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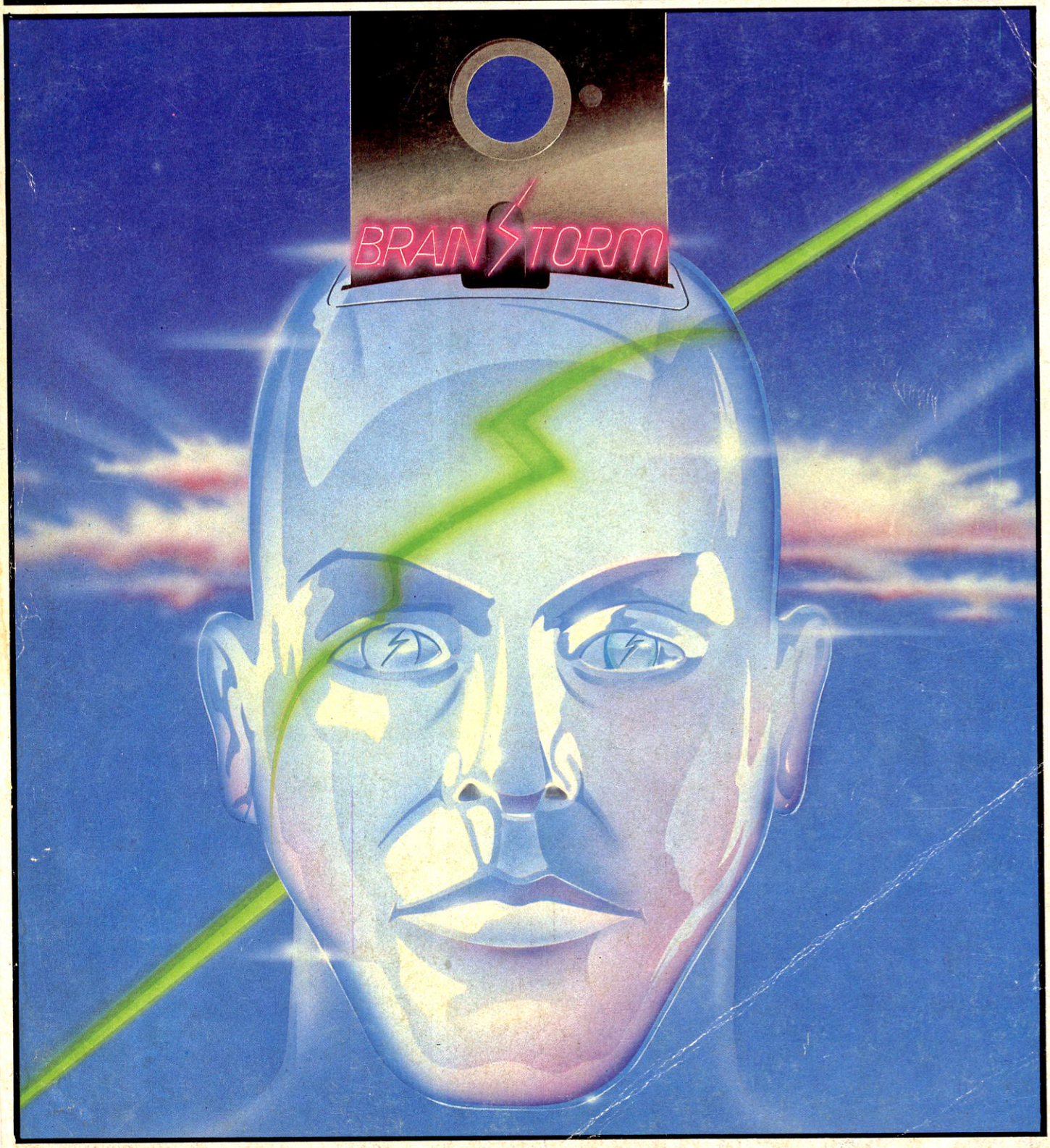

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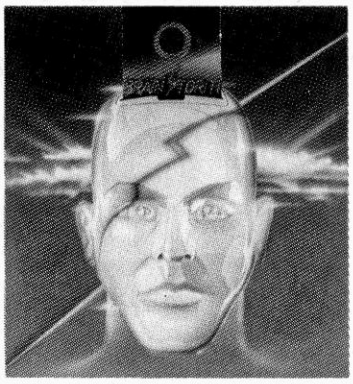

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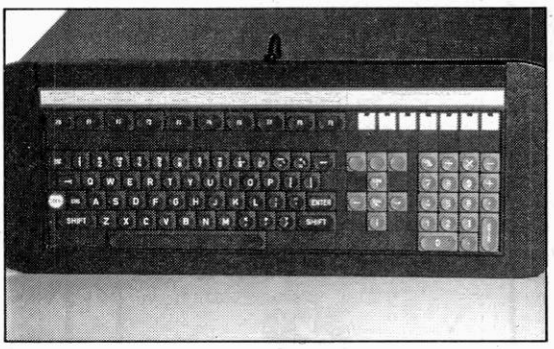

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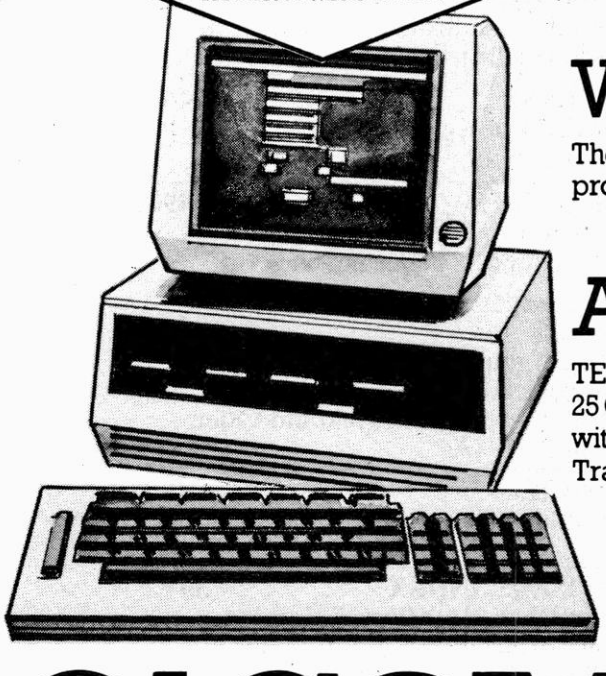

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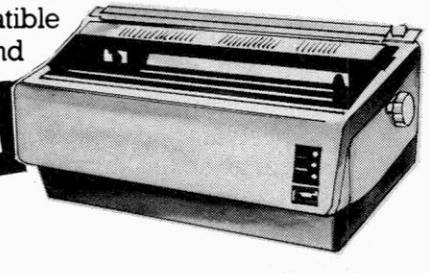

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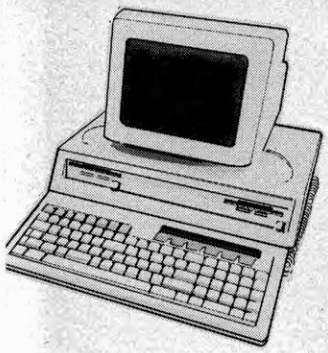

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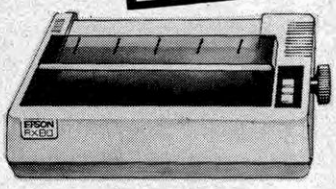

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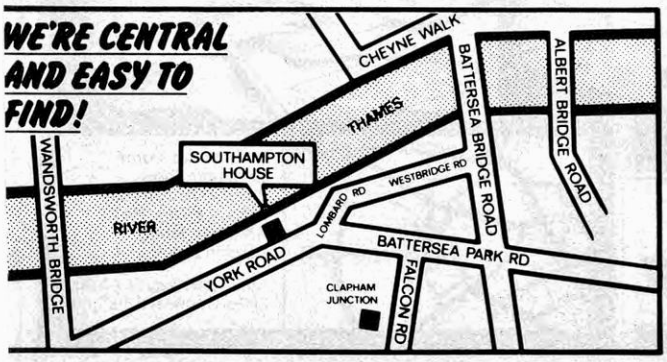

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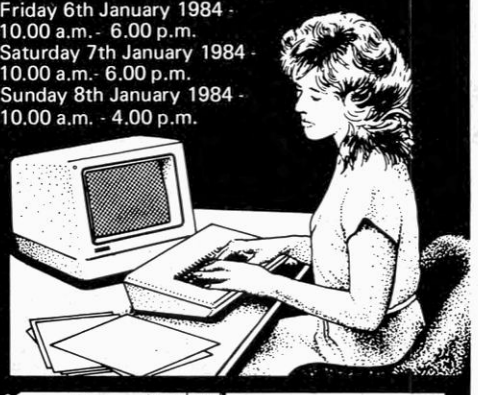

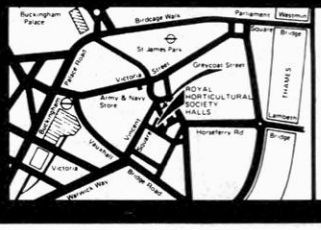

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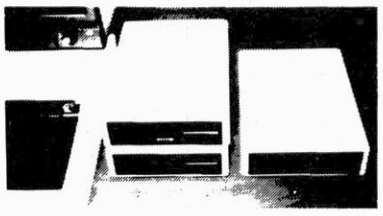

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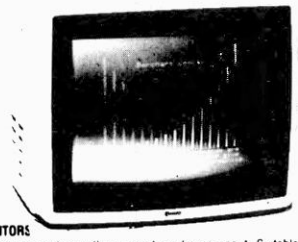

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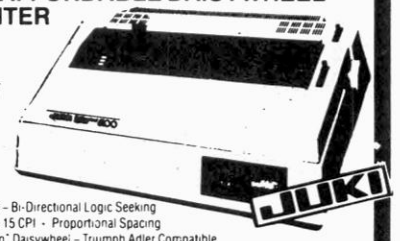

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4070	18
4071	20
4072	18
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4076	18
4077	18
4078	18
4081	18
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4162	99
4163	99
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4490	350
4500	375
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4505	185
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4512	45
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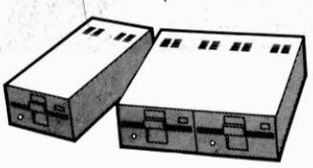

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2.457M	200	10.24MHz	200
3.276MHz	160	12.0MHz	175
3.2768M	150	12.528M	300
3.57594	98	14.31818	170
3.6864M	300	16.0MHz	200
4.0MHz	150	18.0MHz	180
4.032MHz	290	18.432M	150
4.194304	200	19.968M	150
4.433619	100	20.0MHz	200
4.80MHz	200	24.0MHz	170
5.0MHz	160	24.930M	325
5.185MHz	300	48.0M	175
5.24288	390	100.0M	375
6.0MHz	140		
6.144MHz	150		
6.5536M	200		
7.0MHz	150		
7.7328M	250		
7.168MHz	160		

IDC Connectors:

Speed Block type	PCB PLug with latch Strut Pins	PCB PLug with latch Angle Pins	Female Header Socket	Female Card-Edge Connectors
Two rows				
10 way	90p	99p	85p	120p
16 way	130p	150p	110p	—
20 way	145p	166p	125p	195p
26 way	175p	200p	150p	240p
34 way	205p	236p	160p	320p
40 way	220p	250p	190p	340p
50 way	235p	270p	200p	395p

JUMPER LEADS Ribbon Cable Assembly/DIL Plug (Headers) Single Ended Lead 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	325p
Double Ended Leads				
6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	219p	235p	345p	540p
36"	230p	250p	375p	595p

IDC FEMALE RECEPTACLE JUMPER LEADS

	20way	26way	34way	4way
24"				
1end	160p	200p	260p	300p
2end	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey Price per Foot	Colour Price per Foot
10	15p	28p
16	25p	40p
20	30p	50p
26	40p	65p
34	60p	85p
40	70p	90p
64	120p	160p

DIL PLUGS (Header)

	Solder	IDC
14pin	40p	99p
16pin	49p	106p
24pin	88p	170p
40pin	250p	265p

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41612 A + C 2 x 32 way	295p	340p	240p	300p
41612 ABC 3 x 32 way	360p	385p	260p	395p

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TWO ROWS	.1"	.156"
2x18 way	180p	145p
2x22 way	199p	200p
2x23 way	185p	
2x25 way	225p	220p
2x28 way	210p	
2x30 way	245p	
2x36 way	295p	
2x40 way	315p	
2x43 way	395p	

D CONNECTORS: Miniature

	Male 9 way	Male 15 way	Male 25 way	Male 37 way
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
	Female			
Solder	110p	160p	210p	350p
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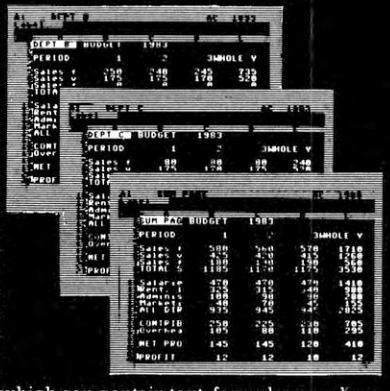

