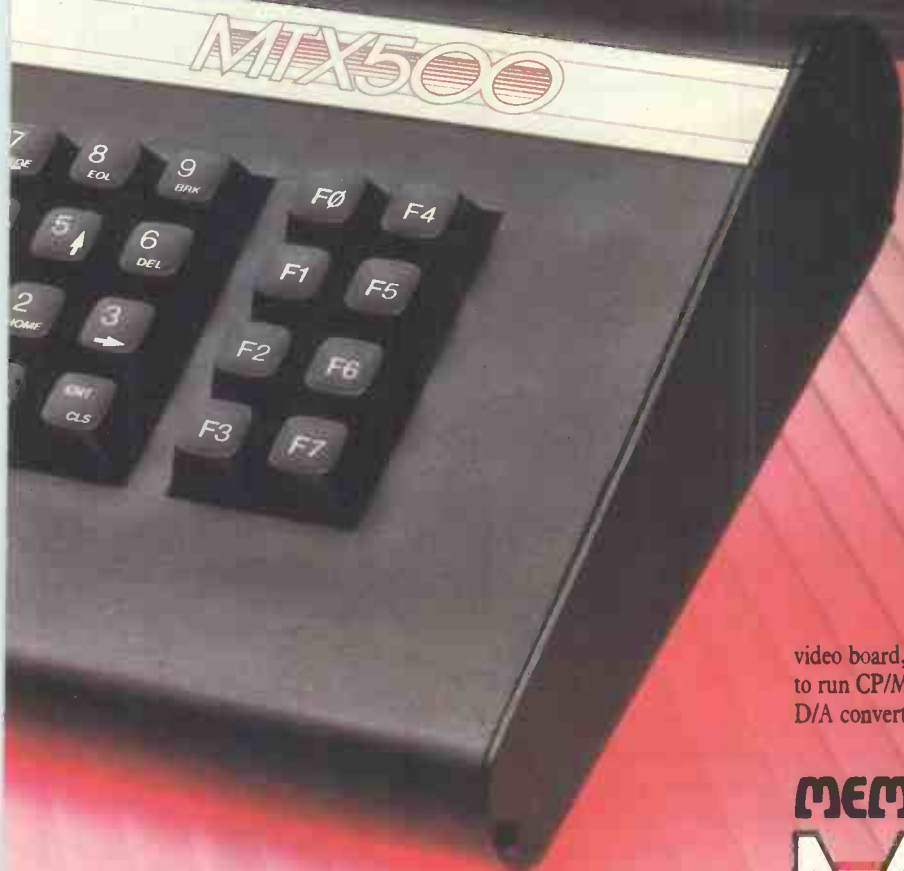
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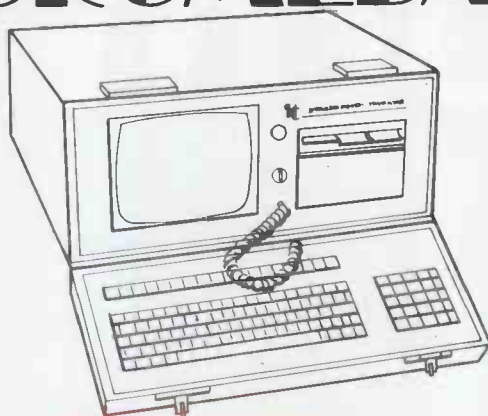
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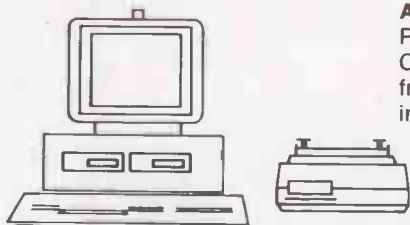
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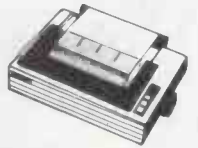
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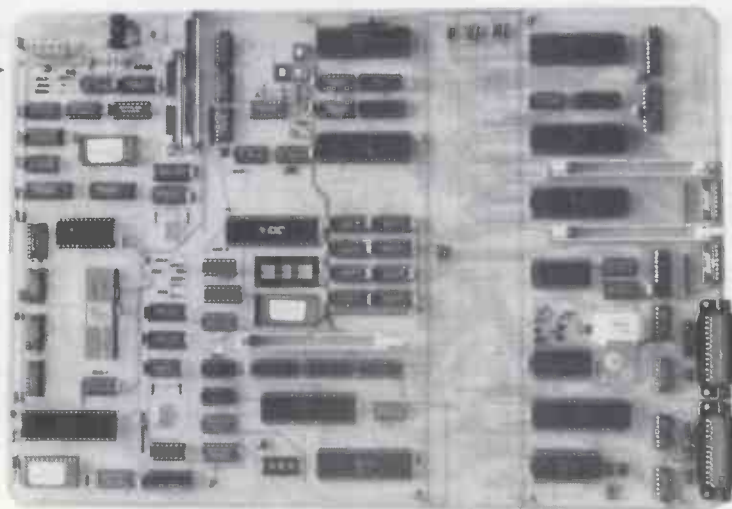
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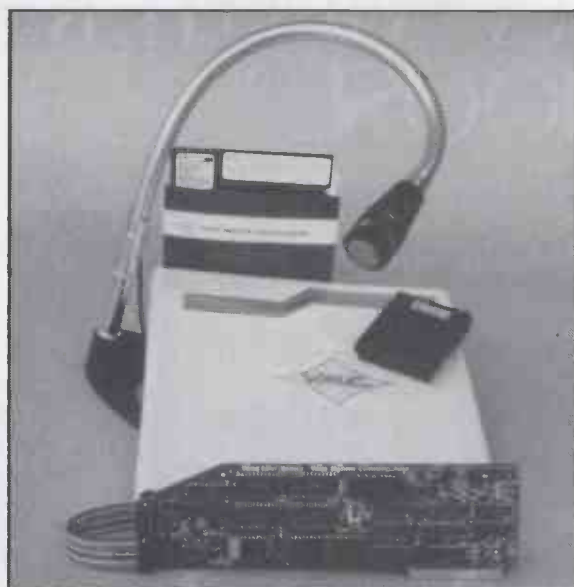
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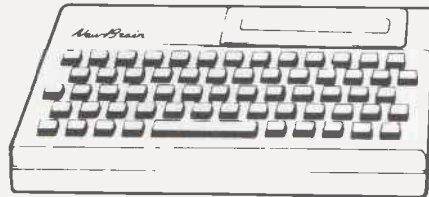
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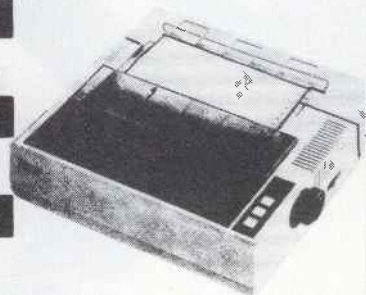
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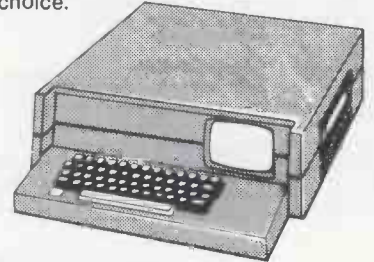