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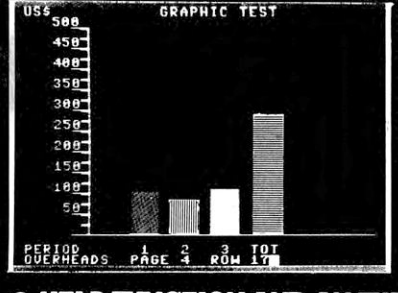

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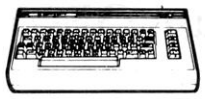

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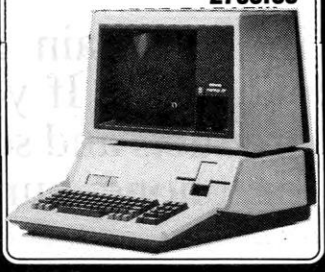

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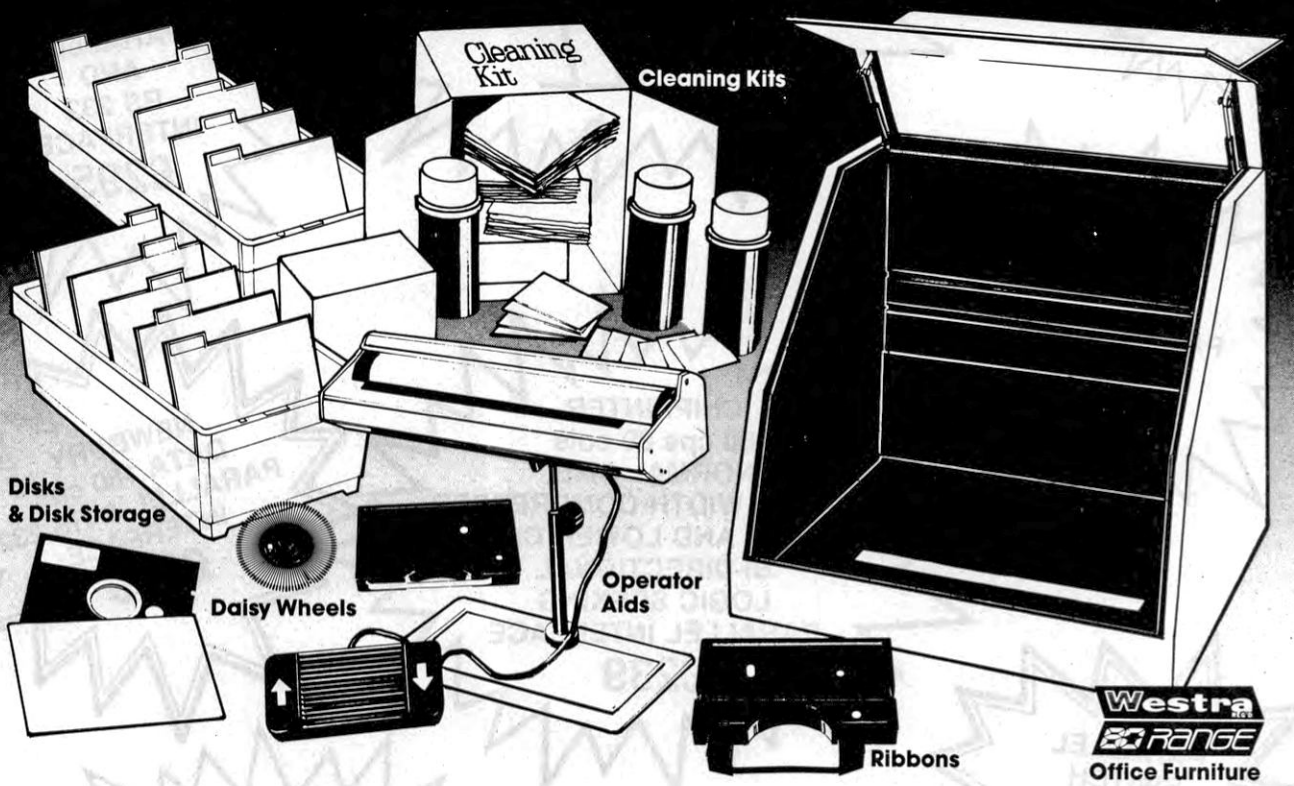

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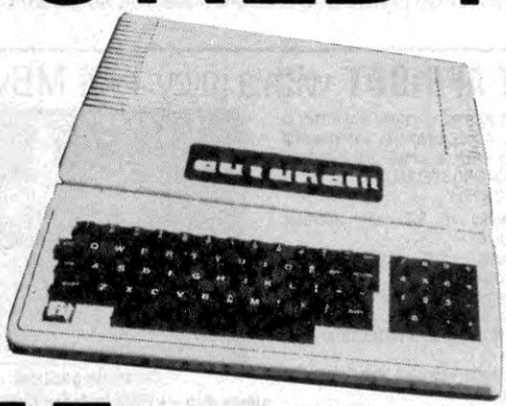

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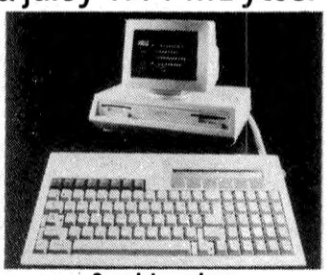

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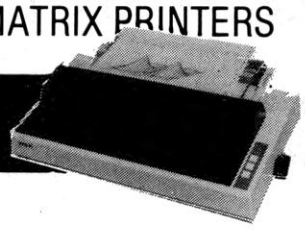

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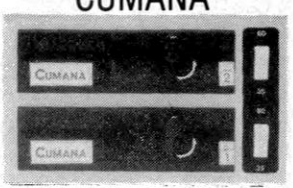

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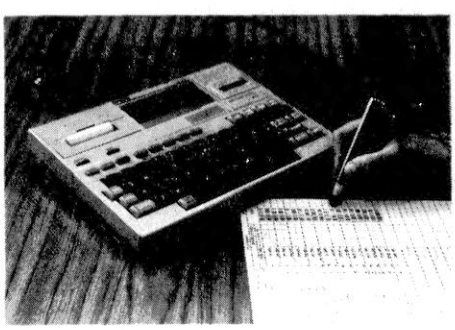

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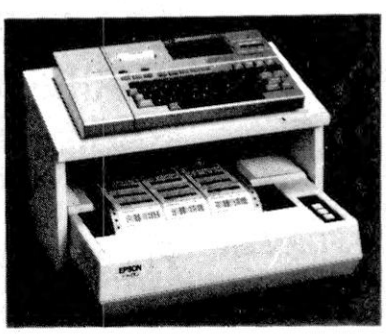

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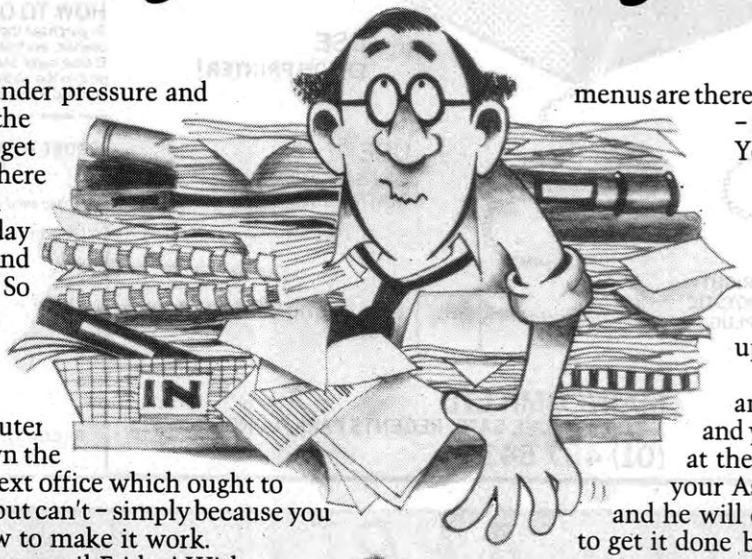

You are under pressure and you can't find the information to get the job done. Where is it? You could spend half the day looking for it. And still not find it. So you just give up and start all over again.
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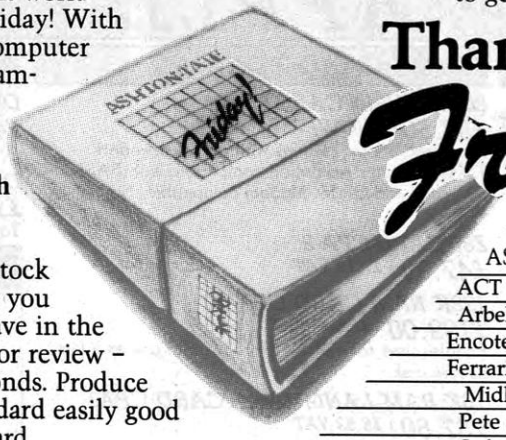

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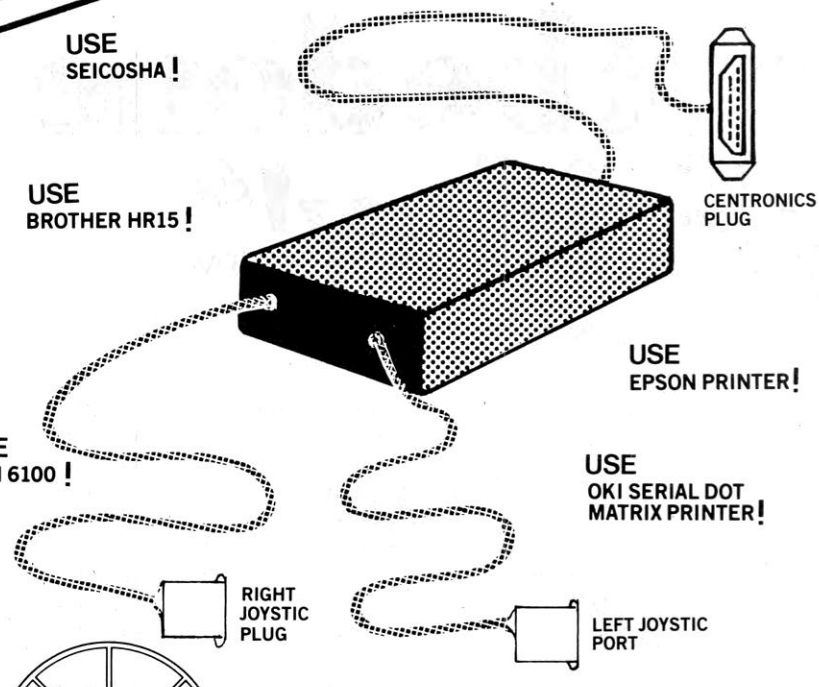

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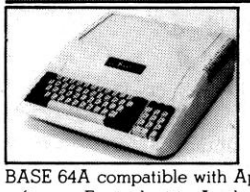

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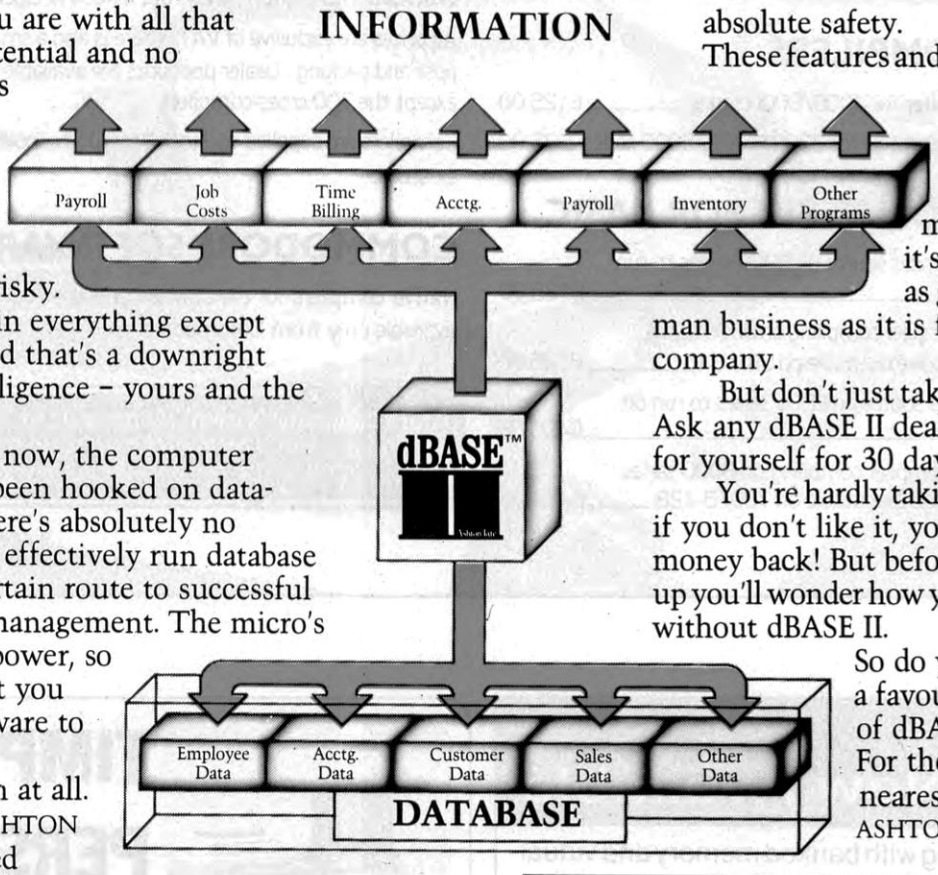

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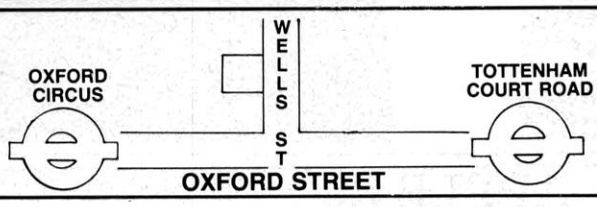

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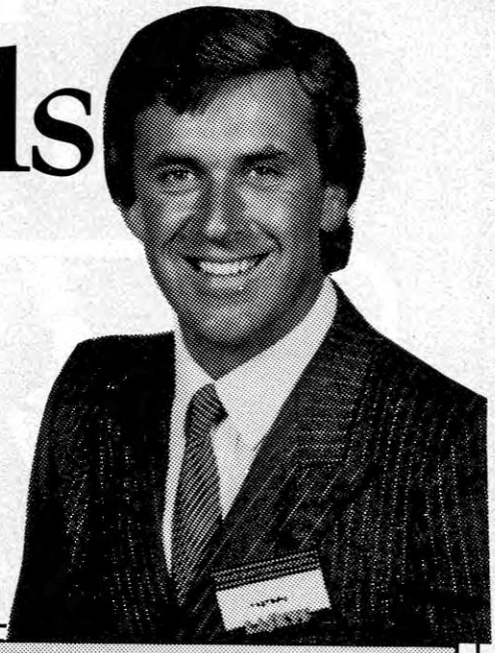

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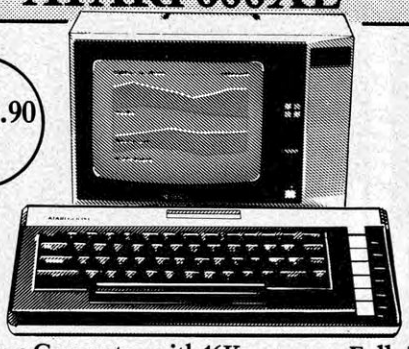

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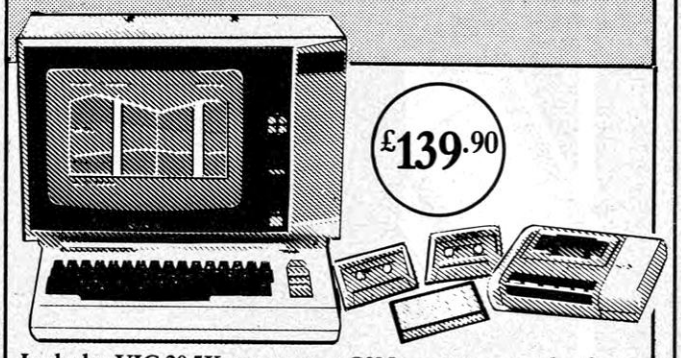

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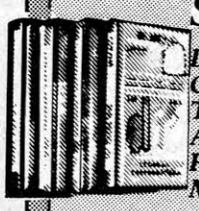

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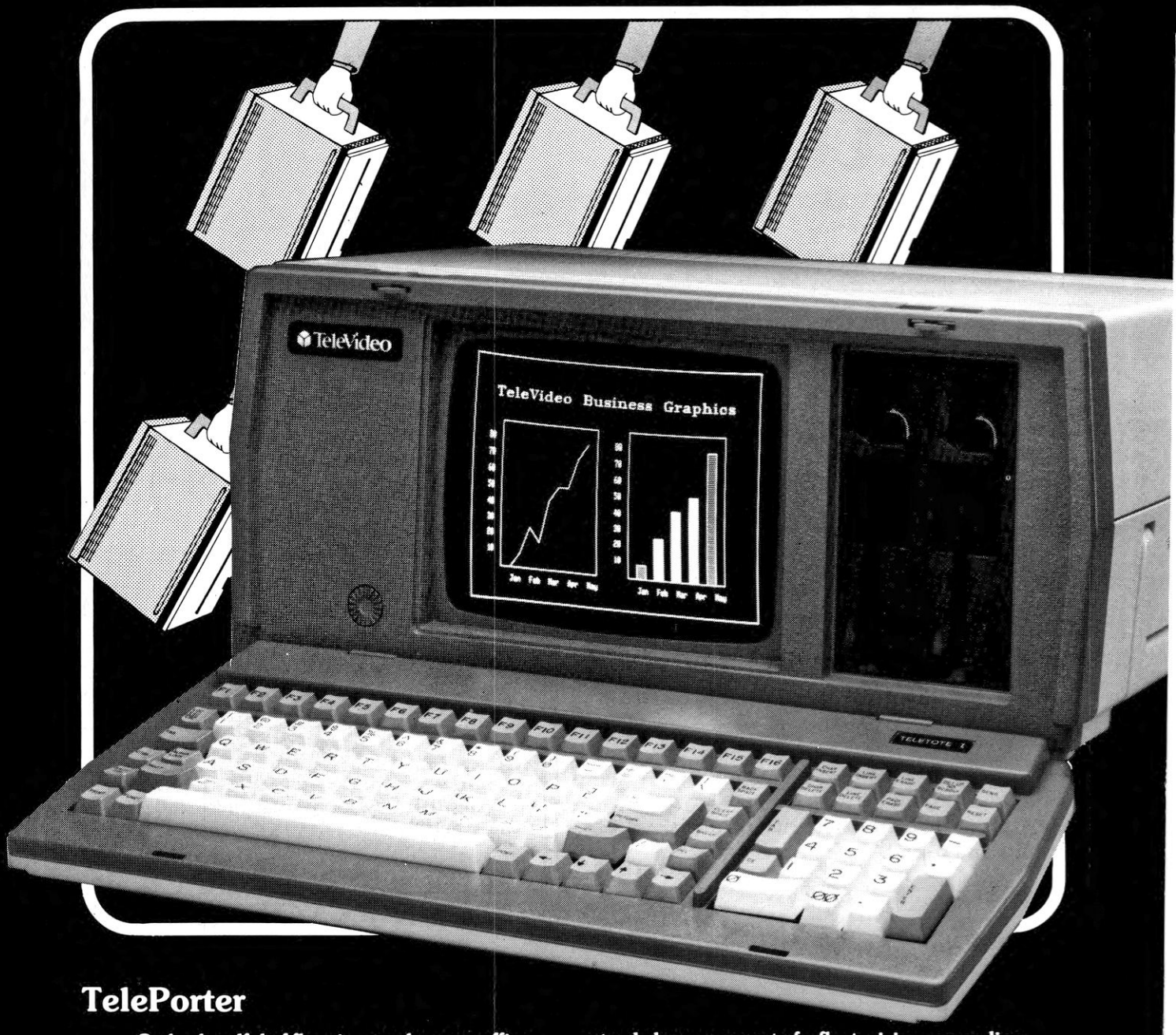

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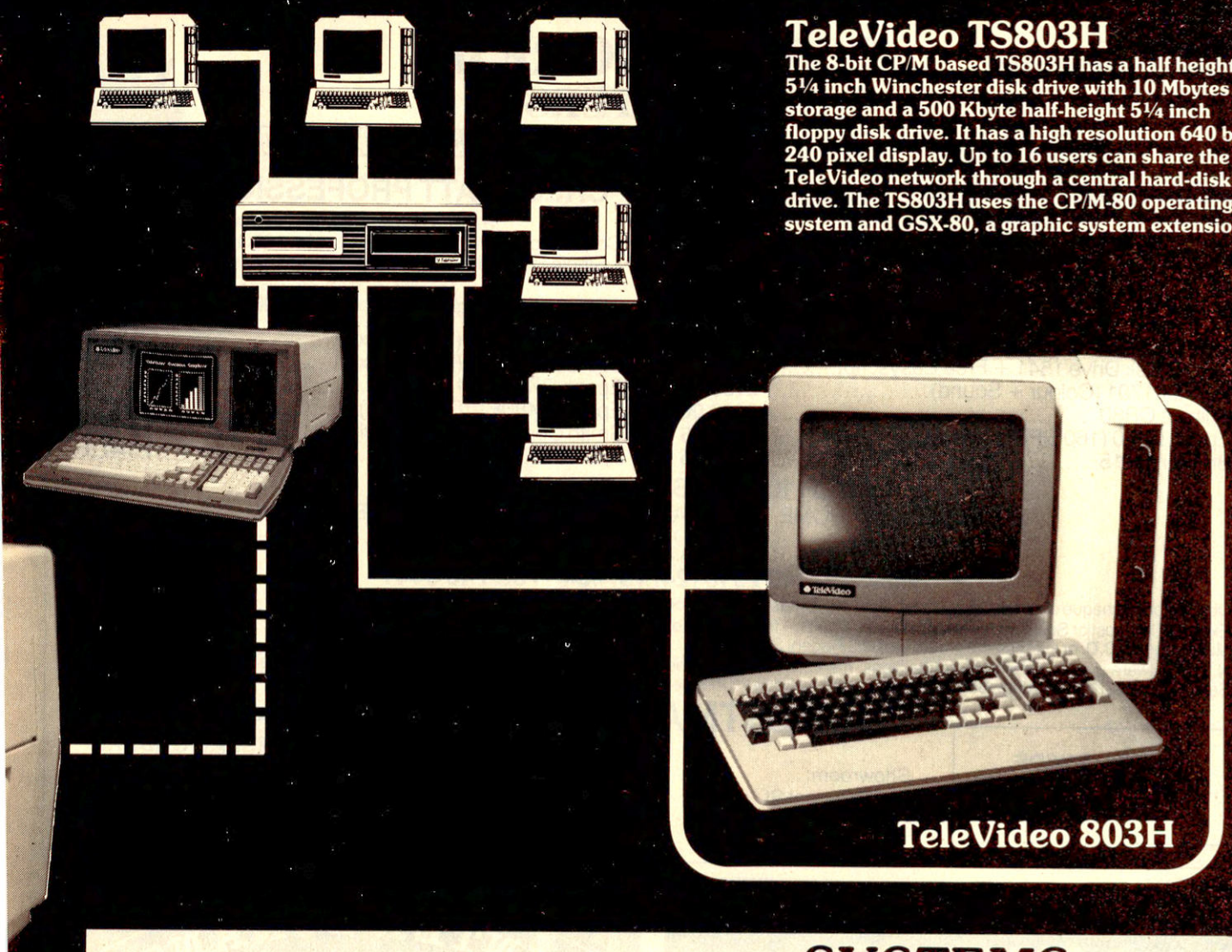

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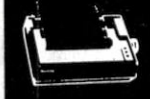

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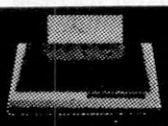

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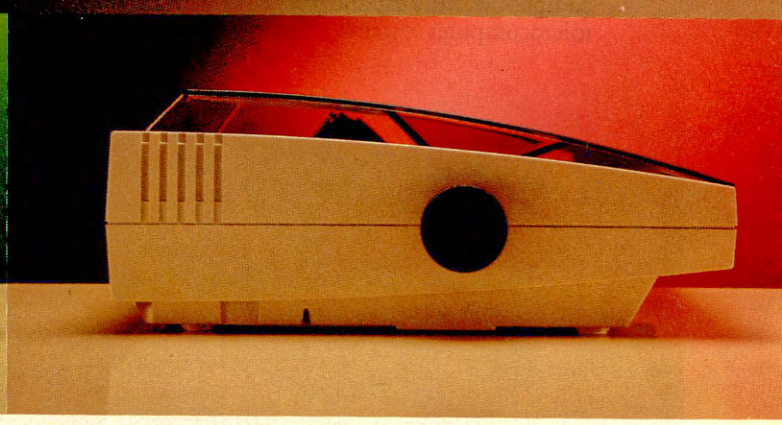

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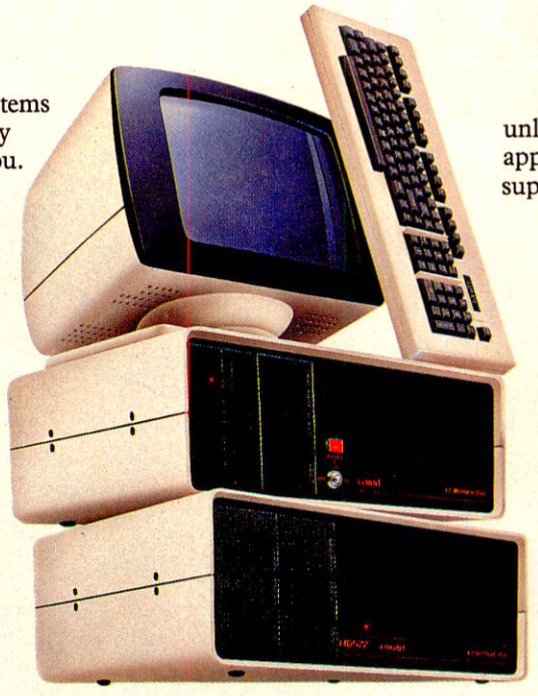