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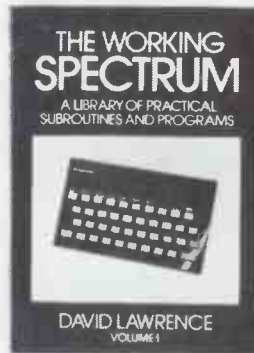
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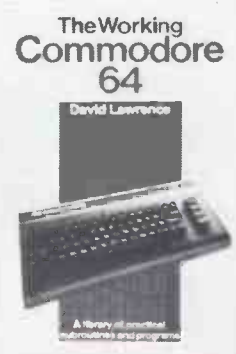
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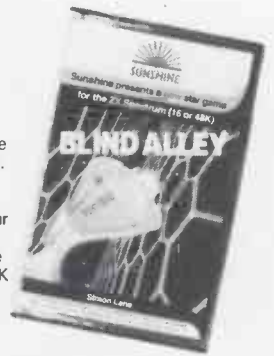
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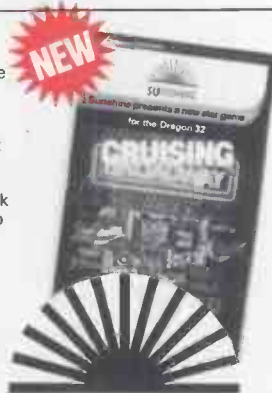
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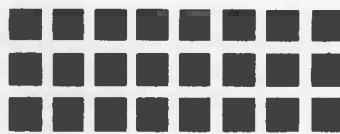
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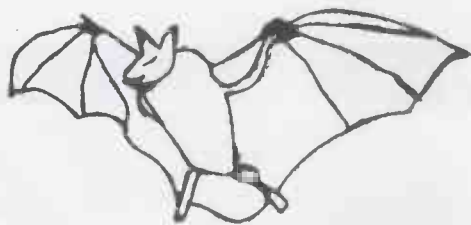
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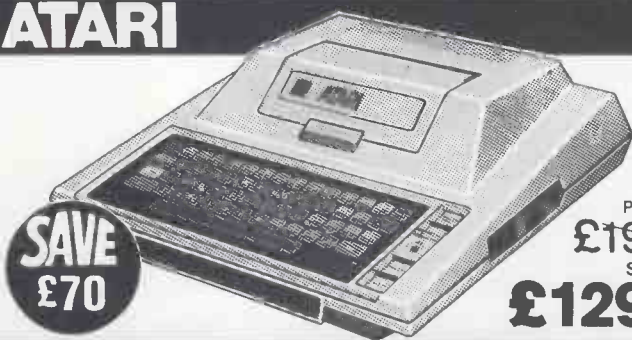
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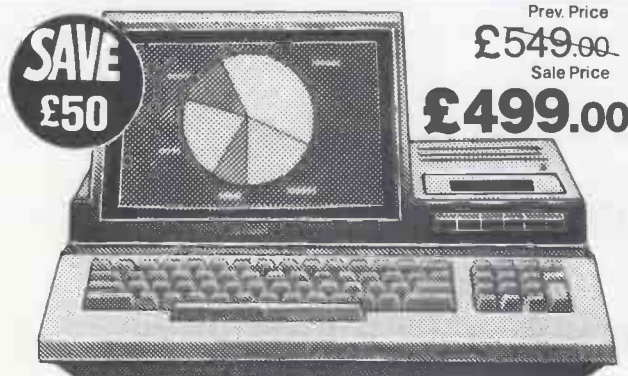
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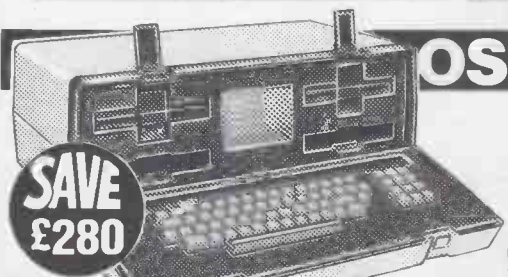
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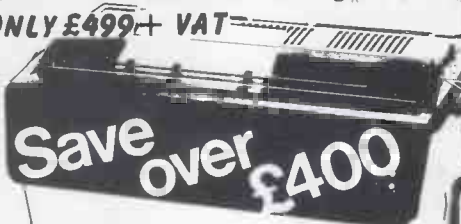
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Critical review?



“The sound commands on the Oric 1 are, for a computer of this price, very sophisticated. Three music channels, and one noise channel, mean that you can program some fairly complex sounds.”

POPULAR COMPUTING WEEKLY

“Oric is everything you hoped it would be. Alive with colour, and zapping with built-in sound effects, the Oric looks like a match for any machine now selling for less than £200.”

YOUR COMPUTER

“The 16k Oric – fighting the 16k Spectrum – is £25 cheaper. It feels a good deal more ‘professional’ than the home-appeal Sinclair. Oric’s sound is extremely versatile, and well up to the standard of the £300 or £400 BBC microcomputer made by Acorn.”

WHICH MICRO?

“Oric was over twice as fast as the Spectrum. Surprisingly perhaps the Oric, which initially seemed only faster when performing the simplest of calculations, has come back to beat the Spectrum by a small amount. As the problems get more complex the Oric comes into its own. One final point – in entering the benchmark tests – the Oric was certainly the easiest to handle.”

WHICH MICRO?

“This slope coupled with the design of the keys makes the Oric an easy machine to touch-type on. All keys have auto-repeat and there are four keys dedicated specifically to cursor control. It is certainly easier to type on than any of Sinclair’s offerings.”

YOUR COMPUTER

“Oric will soon be selling a Modem so that Prestel will become available. Owners will be able to accept telesoftware – programs loaded straight down the phone line – eventually electronic mail could come into the home by the same route, and with the addition of a tape recorder the Oric with its Modem could become a telephone answerer and message taker.”

YOUR COMPUTER

“When compared to the stogginess of the Spectrum’s keyboard this is certainly an improvement. I can’t see any Orics failing through bad assembly. If only the £2400 IBM were so easy to use.”

WHICH MICRO?

“Instead of the Spectrum’s 28 look-up single-character error reports, the Oric has 18 self-explanatory messages. If you actually want to do computing, rather than just exploring the world of off-the-shelf games programme entertainment the Oric will be a better buy.”

WHICH MICRO?

“One good feature of the Oric is an on-screen reminder in the top right hand corner to show that you’ve engaged all-capitals mode. So much better than the BB’s variety of lights in the corner of the keyboard. The Oric is sound, simple to get along with and offers great expansion potential.”

WHICH MICRO?

“A good speaker and built-in noises get the Oric’s sound off to a good start. Typing Zap, Ping, Shoot or Explode produces convincing ‘arcade game noises which can easily be incorporated into any program.”