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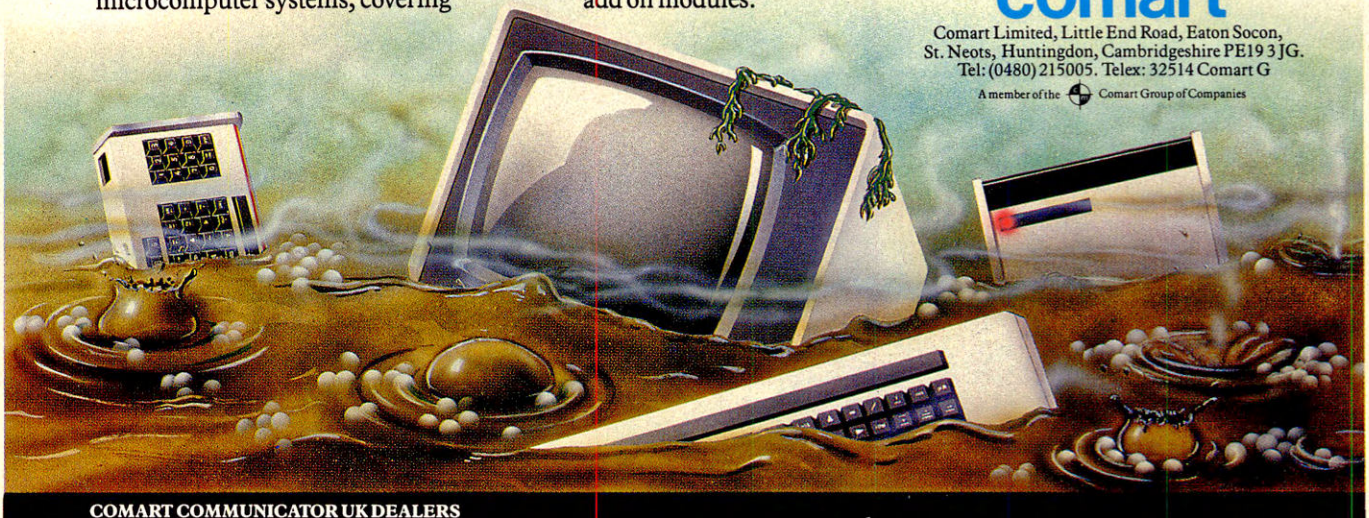

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* Delta is available for almost any microcomputer with the MSDOS, PCDOS, CP/M, or MP/M operating systems, including IBM, DEC Rainbow, SIRIUS, XEROX, ICL, EPSON and many others.

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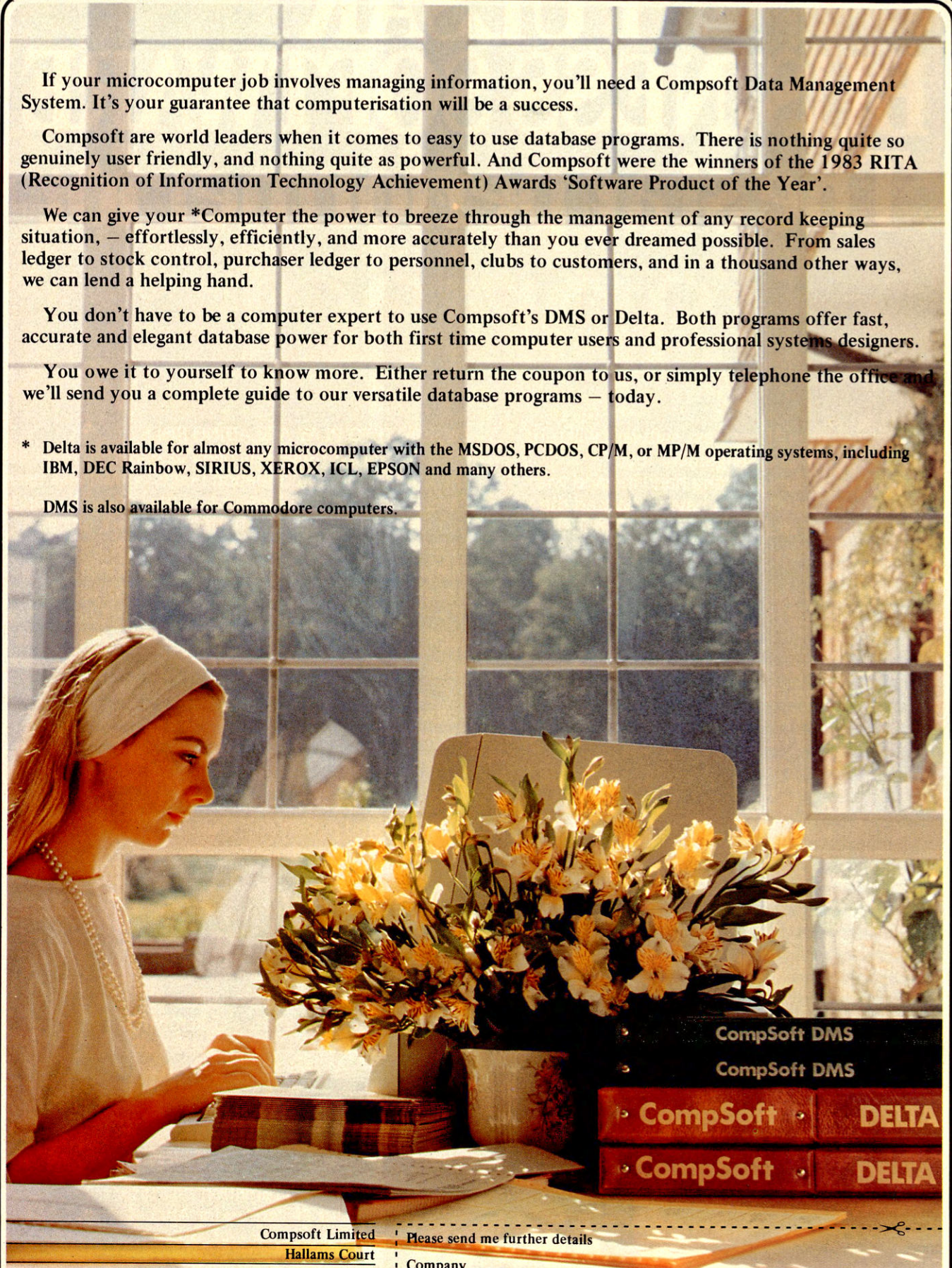

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PULSAR BUSINESS SOFTWARE
The star performer for apricot

The Pulsar range of business software will turn Apricot into a powerful management tool.

Software engineers working hand-in-hand with the Apricot development team have enhanced the range of accounting, word-processing and modelling packages to maximise Apricot's exciting fourth generation features.

Already 10,000 users of Sirius and IBM PCs have given Pulsar their seal of approval.

STAR PERFORMER

PULSAR takes the mystique out of computing without sacrificing performance. From the design of the software through to the documentation, the accent is on friendliness and ease of use, making it an effective business partner in a matter of hours.

And by harnessing the new fourth generation features of Apricot – like the unique MicroScreen™ – Pulsar has become the friendliest business software around.

Pulsar is true 16-bit software developed by ACT at a cost of over £1 million for today's business computers. Pulsar owes nothing to early 8-bit software, being developed from powerful programs written by ACT's engineers for its own bureau mainframe computers. It draws on over 18 years experience in creating packaged business software.

DESIGNED TO PLAY A LEADING ROLE

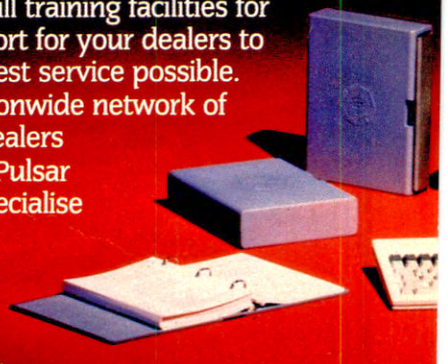
The Pulsar range has been designed to meet all the management information needs of business users. Consisting of some 15 integrated packages, the range includes commercial accounting functions, office systems for word processing and electronic mail, and management tools for planning and modelling. The integration between packages is powerful and flexible.

Shared information means files don't have to be duplicated and data does not have to be re-entered.

AND IN SUPPORT

ACT's investment in Pulsar goes beyond the software to encompass full training facilities for users and 'hot-line' support for your dealers to make sure you get the best service possible.

In addition to a nationwide network of over 500 independent dealers ACT has hand-picked 60 Pulsar Software Centres who specialise in Pulsar and can give immediate on-the-spot advice and action.



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PCW 1.84

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OCTOBER 1983
VERSION: 3.3
SERIAL : SC 17000
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The 8064 packs all the power you will ever need. Sleek and trim, yet fully expandable with eight slot expansion unit.
The newly designed compact keyboard is a piece of art in itself. The OM8064 features ultrasensitive key and single key programming commands, you will get much more including a powerful 64K dynamic RAM up to 14K of ROM, 24 line x 40 character text display with high resolution graphics a 6502 and Z80 microprocessor.

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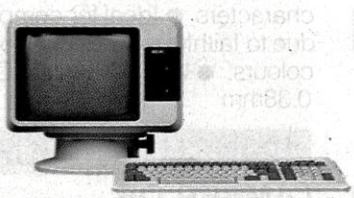


From Intelligence (UK) PLC

Seiko Business Computers have another advantage beyond their impressive hardware capabilities and software acceptance. It's the backing of one of the UK's leading companies in the small computer field – Intelligence (UK) PLC.

A national network of Authorised Seiko Business Computer dealers ensure you get the exact combination of Series 8600 hardware and compatible software you need, and a nationwide service and maintenance organisation makes sure your Seiko computer continues to serve you far into the future.

A Multi-user system

Unlike the majority of personal computers, the Seiko Series 8600 Business Computer has the capability to expand with your needs.

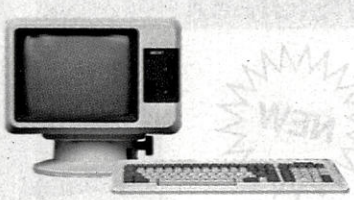
Up to four independent users can perform different functions at the same time, on the same computer, sharing their information and valuable add-ons like hard disks and printers.



More cost effective

A Series 8600 computer needs only terminals to grow and grow, and enables you to maintain your original investment in the system as your needs change.

Compare the cost of expanding your Series 8600 system to the replacement or acquisition cost of further personal computers. You'll discover that the more your system grows, the more cost effective it becomes.



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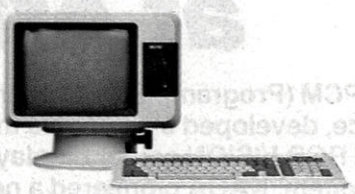

Greater choice of software

Because Series 8600 is compatible with six industry-standard operating systems an entire spectrum of high-powered, 16-bit business software is available to you. What's more, you can still use most "off the shelf" software now available for personal computers, too.

Get the facts

Expandability. Cost effectiveness. Sophisticated multi-user capabilities. Software compatibility. Competitive pricing. Ease of service. And the world-famous Seiko reputation for precision and reliability.

These are the considerations that make the Seiko 8600 so different from the field. To find out more or for the name of your nearest dealer return the coupon below to Intelligence Distribution Limited, Network House, Wood Lane, London W12 7SL. Or telephone 01 740 5758.

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PCW2

KAGA

KAGA RGB VISION
A New Era in Colour Displays at Affordable Prices

The PCM (Programmable Colour Modulation) Interface, developed by KAGA is the heart of KAGA TAXAN RGB VISION colour display series. With this PCM system, KAGA pioneered a new era in colour display well ahead of the competition. And the PCM system is now being employed by IBM™ and other leading manufacturers in colour displays for their computers.

The PCM system makes it possible to display the colours unique to each computer manufacturer's programming because it uses a linear amplifier for colour signals. This was not possible with the digital amplifiers used in older colour monitor designs.

The PCM system goes farther – it can display limitless colour variations when used with a personal computer. Gone is the idea that the RGB colour monitor for personal computers can display only eight colours!

In the first ten months after its introduction, KAGA TAXAN RGB VISION has been the choice of more than 40,000 buyers for use with their personal computers.

In Europe, KAGA TAXAN RGB VISION is being used as the display unit for highly advanced communications systems, demonstrating the multiple compatibility of RGB VISION colour monitors.

RGB VISION-I £239 or less

● Low-cost, compact 12″ RGB colour display capable of displaying 1,500 characters ● Slit pitch: 0.63mm

RGB VISION-II £285 or less

● 12-inch RGB colour display capable of displaying 2,000 characters ● Display capable of virtually an unlimited number of colours, due to use of linear amplifier ● Slit pitch: 0.47mm



RGB VISION-III £399 or less

● High resolution 12-inch colour display capable of displaying more than 2,000 characters ● Ideal for computer graphics due to faithful reproduction of intermediate colours. ● Uses non-glare CRT. ● Dot pitch: 0.38mm

VISION-P/C £399 or less

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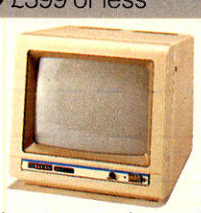

● New cabinet design to complement the IBM PC™ ● High-resolution 12-inch colour display for exclusive use of IBM P/C™ ● Dot Pitch: 0.38mm

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NEW



● Ultra-low-cost lightweight, compact 12-inch colour monitor. ● Capable of input by both PAL VIDEO SIGNAL and RGB separate input signal. ● 0.7W Audio speaker. ● Slit pitch: 0.63mm

12-INCH MONOCHROME (AMBER OR GREEN DISPLAY)

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● Fully compatible with most computers and word processing systems. ● Wide video bandwidth (18MHz) for clear, sharp picture. ● Compact design and light weight (7kg). ● Low power consumption (26W)

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COMPATIBILITY

KAGA monitors are compatible with all popular micro computers. Apple,™ IBM,™ Acorn/BBC,™ Commodore,™ Oric,™ Dragon,™ Research Machines,™ Osborne,™ Tandy,™ Sinclair™ (with interface), you name it, KAGA's made for it. KAGA TAXAN RGB Monitors have built-in switchable interface allowing simple plug-in compatibility for most micros with RGB output.

Apple IIe and II RGB adaptors and RGB Cables for most popular micros are available from Data Efficiency for the KAGA TAXAN range.

RELIABILITY

KAGA TAXAN monitors have proven to be among the most reliable displays around, and are all backed by a full 12 months warranty.

AVAILABILITY

Wherever you are, there's a Data Efficiency KAGA dealer close at hand to advise and help you **before** and **after** you choose your KAGA monitor.

Trade and OEM enquiries welcome.

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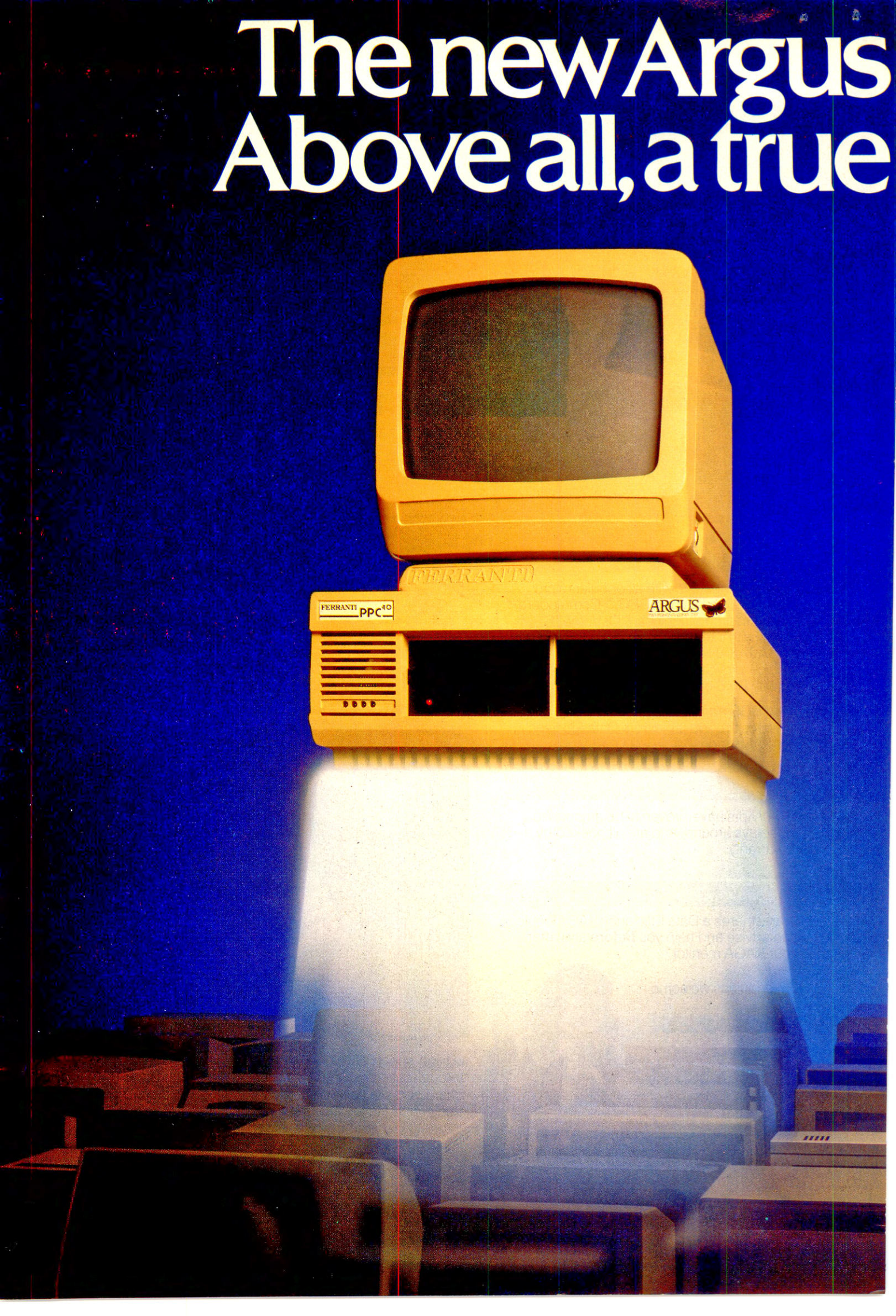

Pro-personal. 16-bit computer.

On performance alone, the new Argus Pro-personal computer is way above the rest.

It's a true 8086-based 16-bit machine. And it's fast–8MHz.

Our Argus Pro-personal also gives you a choice of backing store from floppy right up to big Winchesters, and memory up to 896K.

So you've got the capacity and speed for professional-sized programs, and that means savings in expensive professional time.

A New World of Software

Running industry-standard CP/M-86†, the Argus Pro-personal opens your door wide to a vast array of 16-bit application software.

Ferranti also supplies software packages for major applications such as word processing and spreadsheet calculations. Of course the Argus Pro-personal can also run your existing 8-bit software.

It adds up to all the power and capacity you need. Benchmark tests have proved it outperforms its competitors.

A Complete Package Puts You One Up

Right from the start the Argus Pro-personal gives you what you want. CP/M-86† and BASIC are included. So is 128K of memory–and it's all available to you because the VDU has its own memory for both alphanumerics and high resolution graphics.

Check this out against the competition.

A Computer With the Human Touch

For all its professionalism, the Argus Pro-personal computer is easy to live with. It's user-friendly in every way. Compact and good looking, with clear characters on an anti-reflective screen. The VDU tilts and swivels, and the keyboard, VDU and processor box can be placed to suit the operator.

CP/M-86† is menu-driven so it's easier to use.

If You're Launching an Automated Office

The Argus Pro-personal with the rest of the Ferranti office product range allows access to mainframe computers, so if you want it to be part of a general office automation scheme, there's no problem.

You're On Firm Ground With Ferranti

Behind the Argus Pro-personal computer, a product at the leading edge of a fast moving technology, is a company with over 20 years in the computer business.

Ferranti has an unsurpassed reputation for quality assurance and reliability.

So, your investment is protected for the longest possible time. And you get a first-class maintenance service to back it up.

For a high-flying computer the Argus Pro-personal price tag is remarkably low level.

It starts at just £2,800.

Ferranti Computer Systems Limited,
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Telephone: 061-499 3355, Telex: 668084

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†CP/M-86 is a trademark of Digital Research Inc.

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ARGUS
PRO-PERSONAL COMPUTER

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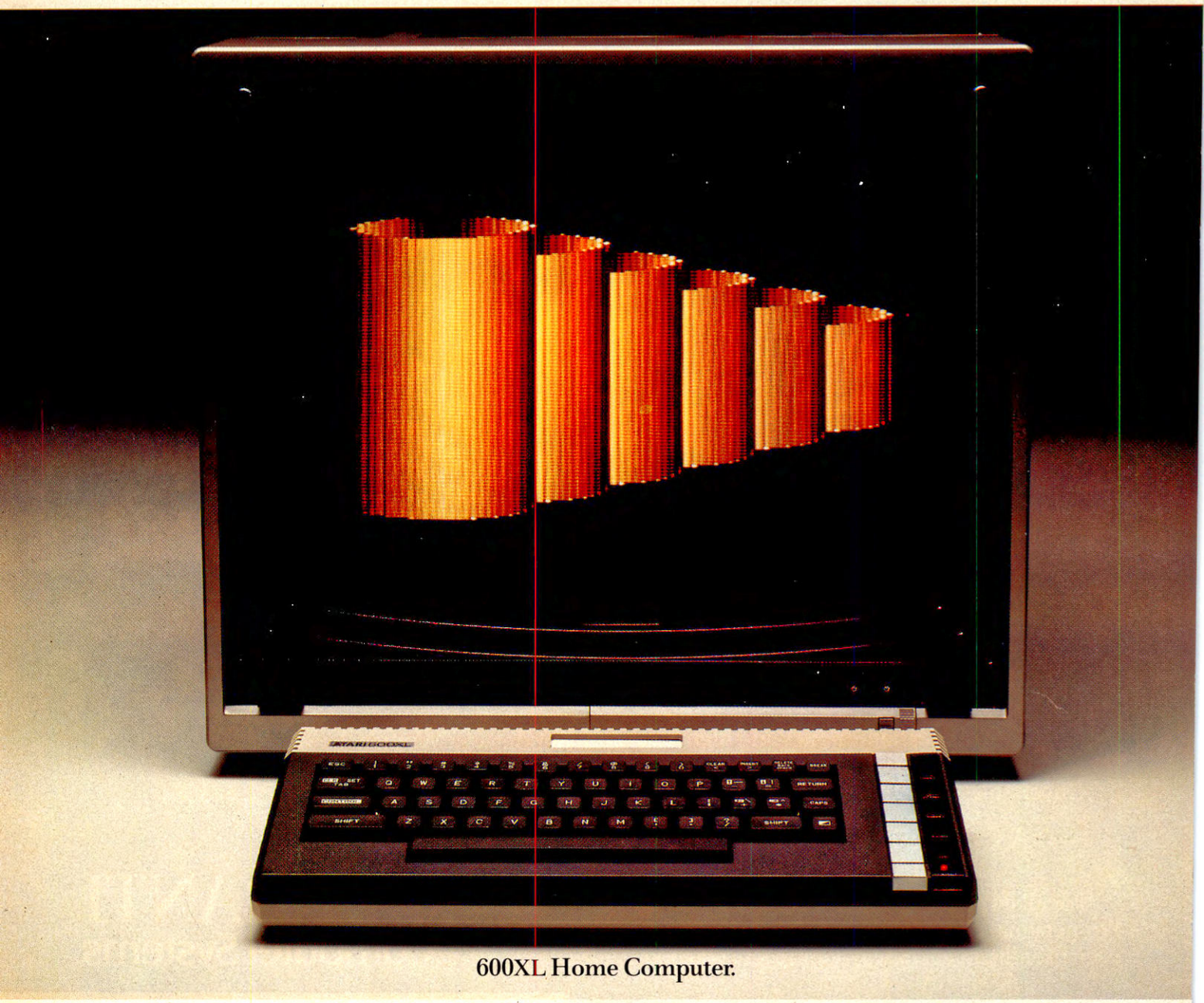

600XL Home Computer.

Whatever you want your home computer to do, the ATARI 600XL™ can do it.

ATARI 600XL product specifications.

Colour capabilities: 16 colours and 16 intensities. 256 shades.

Memory: 16K RAM expandable to 64K with memory expansion module. 24K ROM operating system including ATARI BASIC programming language.

Sound: 4 independent sound synthesisers. Each with a 3½ octave range.

Display: 11 graphic modes. 5 text modes. Up to 320 x 192 resolution. Maximum text display 24 lines by 40 columns.

Special ATARI integrated circuits: GTIA for graphics display. POKEY for sound and controller ports. ANTIC for screen control and I/O.

CPU: 6502C microprocessor. 0.56 microsecond cycle. 1.8 Mhz.

Extended graphics functions: High resolution graphics. Multi-coloured character set. Software screen switching. Multiple redefined character sets. Player missile (sprite) graphics. Fine screen scrolling. Changeable colour registers. Smooth character movement. Simple colour animation facilities.

Programming features: Built in ATARI BASIC programming language plus 8 other languages. HELP key will provide additional information and menu screens. Syntax checking on entry.

Input/Output: External processor bus for expansion with memory and peripherals. 2 controller ports. Serial I/O connector. Monitor output.

Software: Over 1000 items of software available including self teaching programs with unique voice over. Education. Home management. Programming aids. Atari user written programs (APX). And Atari's famous entertainment software.

rience grows Atari 600XL.