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S16-Bit Mega Micro

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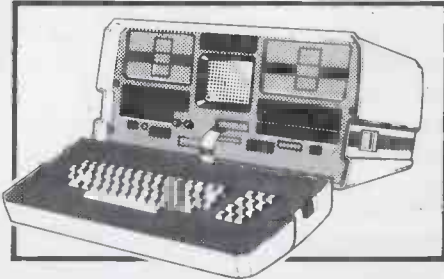
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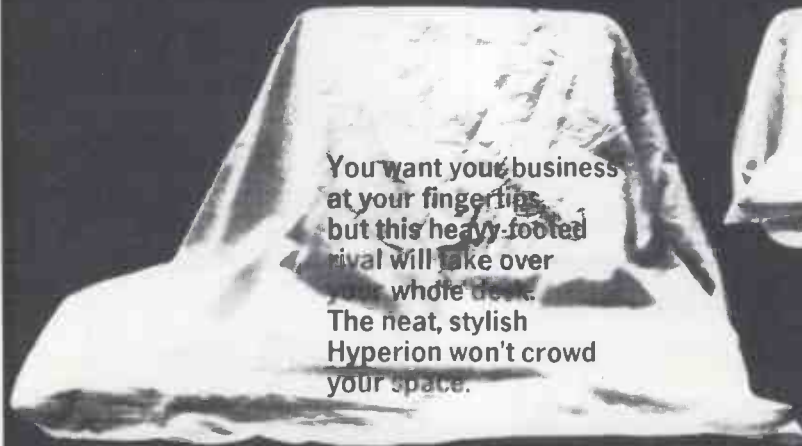
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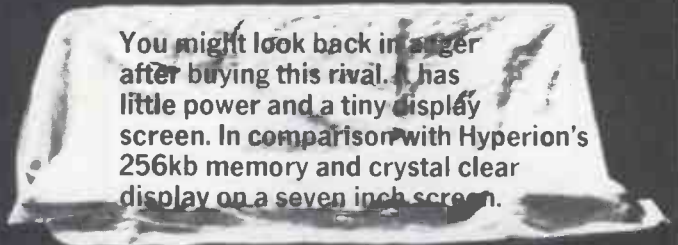
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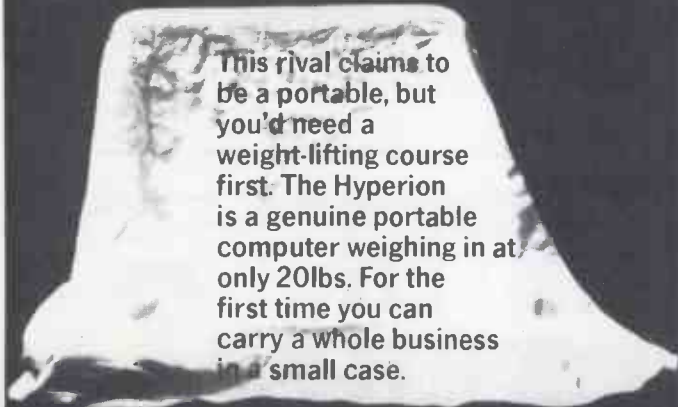
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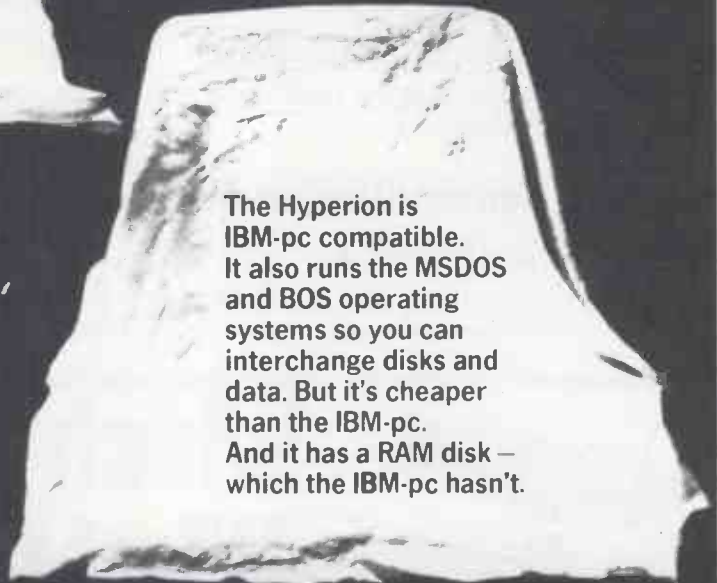
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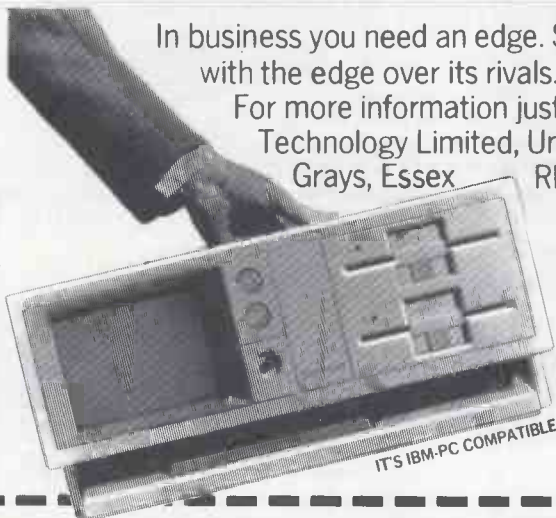
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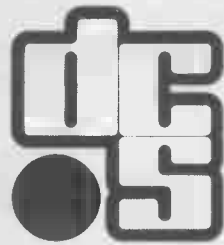
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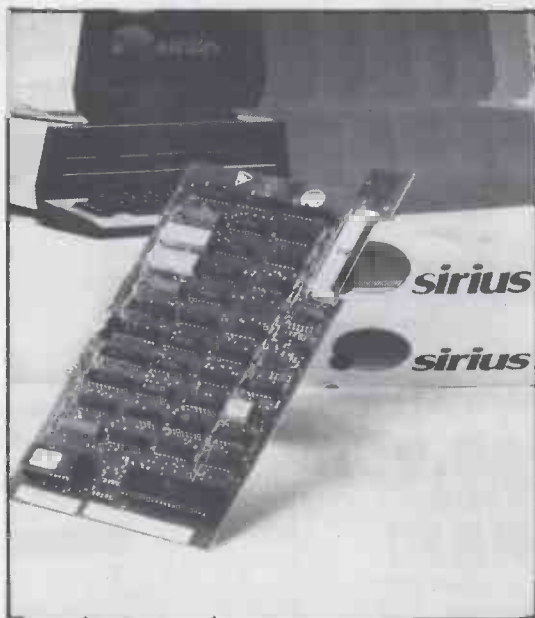
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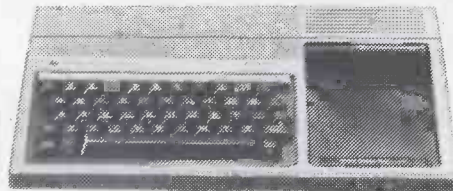
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3		33	
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5		35	
6		36	Food: 120
7	Food: 150	37	car: 225
8	car: 225	38	gas: 90
9	gas: 100	39	rent: 325
10	rent: 300	40	
11		41	total: 760
12	total: 825	42	
13		43	left: 500
14	left: 675	44	
15		45	
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17		47	
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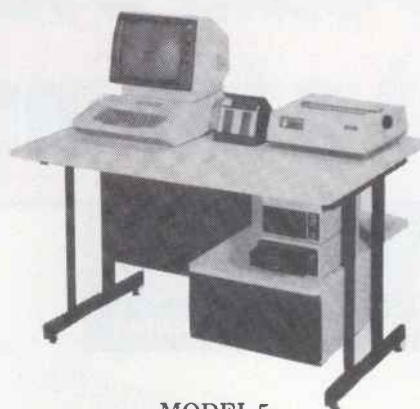
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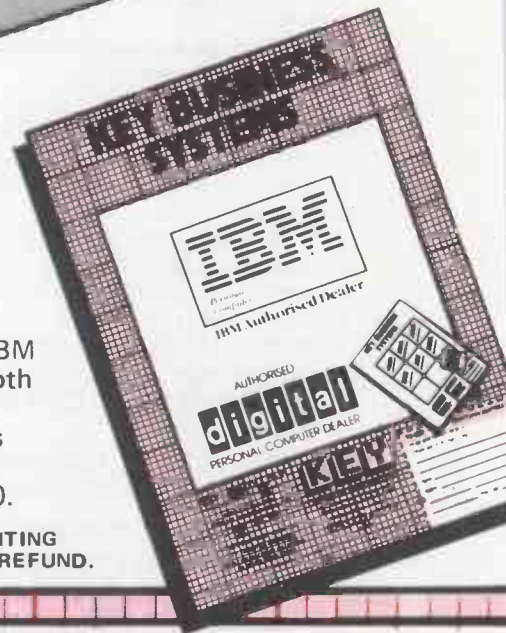
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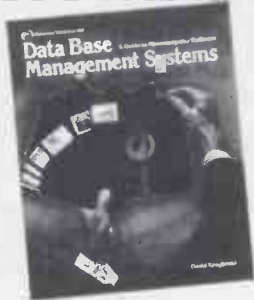
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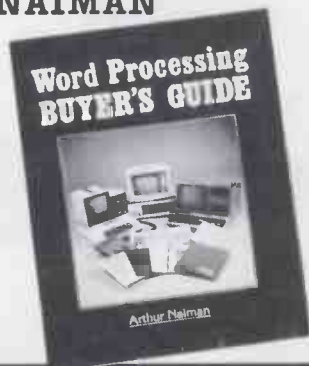
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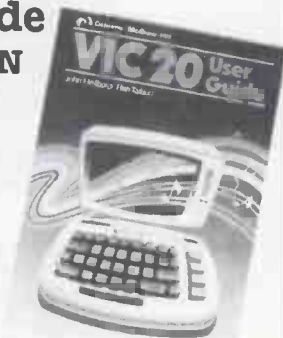
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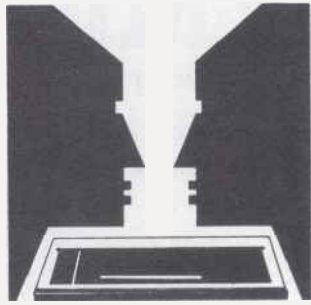
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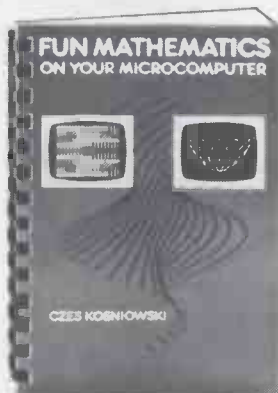
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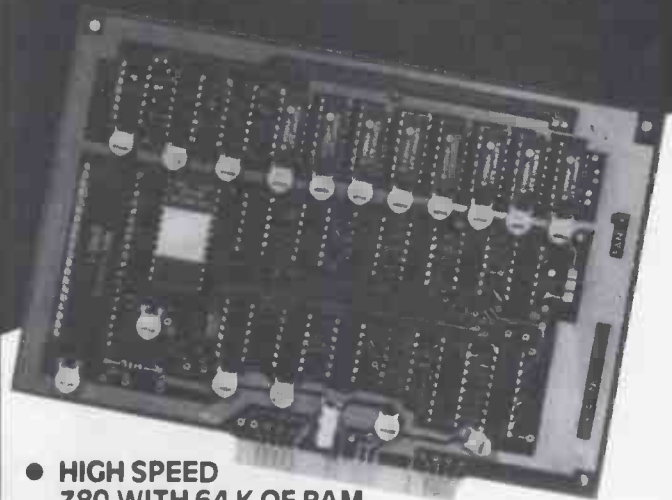
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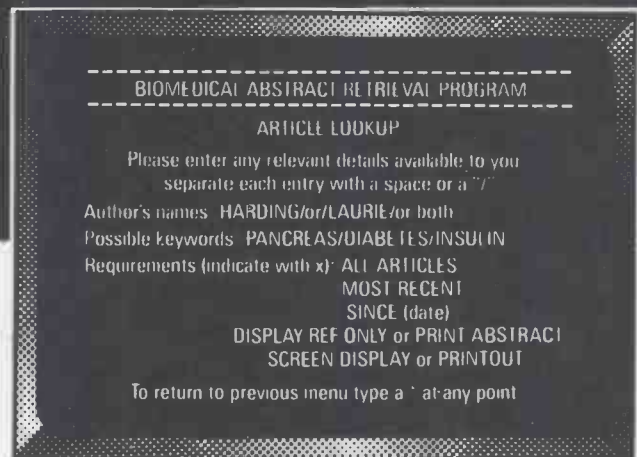
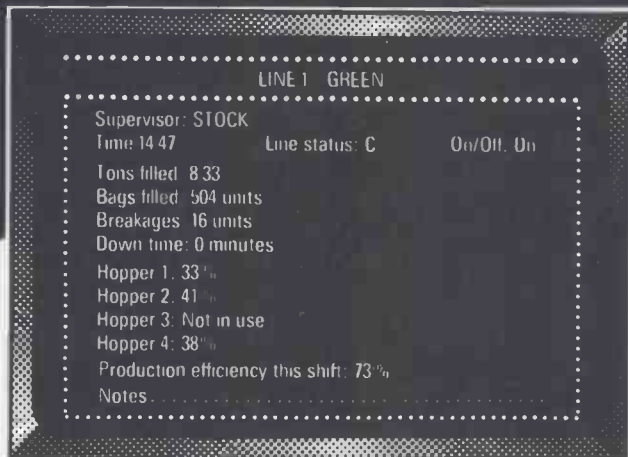
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Nec 8023 (100 cps & prop. spacing)	339.00	389.85
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Tec Starwriter F10-40cps	1099.00	1263.85