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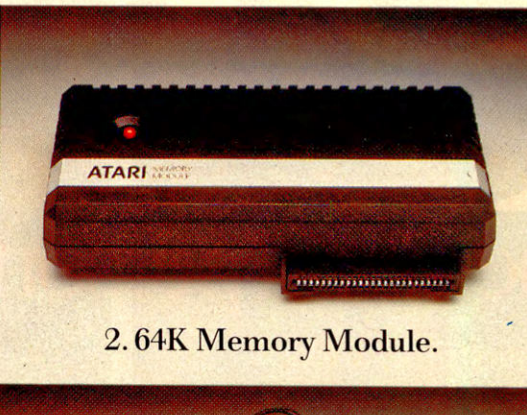
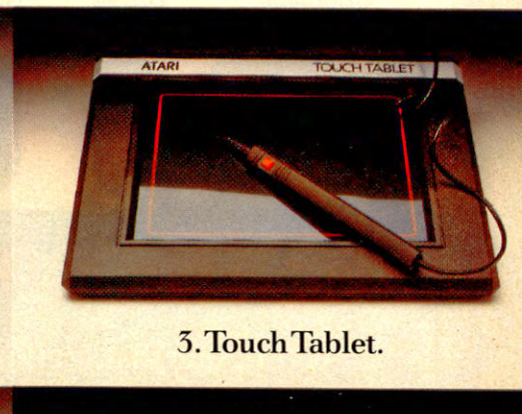


2. 64K Memory Module.



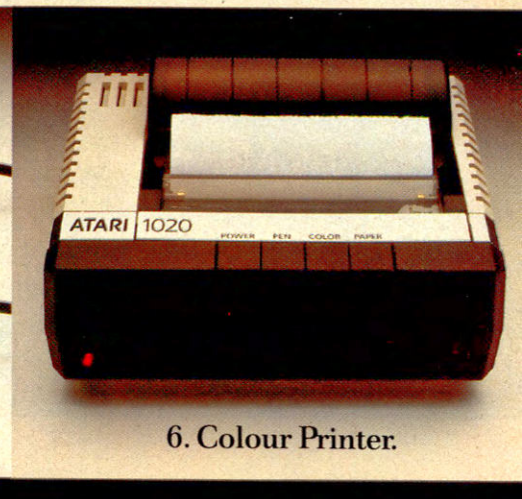
3. Touch Tablet.



4. Trak Ball™ Controller.



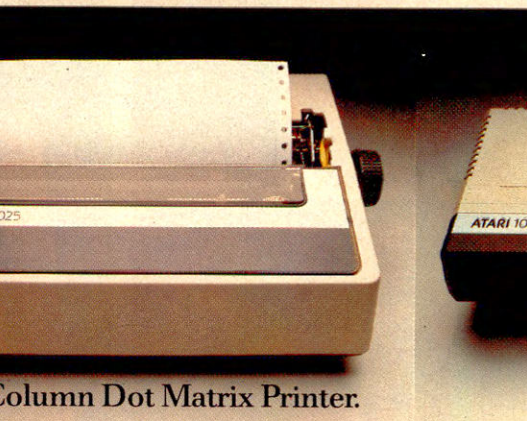
5. Super Joysticks.



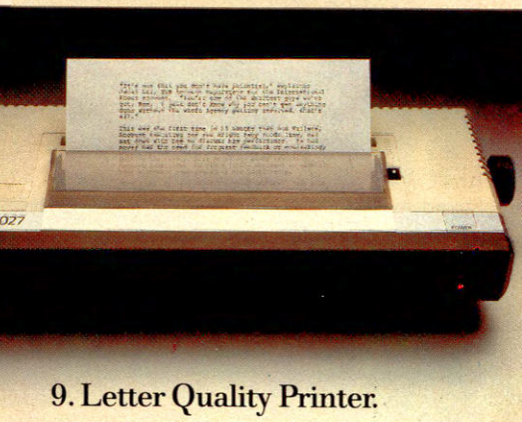
6. Colour Printer.



7. Disk Drive.



8. 80 Column Dot Matrix Printer.



9. Letter Quality Printer.

These peripherals will be available soon:

1. ATARI 1010™ Program Recorder for low ost storage and retrieval capability. Data ansmission 600 baud. Storage capability 00K bytes on a 60 minute cassette. Track onfiguration 4 track, 2 channels (digital nd audio). Auto record/playback/pause ontrol.

2. ATARI 64K Memory Module gives the 00XL a massive 64K RAM.

3. ATARI Touch Tablet enables you to aint pictures and draw diagrams, with the ouch of a stylus.

4. ATARI Trak Ball™ Controller enables cursor movement in any direction; adds to the pleasure of Atari games.

5. ATARI Super Joysticks. Gives you a greater competitive edge over your games.

6. ATARI 1020™ Colour Printer plotter. Four colour graphic print capability. 40 column. 10 characters per second. 5, 10 and 20 characters per inch.

7. ATARI 1050™ Dual Density Disk Drive. 5¼ inch disks holding 127K randomly accessible bytes provides both expansion and flexibility for your 600XL system with DOS III.

8. ATARI 1025™ 80 Column Dot Matrix Printer prints 5, 10 or 16.5 characters per inch. 40 characters per second. Ideal for program listings, financial reports, etc.

9. ATARI 1027™ Letter Quality Printer for word processing letters in professional type.

If you'd like to know more about the ATARI 600XL, write to Atari International (UK) Inc., P.O. Box 407, Blackhorse Road, London SE8 5JH and we'll send you all the details.

The new Atari XL home computer system.

ATARI®

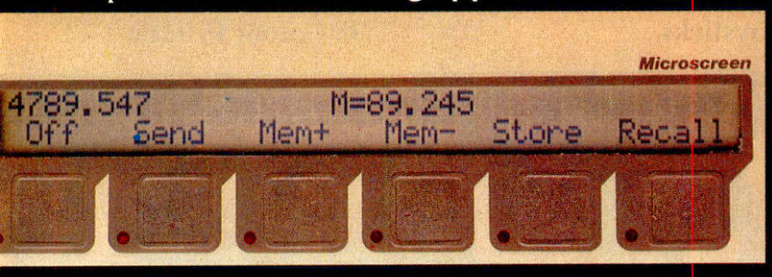
®ATARI and design. Reg. U.S. Pat and TM Off. TM: Trademark of Atari Inc. The ATARI 600XL is compatible with ATARI 400 and 800 programs.

apric

The 4th generation personal computer

A computer that, for the first time, works with you rather than just for you. Hardware and Software co-ordinating perfectly, Apricot arrives complete and ready to work.

The MicroScreen™ on the keyboard, unique to Apricot, performs a variety of practical functions—as a calculator, calendar, time display, and as a window on the screen. Most significantly the MicroScreen™ prompts and assists the user by presenting simple options whilst running applications.



Incorporating the very latest advances in computer technology, Apricot uses 3½" pocket-size diskettes. Secure and compact, yet offering increased storage capacity.



As you'd expect with a 4th generation system, Apricot offers true 16-bit processing, multi-processor architecture and 256k RAM as standard.

With Pulsar 16-bit business software and compatibility with the best selling ACT Sirius 1 and IBM PC, Apricot already has the largest available software library.



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Apricot includes over £750 of software—SuperCalc spreadsheet, business and communications software—to ensure that your system is immediately effective.

And because executives are not office bound, Apricot offers portability, a further feature aimed at improving efficiency.

Powerful sleek and sophisticated—and all at an amazing 4th generation price.

Go 4th from £1495

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PCW JAN

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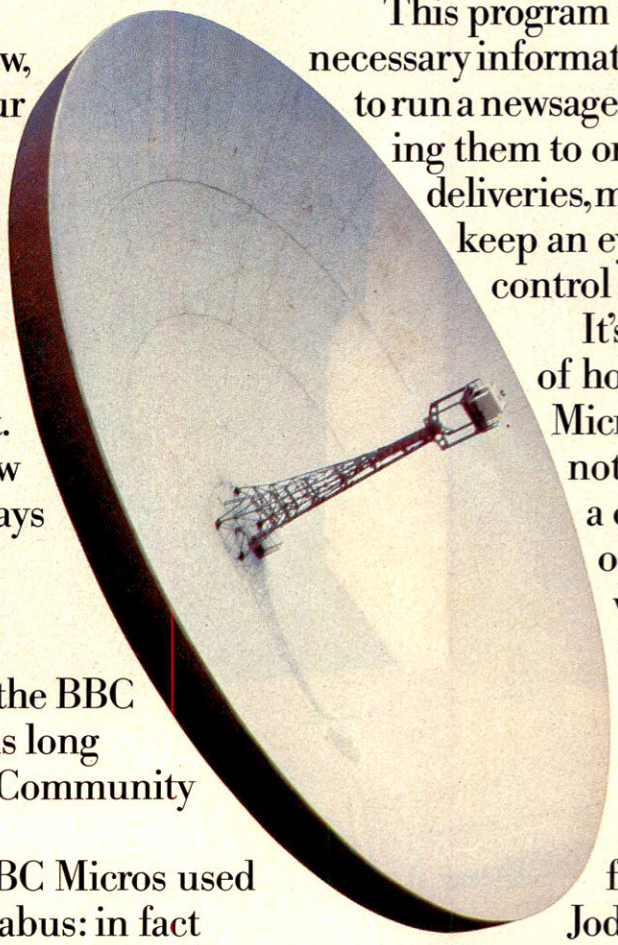
The BBC Micro is the ideal family computer–simple to operate, yet fast, powerful, with enormous potential.

But it's nice to know, when you buy one for your home, that the business, educational and scientific worlds agree with your choice.

Here are a few stories to illustrate how the BBC Micro gets out and about. And one to remind you how helpful it can be when it stays at home.



A practical lesson in business admin.

The contribution of the BBC Micro in the classroom has long been recognised at Perins Community School in Hampshire.

The School has 12 BBC Micros used extensively across the syllabus: in fact some pupils are using them to study for their GCE O Levels in computing.

One of the programs available to Perins teachers such as David Beck, pictured below with his class, is "Newsagent."

This program contains all the necessary information for the class to run a newsagent's shop; allowing them to organise daily deliveries, make up bills and keep an eye on stock control and ordering.

It's a nice example of how the BBC Micro can be used not only to acquaint a class with the language of computers, but also with some of the realities of the community in which they live.



Correcting Jodrell Bank.

The BBC Micro is a familiar worker around Jodrell Bank.

You'll find it in the reception area explaining the workings of a radio telescope to visitors, for example.

But it's also been helping in a more testing task: to improve the performance of the Defford telescope.

In this application it has been used to make calculations necessary to determine the precise parabolic shape of the dish.

Theodolites are used to do the measuring–then the BBC Micro works out the necessary corrections.

The end of the scrawl.

If any of you have noticed how much easier it is to read and understand labels on drugs and medicines these days, then you can most probably thank the BBC Micro. John Richardson, a Preston pharmacist, was first to realise how a micro with a suitable printer could produce labels that were accurate and legible and which could include, automatically, such information as drug reaction warnings.



At the same time it could record drug usage for better stock control.

He chose the BBC Micro for its versatility and potential for expansion.

John Richardson believes that this system will be recognised as standard in the profession and be used in hospitals, health centres and pharmacies throughout the UK.

Meanwhile back at home.

Dr. & Mrs. Yarwood bought a BBC Micro as a birthday present for their 12 year old daughter.



However, it quite quickly became common property.

All three can now write their own programs. Mrs. Yarwood is particularly proud of one program she has compiled to help teach her daughter French vocabulary.

They all agree that although the Micro is fast and powerful enough to be at home in Jodrell Bank, it is also the ideal computer at the Yarwood home: simple to set up (virtually any TV set and cassette player is all you need) and simple to use.



All this for only £399.

The BBC Micro comes with a comprehensive, step-by-step User Guide which introduces you to your micro and shows you how to construct useful programs of your own.

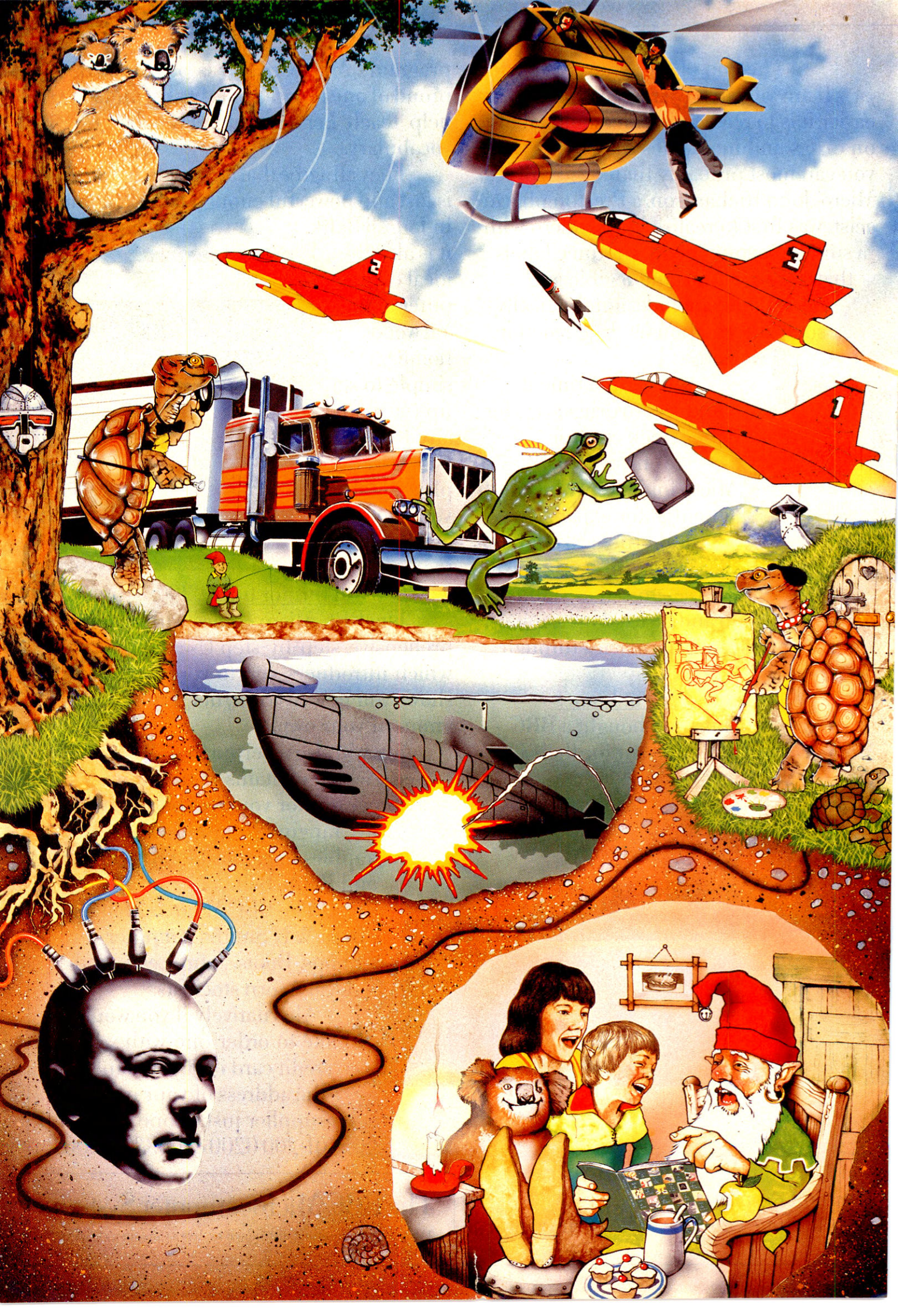
You will also receive a free "Welcome" cassette which contains 15 different programs for you to experiment with, ranging from music and graphics to games like Kingdom and Bat 'n' Ball.

The BBC Micro is available from W H Smith Computer Shops, Boots, John Lewis and local Acorn stockists.

Alternatively if you would like to order one with your credit card or if you want the address of your nearest supplier just phone 01-200 0200 or 0933-79300.

The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.


2
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1

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You're the pilot. Climbing, diving, swooping in on an enemy fortress. A barrage of missiles and gunfire will try and stop you. Just when you think you're through, a powerful robot's lethal homing missile zaps you...or does it?

2. Frogger *by Sierra On-Line.*

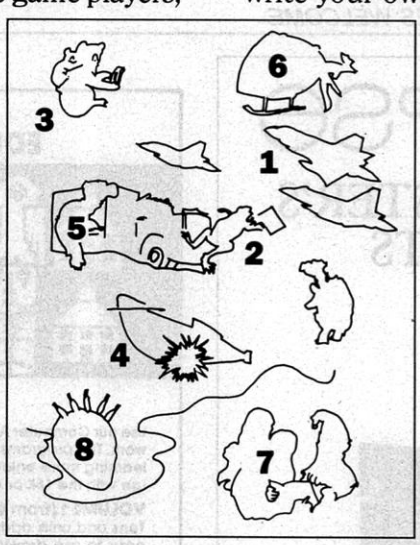
Now you're a frog stranded a long way from home. A perilous journey awaits you. Once across the busy motorway, a surging river full of logs, turtles and alligators awaits. Better flex those Froggy leg-muscles though, the bank is steep, so look before you leap!

3. KoalaPad Touch Tablet *by Koala.*

You can't overfeed this Koala — he'll make his own menu selections. He'll also move game players, make musical notes, draw computer graphics and much more. The KoalaPad Touch Tablet is an accessory that'll enhance the capabilities of your home computer system.

4. Sea Dragon *by Adventure International.*

Take a deep breath — you'll need it to navigate your sub through a labyrinthian underwater passage to free the menace of the imprisoned Sea Dragon. Mines, electrifying eels and lethal laser beams await you in this murky underwater world. You've limitless torpedoes, but limited air, so hurry!



5. Turtle Graphics II *by HesWare.*

This Turtle's about to paint the town red. Or green. Or blue with pink spots. By teaching him to paint, draw and colour he'll teach you, painlessly and enjoyably, the basics of computer programming — maths, logic, communications and more with over sixty commands. Ideal for children from six to sixty.

6. Choplifter *by Broderbund.*

Sixteen hostages are holed up in an inaccessible barracks. Only an ace chopper pilot can free them — you!

Watch out for the tanks, they'll crush anything. They're just for starters — fighter jets and the awesome homing air-mines are yet to come. Good luck . . . you'll need it!

7. Kids and the Apple/Atari *by Datamost.*

These books will teach you, simply, how to write your own programmes. Step-by-step instructions teach you how to create your own action, board and word games. Programme your finances or even learn another language — whatever you do, you'll get the most out of your home computer.

8. Suspended *by Infocom.*

20 miles beneath the earth's surface your brain is wired to a computer network. You'll strategically manipulate 6 robots to overcome a myriad of realistic and original problems as you try to maintain surface-side equilibrium. But don't worry, the end is in sight — you're only there for 500 years!

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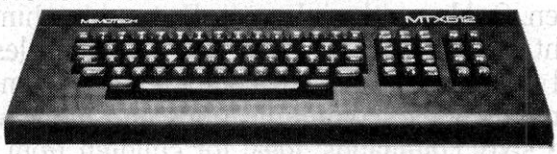

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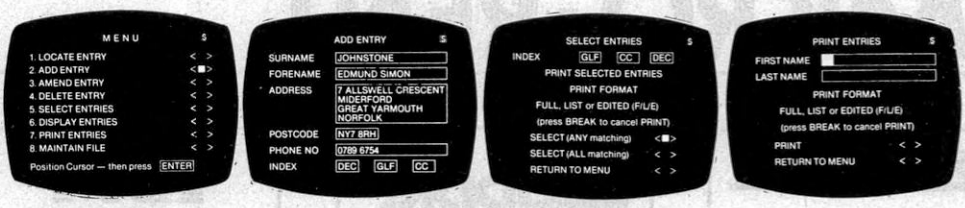
ADDRESS MANAGER utilises the same "on the page" presentation as FINANCE MANAGER and offers Spectrum owners a professional standard address filing, indexing and retrieval system. Below are examples of the screen presentations.



ADDRESS MANAGER has been carefully constructed to provide the user with a tool that is extremely friendly and easy to use, the speed and presentation of this program are second to none.

ADDRESS MANAGER features **MULTIPLE INDEXING** via our 3 way 3 character index, an ability to store over 400 full names and addresses or 1500 individual names/titles.

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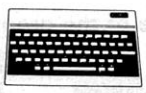

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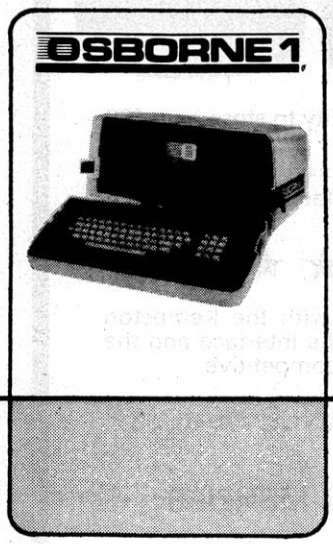

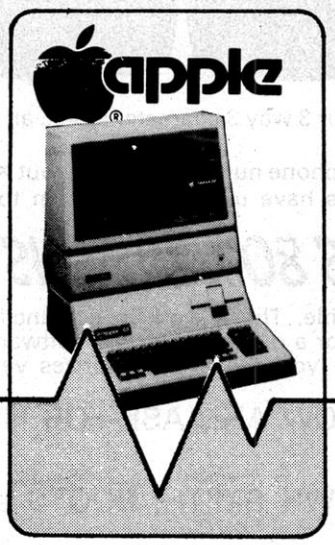

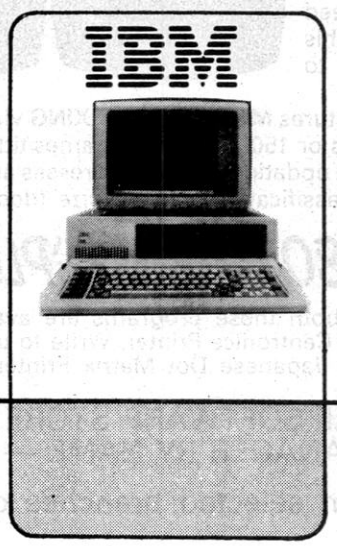

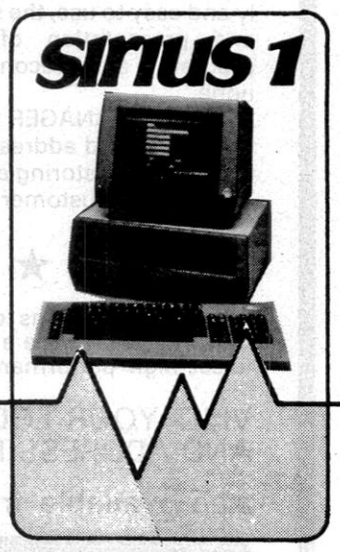

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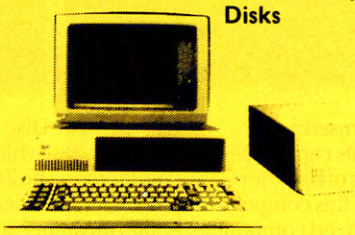

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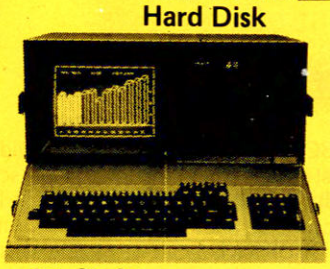

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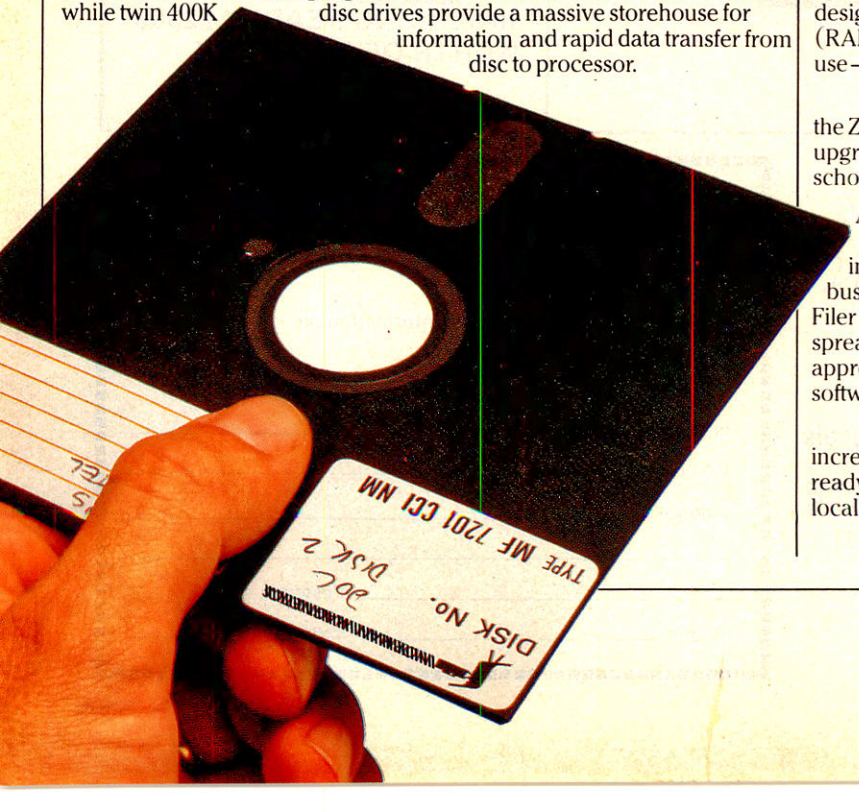
The BBC Model B microcomputer is widely recognised as an impressive first computer for the home or the school, but its capabilities are restricted by its lack of data storage and the limitations of Basic for serious programming. For the user who needs more from this computer the Torch Z80 Disc Pack is a gateway to the world of advanced computing.

Model B's fitted with disc interface can be upgraded to full business machines by the Torch Z80 Disc Pack thereby offering the use of more powerful and flexible languages such as Fortran, Pascal, BCPL and Cobol, while twin 400K disc drives provide a massive storehouse for information and rapid data transfer from disc to processor.



The Disc Pack includes a second processor – the proven and reliable Z80 which powers Torch's highly acclaimed C-series business computer. The Z80 co-operates with the Model B's own 6502 chip, delegating screen and peripheral handling to provide faster access speeds than any other comparable disc drive system.