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Aristocard Serial	75.00	86.25
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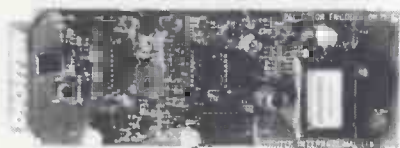
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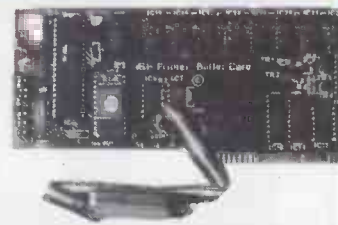
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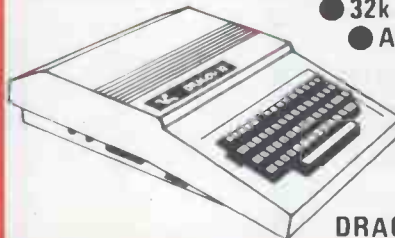
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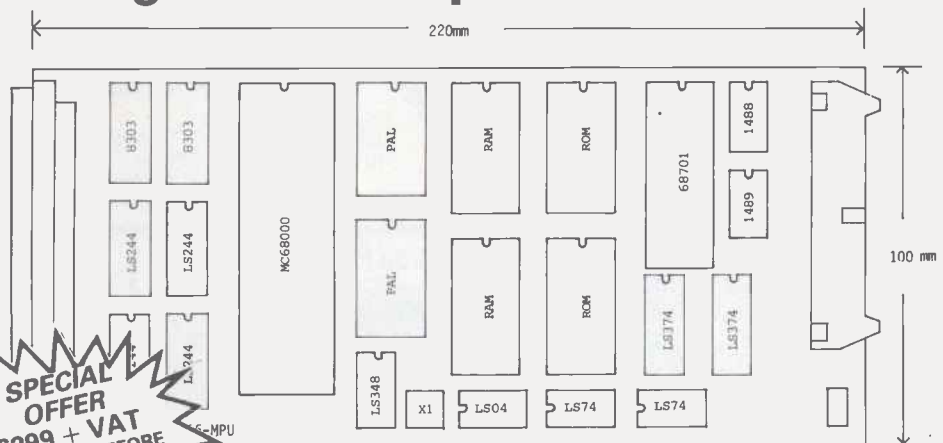
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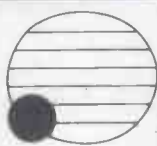
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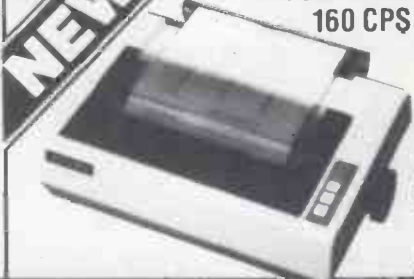
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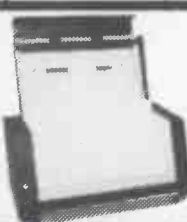


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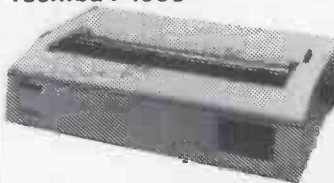
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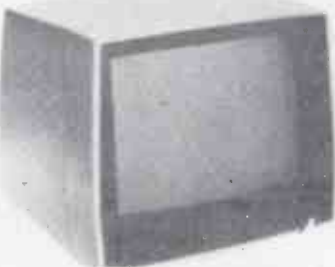
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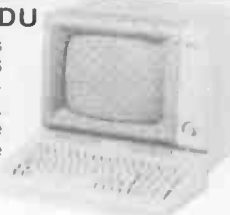


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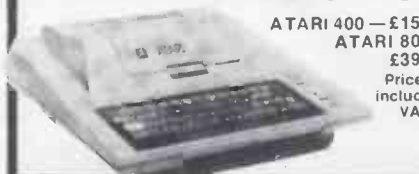


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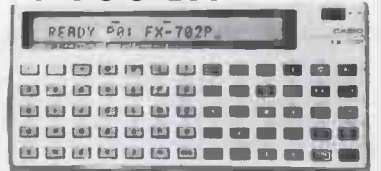
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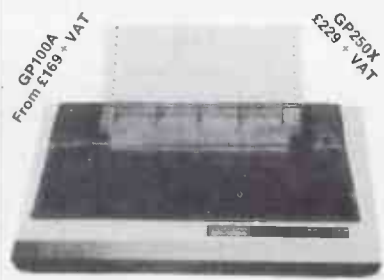
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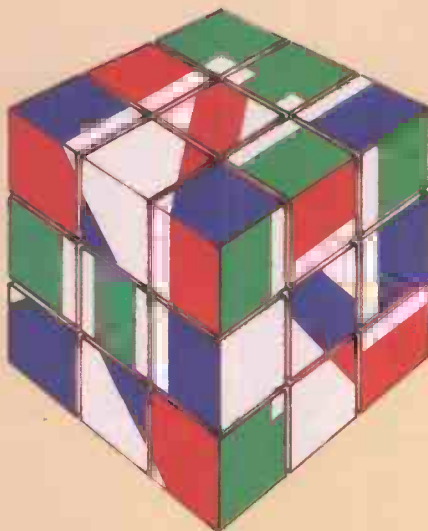
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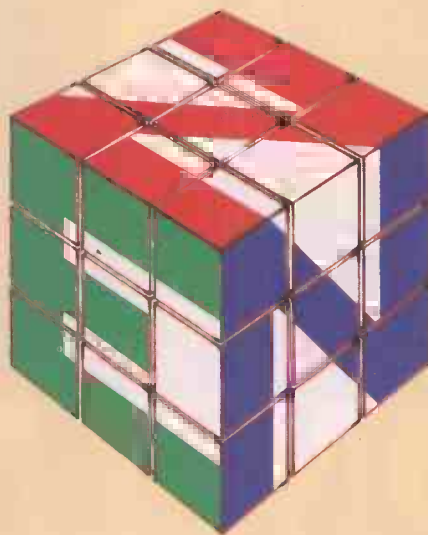
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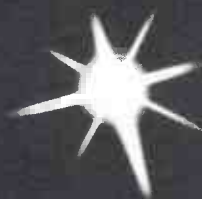
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SOFTWARE COUNTRY

		CP/M-80	CP/M-86	PC-DOS
Word Processing				
WORDSTAR	MicroPro	□	●	**
MAILMERGE	MicroPro	□	●	**
SPELLSTAR	MicroPro	□	●	**
EASYWRITER II	IUS			**
EASYSPELLER II	IUS			**
Data Bases And File Management Systems				
DASTAR	MicroPro	□		
DBASE II	Ashton-Tate	□	●	**
EASYFILER	IUS			**
FMS-80, 81, 82	DJR Assoc	□		
INFOSTAR	MicroPro	□		
PERSONAL PEARL	Pearl Software	□		
REPORTSTAR	MicroPro	□		
RESCUE	MBS	□		
Business Systems, Financial Planning, Accounting				
CALCSTAR	MicroPro	□		
EASY PLANNER	IUS			*
MULTIPLAN	MicroSoft	□		
SAPPHIRE MARS	Sapphire Systems	□	●	
SUPERCALC	Sorcim	□	●	*
MILESTONE	Organic Software	□	●	
GBS (General Business System)	ByteSoft	□		
ISL (Integrated Stock & Ledger)	ByteSoft	□		
Statistics				
MICROSTAT	Ecosoft	□		*
Training Packages				
HANDS-ON CP/M	MicroCal	□	●	
HANDS-ON COBOL	MicroCal	□	●	
WP WORKSHOP	MAC	□		
FLIGHT SIMULATOR	MicroSoft			*
Languages				
BASIC COMPILER	MicroSoft	□		
BASIC INTERPRETER	MicroSoft	□		
BAZIC	MicroMikes	□		
CBASIC	Digital Research	□	●	
CBASIC COMPILER	Digital Research	□	●	
CIS COBOL	MicroFocus	□	●	
COBOL	MicroSoft	□		
FORTRAN	MicroSoft	□		
LEVEL II COBOL	MicroFocus	□	●	
MULISP/MUSTAR	MicroSoft	□		
MUMATH/MUSIMP	MicroSoft	□		
PASCAL/MT	Digital Research	□	●	
PASCAL/MT & SPP	Digital Research	□	●	
PL/1	Digital Research	□	●	
XBASIC	Xitan	□		

		CP/M-80	CP/M-86	PC-DOS
Programming Tools (inc. Cross Assemblers)				
ACCESS MANAGER	Digital Research	□		
ANIMATOR	MicroFocus	□	●	
EDIT	MicroSoft	□		
BT-80	Digital Research	□		
DISPLAY MANAGER	Digital Research	□		
FORMS 2	MicroFocus	□	●	
LINK-80, PL1L1B	Digital Research	□		
MAC	Digital Research	□		
MACRO	MicroSoft	□		
RMAC, LINK & XREF	Digital Research	□		
SID	Digital Research	□	●	
SPP	Digital Research	□	●	
WORDMASTER	MicroPro	□	●	
XASM18 (1802)	Avocet	□		
XASMF8 (F8/3870)	Avocet	□		
XASM65 (6502)	Avocet	□		
XASM68 (6800/01)	Avocet	□		
XASM48 (8048/8041)	Avocet	□		
XLT86	Digital Research	□		
ZSID	Digital Research	□		
Operating Systems				
CP/M	Digital Research	□	●	
CP/M PLUS	Digital Research	□		
CP/NET & CP/NOS	Digital Research	□		
MP/M II	Digital Research	□	●	
CONCURRENT CPM-86 (IBM PC)	Digital Research	□	●	
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DESPOOL	Digital Research	□		
FILESHARE	MicroFocus	□		
FILESTAR	MicroSec	□		
MUCOPY	Wheatcroft Hards	□		
SORT	MicroSoft	□		
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SUPERVYZ	Epic	□		
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BSTMS	Byrom Software	□		
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GSS- Kernel	Digital Research	□		
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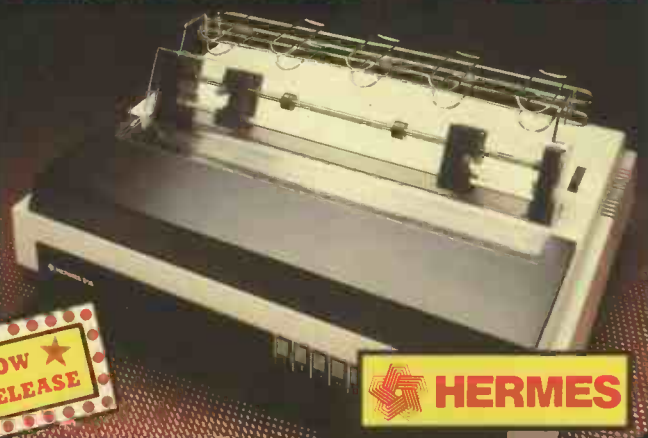
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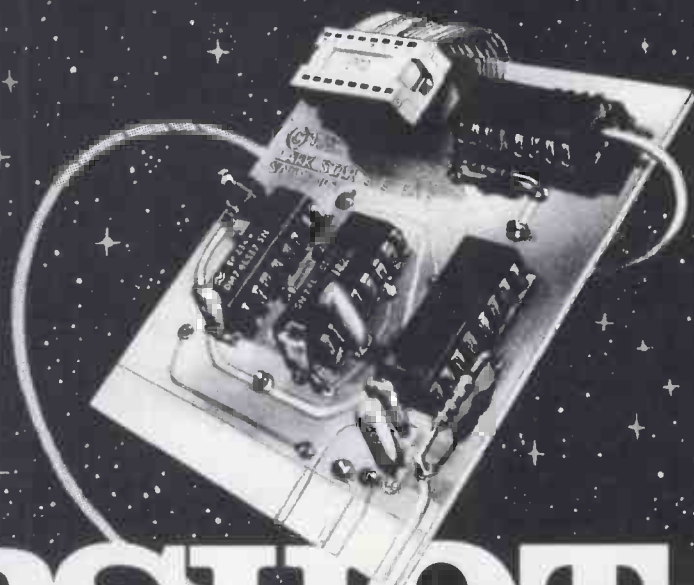
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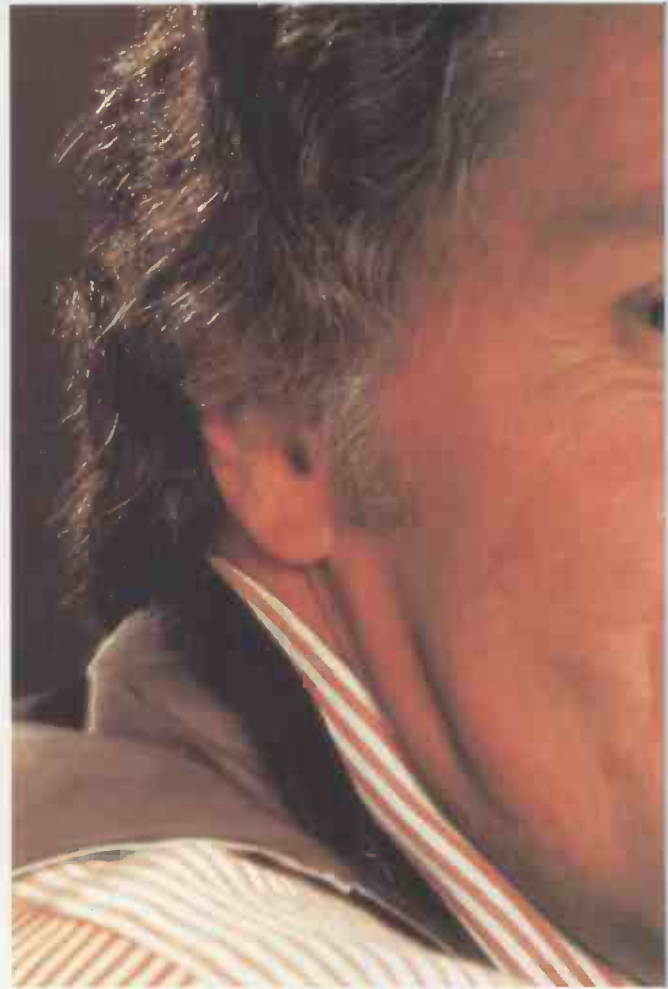
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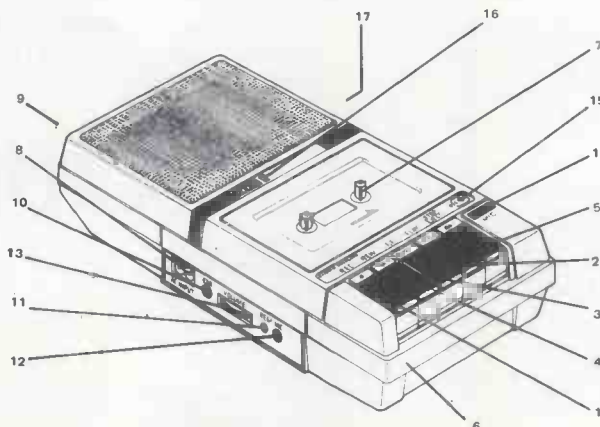
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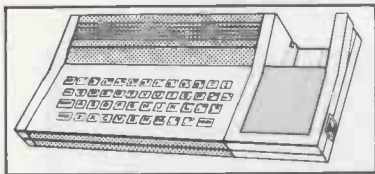
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HOME COMPUTERS

AQUARIUS



AQUARIUS: The brand new Aquarius Personal Computer is part of Mattel Electronics latest developments in advanced technology and offers full home computing facilities, as well as extensive game play, using a very wide range of plug in cartridges. Since Aquarius is a Mattel Electronics product, it benefits by the company's wide experience of producing high technology equipment, as well as their game programming expertise which is evident from the advanced games which have been produced for the Intellivision. Aquarius costs £79 and comes with microsoft basic built in. It is so simple to use that you'll be writing your first programs within minutes of taking the machine out of its box. You can even record the programs on your own cassette recorder at home, so you can use them again at a later date. Most available domestic tape recorders are compatible with the Aquarius.

A POWERFUL MACHINE: For all its simplicity, it is also very sophisticated. It has a Z80A processor and 8K of built in ROM as well as 4K of RAM, which is user expandable to 52K. It has a display of 40x24 characters, and a graphic resolution of 320x192 with a total character set of 256 (including the complete ASCII set with upper and lower case letters, numbers and additional graphic symbols). The keyboard has 49 full stroke moving keys, unlike some of the cheaper machines which have membrane keyboards. The size of the machine (excluding any of the additional peripherals), is 13" x 6" x 2".

PERIPHERALS: It is very easy to increase the capabilities of your Aquarius as all the peripherals plug straight into one another. You can add a Printer, a Modem, a Data Recorder, Mini Expander and other items. All of the peripherals are very easy to install and what is more, they're easy to use. But the best news of all is, they're easy to afford.

CPM OPERATING CAPABILITY: The Aquarius is capable of being expanded to 52K RAM and later in 1983 a disk drive will be available for it, with the commercial CPM business operating system. This will allow you access to one of the largest software libraries in the world, with literally hundreds of programs available for you to use.

CARTRIDGES: Various sophisticated programs will be launched on plug in cartridges such as a Visicalc type spreadsheet and a word processor. In addition there will be dozens of games and utilities and alternative languages such as Logo, which combined with the built in microsoft basic gives an unbeatable combination of high quality programming ability.

MATTEL AQUARIUS - £68.70 + VAT = £79

ATARI 400/800



NEW LOW PRICES

ATARI 400/800: With the Atari Personal Computers, you can play the ultimate T.V. games, teach yourself new subjects or skills, balance budgets, and even write your own computer programs in Basic.

SPECIFICATIONS: Both the Atari 400 and 800 can display in up to 16 colours each with 16 intensities. They have independent sound synthesizers for multiple game sounds, giving four octaves with variable volume and tone control on your T.V.'s speaker. The display graph

are of amazing quality, having a detailed resolution of 320 x 192, comprising 24 lines of 40 characters. Atari personal computers have a standard 10K ROM operating system. In addition the standard Atari 400 (£149) comes with 16K of RAM, and the expanded version with 48K (£198). The Atari 800 (£299) comes with 48K as standard. Both the 400 and 800 are now supplied with a FREE E40 Basic Programming Kit, which includes the Basic Programming Cartridge, as well as a 120 page Basic Reference Manual and a 184 page Self Teaching Manual by Bill Carris called 'Inside Atari Basic', so you can be programming straight away, without buying any 'extras'. Even a mains plug is supplied.

OVER 500 PROGRAMS AVAILABLE: The Atari computers are supported by well over 500 programs available for your use, a larger selection than you will find on any other television game or home computer! The wide selection puts Atari way ahead of the competition. Just fill in the coupon and we will be pleased to send you a full price which gives details of our range of software available for entertainment, home education programming and home office use. We think you'll agree when we say it's quite impressive.

100 FREE PROGRAMS FROM SILICA SHOP: If you buy your Atari Home Computer from Silica Shop, you will receive a FREE presentation pack of 6 cassettes, containing 100 programs including games, utilities and demonstrations. A 16 page booklet giving the details of all of these programs is available on request. If you have already purchased your computer elsewhere you can buy the set of 6 cassettes for £30. What's more, Silica Shop offer a two year guarantee on all computers as well as a FREE joystick. This is up to a great offer that we believe can't be beaten or matched by any of our competitors.

ATARI 400 16K - £129.57+VAT=£149
ATARI 400 48K - £172.17+VAT=£198
ATARI 800 48K - £260.00+VAT=£299

COLECOVISION



THE SYSTEM: The CBS Colecovision offers new standards in video game play. The excellent graphics are well implemented with arcade titles such as Zaxxon, Lady Bug, Gorf, Wizard of Wor, Carnival, Mouse Trap and the lovable Smurfs. The console comes supplied with a three screen arcade quality version of DONKEY KONG. Parker and other companies have also announced ranges of cartridges for Colecovision, to further enhance the wide range of quality titles available for this new television games machine.

THE CONSOLE: The CBS Colecovision video games system has advanced technology which produces superlative graphics resolution and excellent sound effects. The styling of the console and hand controllers has been carefully researched; the console is designed to complement modern hi-tech equipment, and has clear features for easy operation. The hand controllers allow fingertip control via the 8 direction joystick, and feature 2 independent fire buttons. The push button keyboard is used for game selection and for game control with some cartridges. The hand controllers are detachable and are connected to six feet of telephone coil cable, storing neatly away in the console when not in use.

ATARI EXPANSION MODULE: The Atari converter module allows Atari VCS software cartridges to be played on the Colecovision console, allowing owners the freedom to purchase from the extensive range of Atari compatible cartridges. It also means that existing Atari owners can buy the CBS Colecovision games system without discarding their software library. Silica Shop offer part exchange facilities if you wish to upgrade.

TURBO EXPANSION MODULE: The Turbo Driver Expansion Module allows you to actually drive the vehicle that appears on your T.V. screen. The module consists of a steering wheel, dashboard and accelerator pedal. One hand controller is mounted on the dashboard to provide a gear change unit. The module comes complete with a Turbo Driver cartridge, the first of several cartridges to make use of the module, which provides all the action of sitting in the driving seat. This facility is unique to CBS Colecovision.

HOME COMPUTER EXPANSION MODULE: The Home Computer Module scheduled for late 1983, allows conversion of the games unit into a sophisticated Home Computer. This flexibility of design is an important feature of the CBS Colecovision System.

COLECOVISION - £127.82 + VAT = £147

VECTREX



THE SYSTEM: Vectrex is a totally unique Home Arcade System, which has been exclusively designed and engineered to duplicate real arcade game play. Complimented with its own monitor display, Vectrex won't cause arguments over the use of the family's television because it has its own built in screen.

THE SCREEN: Vectrex does not use ordinary display techniques, instead it uses vector scanning to control images on the screen. With this scanning method, the gun only updates the area of the screen that has changed whereas a normal T.V. re-transmits the ENTIRE screen 50 times a minute. It is this that gives Vectrex its speed and means that very little computer power is required for screen control, and the results provide very responsive and clear images. These 'Vector Graphs' are used in several arcade games such as Asteroids and Battlezone, to give you incredibly high resolution quality. Vectrex brings all of this from the arcade right into your living room. The Vectrex screen is capable of displaying 80 columns by 40 lines, which is significant to the extensive developments planned for the system.

EXCITING SOUNDS AND ELECTRONICS: Vectrex has an advanced microprocessor with more speed and power and exciting effects than many home video games systems.

REAL ARCADE CONTROLS: Vectrex has a unique control panel, similar to those used in many real arcade games, with 4 concave action buttons and a full 360° self centring joystick. This control panel has a 4 foot detachable cord for maximum player freedom.

REAL ARCADE GRAPHICS: Vectrex has its own 9 inch vertical screen and unlike conventional T.V. screen, uses advanced display technology to achieve brilliant, high resolution imagery and superb game play never before possible. The Vectrex display provides special effects too, such as 3-D rotation and zooming in and out, which regular T.V. cannot match. Using a black and white monitor, each Vectrex game is supplied with its own coloured plastic screen overlay to add to the excitement of game play. The range of Vectrex cartridges (£21.95 each), gives a good selection of arcade games such as Berzerk, Scramble, Rip-Off and Bomber Attack. Vectrex comes complete with a fast paced 'Minestorm' game built into memory.

VECTREX: Vectrex has an advanced state-of-the-art microprocessor with more speed than other T.V. games.

VECTREX - £129.57 + VAT = £149.00

WHO ARE SILICA SHOP?

Silica Shop are one of the leading specialist suppliers of Video Games & Personal Computers. We consider that our service, to those who already own or to those who are interested in any products in our range, cannot be matched by any other supplier. Just look at what we have to offer:

- **SHOP DEMONSTRATION FACILITIES** - we provide full demonstration facilities at our shop in Sidcup, so that you can get hands on experience of our range.
- **SHOP OPENING HOURS** - we are open from Monday to Saturday 9 am - 5:30 pm, but close at 1 pm on Thursday's and from 12 pm on Friday's.
- **MAIL ORDER** - we are a specialist mail order company and are able to supply goods direct to your door at no extra cost.
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- **PART EXCHANGE** - we will offer you up to one third of our current selling price in part exchange on your old Mattel Intellivision or Atari console (and related cartridges), if you decide to buy a new video game or personal computer from us.
- **SECONDHAND GOODS** - we sell second hand Mattel & Atari consoles/cartridges (with a full 1 year guarantee), at two thirds of our normal retail price.
- **COMPETITIVE PRICES** - both our prices and services are very competitive. We are never knowingly undercut and will normally match any bona fide price quoted by our competitors, providing they actually have the goods in stock. We will also send the order to you post and packing free!
- **HELPFUL ADVICE** - our specialist sales staff are always available to give you advice on the suitability of various computers or T.V. games.
- **SERVICE/REPAIRS** - are available on all machines in our range, often utilising our in house service facilities. We will support your machine long after you buy it.
- **ATARI SERVICE CENTRE** - we are now an authorised Atari service centre and can therefore accept repairs on all Atari equipment (TV Game and Computers) even if you did not originally purchase it from Silica Shop. All repairs during the manufacturer's 18 month warranty period will be completed FREE OF CHARGE.
- **2 YEAR WARRANTY** - we offer a 2 year extension on some manufacturers 12 month warranties, including Atari Personal Computers.
- **VIDEO GAMES AND COMPUTER CLUBS** - we offer a full information service on all video games and computers in our range. Advanced information on many new developments is often included, so you are always kept informed. We now issue regular newsletters on software releases to make sure that you join our club.
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VIDEO GAMES

ATARI

ATARI VCS (2600) - THE NO 1 BRAND LEADER IN THE U.K.

ATARI: The Atari Video Computer System known as the Atari VCS or the 2600 has now become the T.V. game brand leader. In the U.K. there are over 700,000 owners of the VCS with access to a range of over 200 different plug in cartridges, each having a multitude of different variations and difficulty levels. Every system comes complete with the main console, two individual joystick controllers, a pair of paddle controllers, aerial splitter, mains adaptor and a 27 game Combat cartridge. It gives you bright crisp graphics, realistic sound effects and even specially designed circuits for the protection of your Television Set.

SECONDHAND GAMES: We currently have several secondhand Atari VCS units in stock which we are selling for only £49 (inc VAT). This price includes the Console, with Combat Cartridge and all the accessories, as well as a 12 month guarantee. We also have stocks of several secondhand cartridges many at half price (all with 12 months guarantee). We will normally buy back secondhand units and cartridges at one third of our standard price.

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EXTENSIVE CARTRIDGE RANGE: The Atari VCS is so popular that in addition to Atari's own cartridges, there are over 150 compatible cartridges, produced by at least a dozen different third party manufacturers. Silica Shop has one of the largest cartridge selections available in the U.K. Our range of over 200 titles (printed either side of this column), includes items in stock now, as well as many of the new releases for later in 1983.

SILICA ATARI CLUB: Silica Shop has over 20,000 Atari VCS club members registered on our computer. As a specialist company we are able to obtain advance information about new developments and send detailed catalogues to all of our club members, enabling them to evaluate new products before they buy. This is a totally FREE service, to receive your copies complete the coupon below.

SERVICE CENTRE: Atari International (UK) Inc has recently appointed Silica Shop as an authorised Atari Service Centre. This means that we can now service your Atari VCS or 400/800 (under guarantee if applicable), whether or not you purchased it from us.

VCS COMPUTER KEYBOARD: A keyboard will soon be launched to convert the VCS into a fully programmable home computer. For further details, join our club by completing the coupon below. We will then let you know when further information is available.

STARPATH SUPERCHARGER: The supercharger plugs into the cartridge socket of your VCS and expands its RAM almost 50 fold, from 128 to 6,272 bytes. This increased memory adds vivid high resolution graphics capabilities and significantly lengthens the game playing time. Supercharger has a range of multi-load games (at £19.45 each), these offer the facility to play a game in several distinct parts (great for adventures), the next section being loaded when you have completed the previous one, thus enhancing the game play. For further information please complete the coupon below.

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ACCESSORIES

We stock a wide range of accessories for the Atari VCS and 400/800 personal computers. The same accessories can be used on the Commodore VIC range of computers. The Wico range can also be used with the Texas Instruments computers on purchasing a special adaptor. To give you an idea of the range available, just take a look at the following list:



Trackball with Wico

a directional control which is similar to a jet fighter joystick.

WICO RED-BALL: An arcade type joystick with a red ball handle, it features 2 fire button locations, one at the base and one on the stick. It comes supplied with 4 grip pads for easier table top use.

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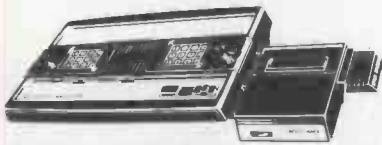
STARFIGHTER: Neat and compact with a small direction stick. Metal interior for added strength.

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MATTEL INTELLIVISION



MATTEL INTELLIVISION: The Mattel games unit is a most versatile T.V. game which offers 3-D graphics quality for only £98. Each cartridge comes with 2 overlays which fit over the unique hand controller giving easy directions for game play. Using the handset's control disc, objects

can be moved accurately in 16 directions giving a realistic simulation of lifelike movement.

VOICE SYNTHESIS: The Intellivision unit, price £49, is used with special cartridges where high quality synthesised male and female voices feature as part of the game play.

NEW MATTEL CARTRIDGE RELEASES: Why not complete the coupon below and join the Silica Mattel Owners Club and receive our FREE news bulletins and 16 page catalogues detailing new Mattel releases. There will soon be over ninety cartridges available for the Mattel, and a small selection from these is listed below:

MATTEL: Arctic Squares, Burger Time, Buzz Bombers, Chess, Cloudy Mountain, Loco Motion, Mission X, Mystic Castle, Sharp Shot, Solar Sailor, Space Shuttle, Vectron, Winter Olympics. **ACTIVISION:** Happy Trails, Pirfall, Stampeed. **C.B.S.:** Blue Print, Carnival, Donkey Kong, Gorf, Mousetrap, Smurf, Solar Fox, Turbo, Venture, Wizard of War, Zaxxon. **MAGIC:** Bezerk, Dracula, Ice Trek, Nova Blast, Safecracker, Swords & Serpents, Tropical Trouble, White Water. **PARKER:** James Bond 007, Lord of the Rings, Popeye, Q-Bert, Spiderman, Star Wars, Super Cobra, Tutankham.

COMPUTER KEYBOARD: In July/August 1983, Mattel will be launching their new £89, 49-key computer keyboard attachment called 'Lucky' which is fully programmable and has microsoft basic built in. It will transform your Master Component into a home computer. The adaptor also accepts a 6 note polyphonic music synthesiser and full size 49-key piano keyboard that will make learning music as easy as playing games.

MATTEL CONSOLE £85.22 + VAT = £98.00

£98

VIDEO GAME CLUB

In a fast moving market like video games, it is difficult to keep up to date with all the developments that take place. With new programmes and accessories being introduced at a fast rate by several different manufacturers, it is impossible to get all the information you require from one manufacturer alone. It is for this reason, that we have set up owners clubs for the more popular video games and home computers, to keep you fully up to date with what is going on with your particular machine. As far as we know, Silica Shop are the only company to offer such clubs, but that is not surprising since we are the specialists. We currently have FREE clubs for the Atari VCS, Atari 400/800 home computers, and Mattel Intellivision. Soon we will have clubs for Colecovision, Aquarius and Vectrex. So if you own one of these machines, fill in the coupon opposite, and we will enrol you FREE OF CHARGE in the club relevant to your computer or video game.

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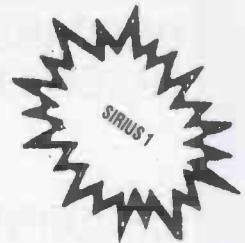
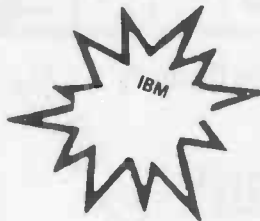
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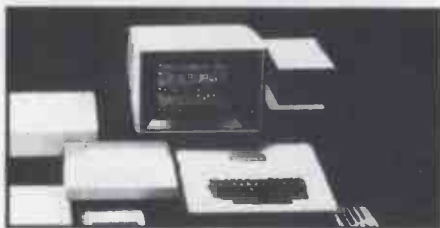
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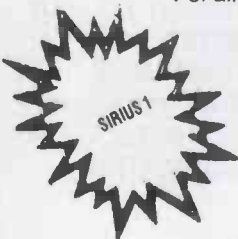


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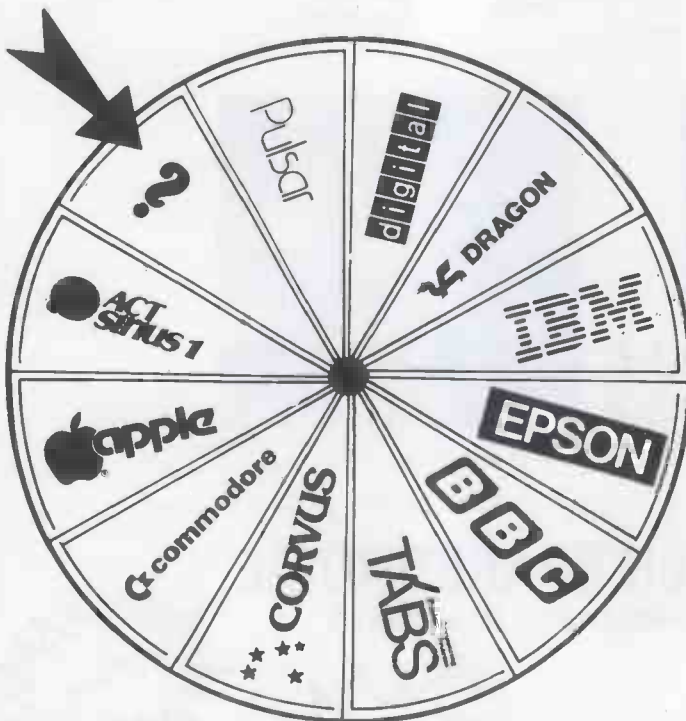
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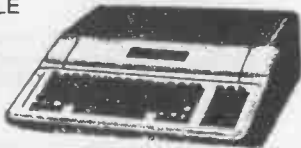
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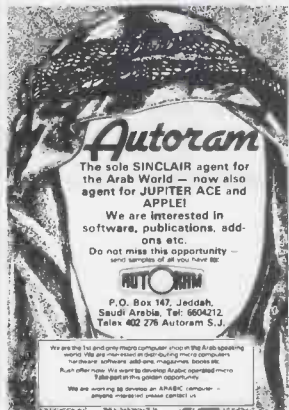
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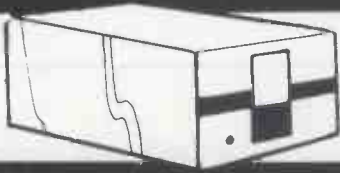
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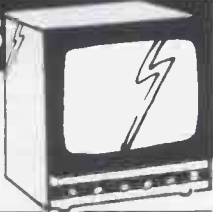
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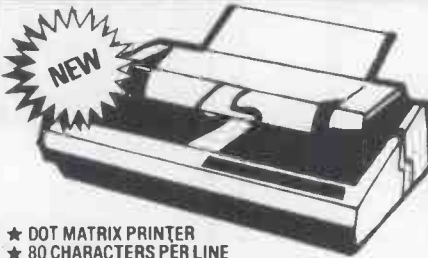


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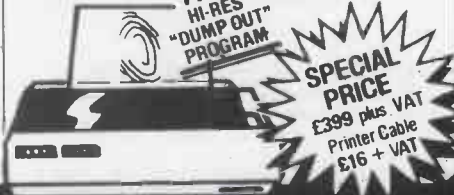
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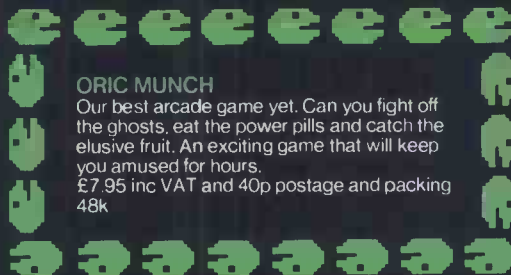
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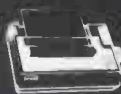
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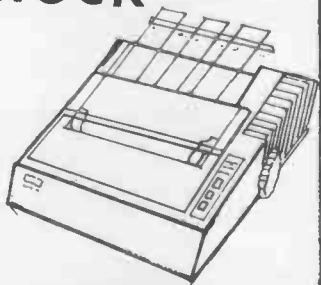
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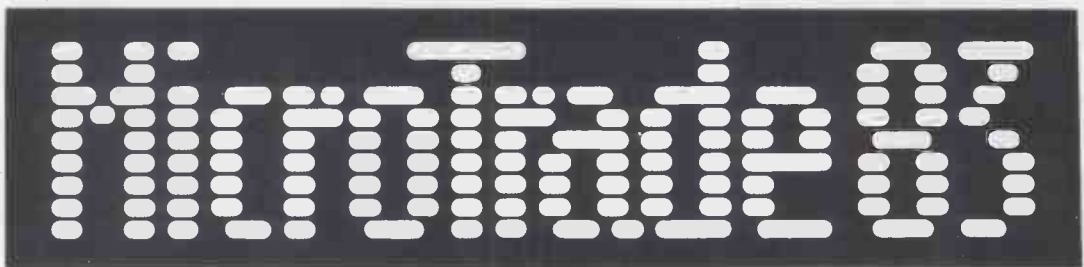
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CHIP CHAT

Portable problem

It is something of a mystery how the same micro can be sold by its manufacturer and a separate distributor under different names.

It can cause severe hostility between the two companies involved and the motivation behind it must surely contain an element of greed — that is to say, the manufacturer notices 'it's selling at lot of them. Why don't we sell it too and cash in — after all we built the thing in the first place.'

Actually the root of this little story is rather less simple, but the end result is just as unnecessary.

Readers may have heard of the Ajile portable. They may also have heard of the Hyperion. The two are one and the same. The Ajile is sold by Anderson Jacobson, which also makes acoustic couplers and other communications devices, and the Hyperion is sold by its manufacturer Bytec, through a subsidiary, Gulfstream Technology.

The original manufacturer, Canadian company Dynalogic, had concluded an OEM agreement with Anderson Jacobson before it sold out to Bytec — unknown to the latter. Upon hearing that Gulfstream would also be selling the machine in the UK,

Anderson Jacobson's PR firm Patria Design sent out a press release under the heading 'Ajile versus Hyperion' which was allegedly authorised by AJ's marketing manager Mike Parrish.

The communication claimed that AJ was 'undaunted' by competition from Gulfstream because AJ, unlike Gulfstream, 'can guarantee a reliable countrywide field service'. Talk about goading an ox...

The release, coupled with a flyer to AJ customers offering a 20 per cent discount on the Ajile, incurred the wrath of Gulfstream and led to Patria Design losing the AJ account. A release from Patria insists that the PR outfit was instructed to issue the offending missive and that the subsequent sacking was 'the easy way out' for AJ's managing director Brian Warrington. AJ now denies authorising the release although, according to Patria Design, the 'unauthorised' release was discussed between Mike Parrish and a journalist. Patria's Jennifer Morbey believes she has been turned into a scapegoat to cool AJ's blushes.

So the sum total of this little storm in a teacup is that, because someone jumped the gun, a PR firm lost an account and two companies look very silly indeed. We are now told that the two companies do not want to tread on each other's toes and wish to co-operate.

But how can they, selling the same computer under rival trademarks?

Snippets

A symposium of eminent American psychologists, says *The Times*, 24 May, has recently held a forum entitled 'Donkey Kong, Pacman and the meaning of life'... A press release about a software company, Pegasus Software, which arrived in the ivory tower early in May, was titled 'Pegasus — a synonym for success'. Could this mean that the word Pegasus will soon be integrated into modern language as such? Soon we may well be referring to 'a really pegasusful young executive' or the computer that was 'never much of a pegasus'... What with Miss World assisting in promotions in her charming way, Epson is going a long way towards buttering up the press as we all know that revered profession deserves. Now it's doing the same thing for its distributors with a free, all-expenses-paid golfing weekend in Cornwall. We're told that this trip 'reflects Epson's move towards a fully committed distributor force...' Hippie types, gurus and trendies who read the Whole Earth Catalog will be edified to know that there is also a Whole Earth Software Catalog. This is published by Point Foundation and licensed by Doubleday & Co of New York. Knowing the content of the Whole Earth Catalog makes the mind boggle with respect to its silicon stablemate — could make interesting reading... Remember

the Statutory Sick Pay packages? If not, in May Chip Chat it was mentioned that wastebins were stuffed full of press releases from large numbers of software houses all having had the same idea — SSP Software. A recent report in *Computing*, the well known computer trade journal, explains that some of these packages may be causing companies to lose vast amounts of money in sickness benefit which is not due. This is apparently caused by a package's inability to allocate sick pay to specific days of the year. Some of the systems are also incapable of holding enough details on an employee. At least twelve weeks of details, says Mike Copleston of IMS, a consultancy firm, should be kept at any one time. One wonders if IMS is selling its own SSP package?

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BLUDNERS



Let's try again with Oric Bug Eater. In lines 1085 and 1105, the pound sign (£) should be entered as a hash (#) — SHIFTed 3. This applies to any program listing unless the pound sign is inside quotation marks. Line 8066 has closing quotes missing after the full

stop. Line 11076 should read as follows: 11076 L=0: N\$="" : K\$=KEY\$: I\$="" . If you have a 16k Oric, insert the following line: 3 HIMEM 13311 and then edit line 1020 to read: 1020 READ DA: POKE 13312+D+8*ASC (""), DA

If, on the other hand, you have a 48k machine, leave line 1020 alone and don't even think about adding line 3: simply delete line 2 instead. Ok so far? Good. The following modifications apply to both 16 and 48k machines: 1111 :PAPER(F-1) AND 7: INK(F+1) AND 7, 1170 X=20: Y=24: T=0: H=1:

PLOT X,Y,"\$", 10090 K\$=KEY\$: WAIT 100.

Moving onto the MZ-80K Pascal program, we told you that the program was written under the Hi-Soft Pascal 3, but the title of the program disappeared somewhere along the line. We were in fact referring to MZ-80K 'Double Trouble'.

There were two omissions in 'Spectrum Blaster'; one in the listing and one in the description. The line 35 LET SS=450 is missing and the 'A' in lines 160 and 212 are graphics characters.

Yet another correction to a correction! Last month, we

gave two lines missing from PET Billy. These lines were in fact slightly wrong. In both lines, there should be five, not three, spaces after the cursor-control at the beginning of the line, and you should also add five cursor-lefts to the end of each line.

Finally, two lines were inadvertently omitted from the Lisp database (June *PCW*, page 150). Fig 9 should commence (DEF MY (YOUR 2 ((YOUR @ MFBS / FAMILY) (HOW WELL DO YOU AND YOUR = /FAMILY GET ON ?))

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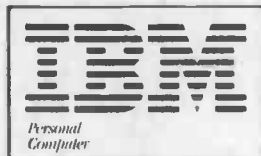
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