In addition to accepting the BBC's extensive range of software, the Z80 Disc Pack supplies Torch's own CP/M® – compatible Network operating system, based in Read Only Memory (ROM). This advanced design means that almost all of the 64K of Random Access Memory (RAM) provided on the Z80 board is available for CP/M programming use – an advantage that no other BBC micro upgrade can offer.

If your BBC micro has the Econet® option, there is a further benefit the Z80 Disc Pack can provide. Torchnet can link together up to 254 upgraded Model B's on a local area network, so for enthusiasts' clubs and schools it is a simple and low-cost way to set up a local area network.

At only £730*, including installation at your dealer, the Torch Z80 Disc Pack offers real value for money. It is supplied with an impressive package of software including the PERFECT® range of business software comprising Perfect Writer (word processing) Perfect Filer (database management) and Perfect Calc (advanced, powerful spreadsheet). Add to that COMANEX® the interactive management game, approved and used by leading Management Consultants – and you have a software package valued at over £1,000.

The Torch Z80 Disc Pack is a proven and cost-effective way of increasing the computing power of your BBC Model B micro, so if you are ready to take a step into the world of serious computing, contact your local dealer, listed on the facing page.

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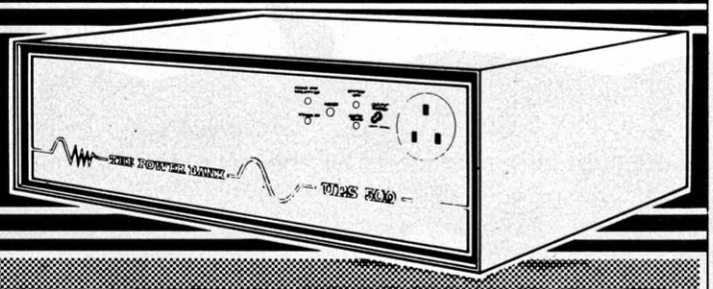

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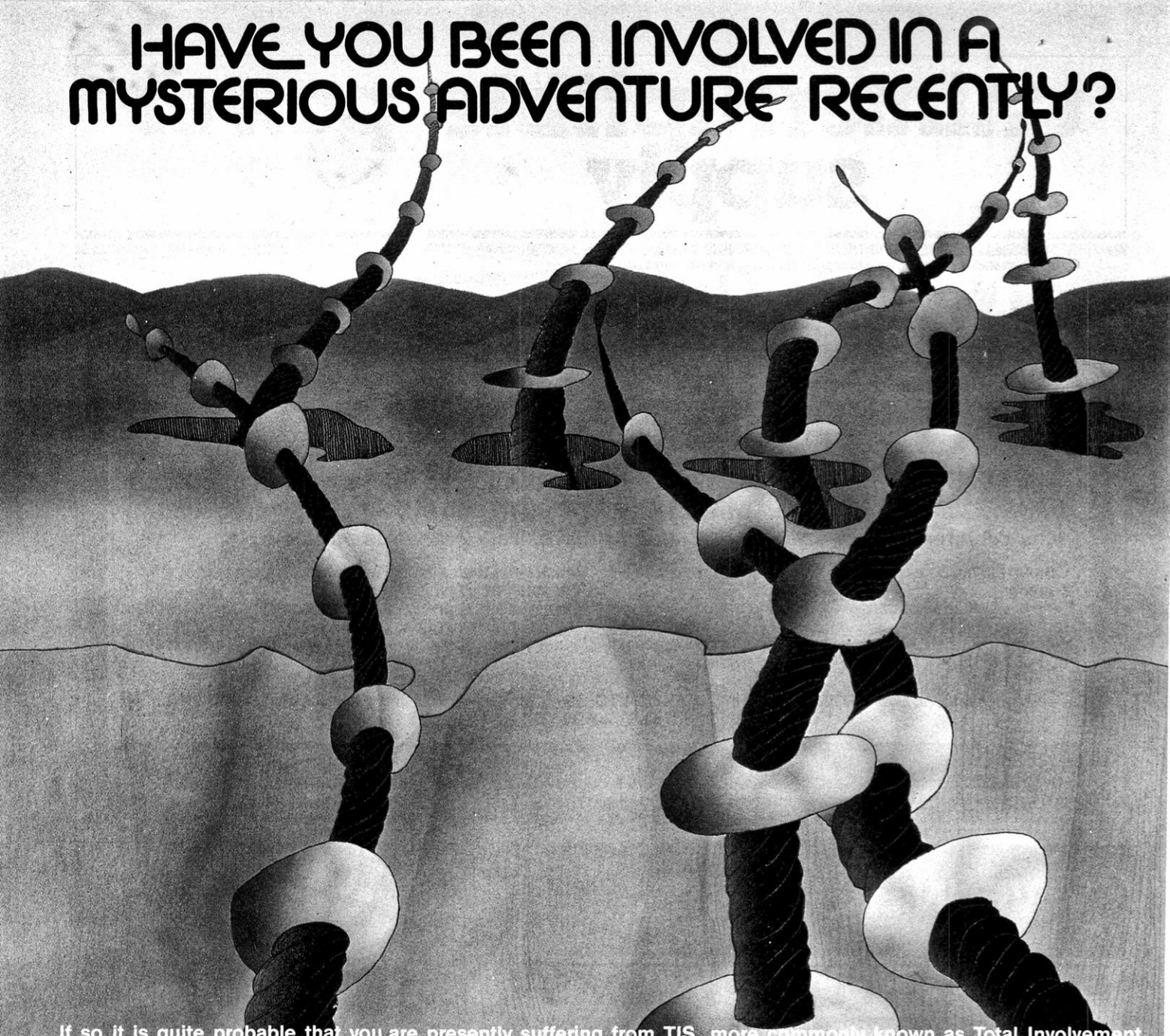

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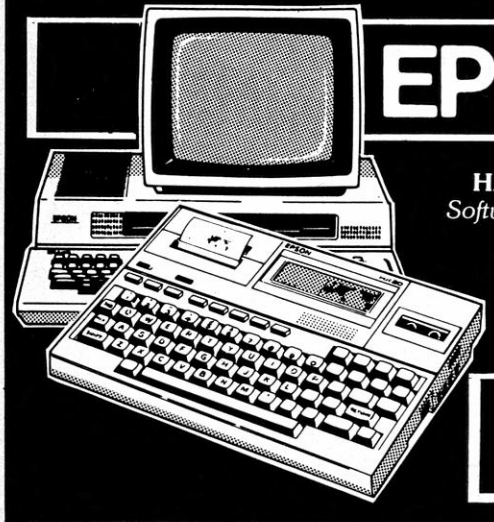

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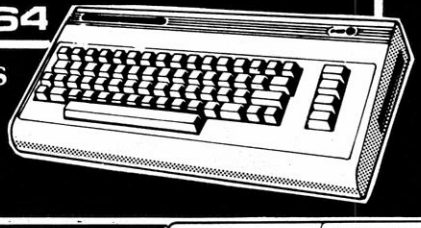

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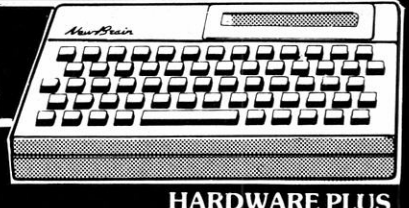

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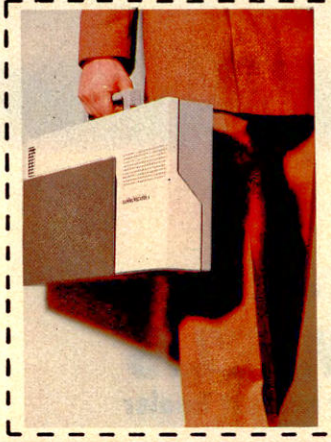

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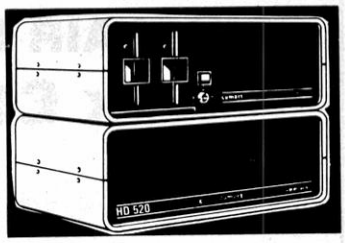

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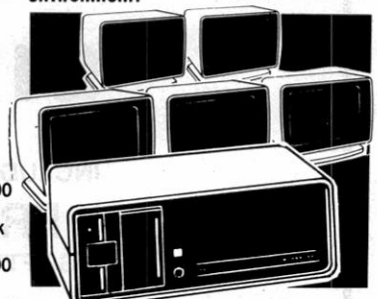

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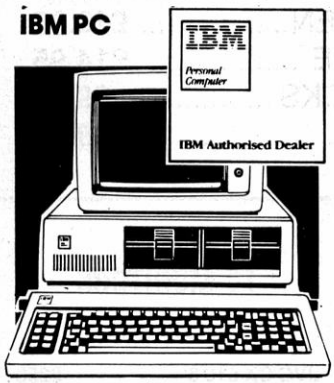

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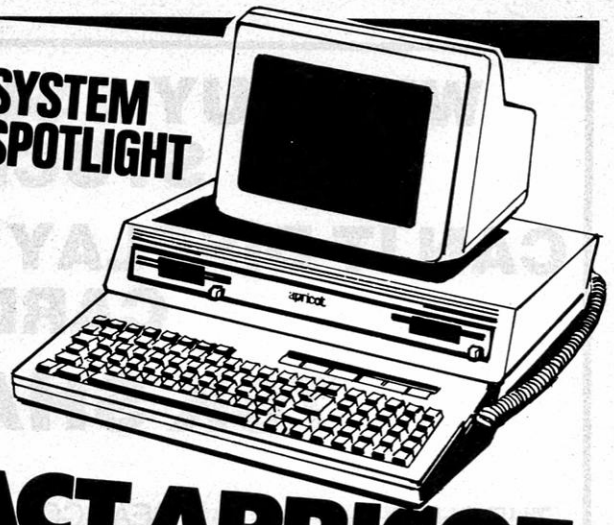

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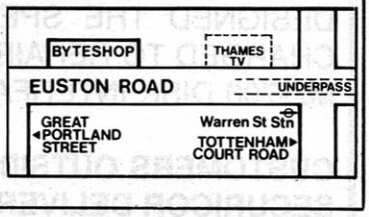

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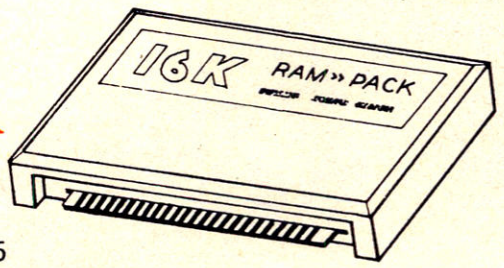

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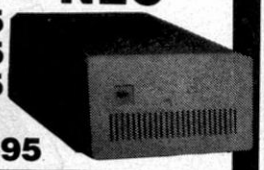

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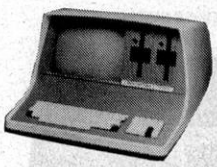

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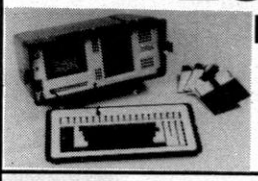

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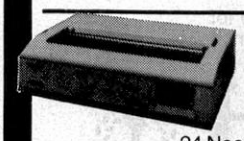

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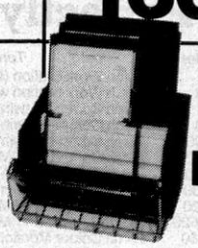

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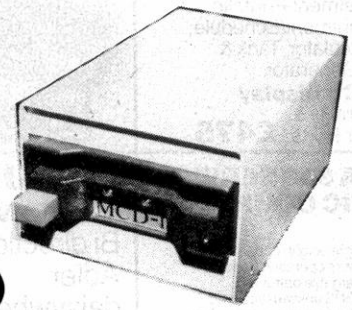

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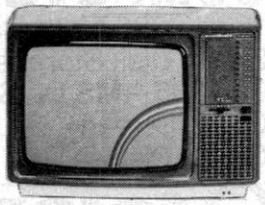

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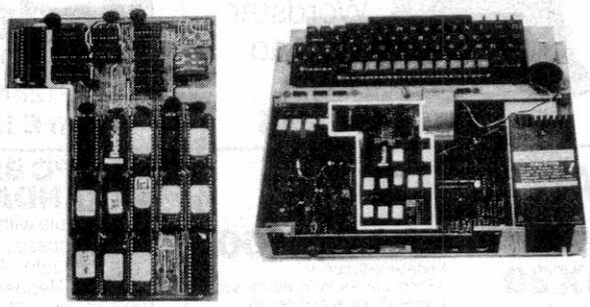

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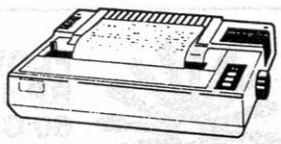

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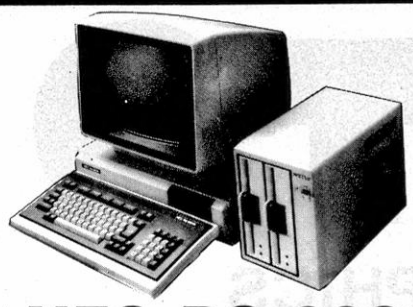

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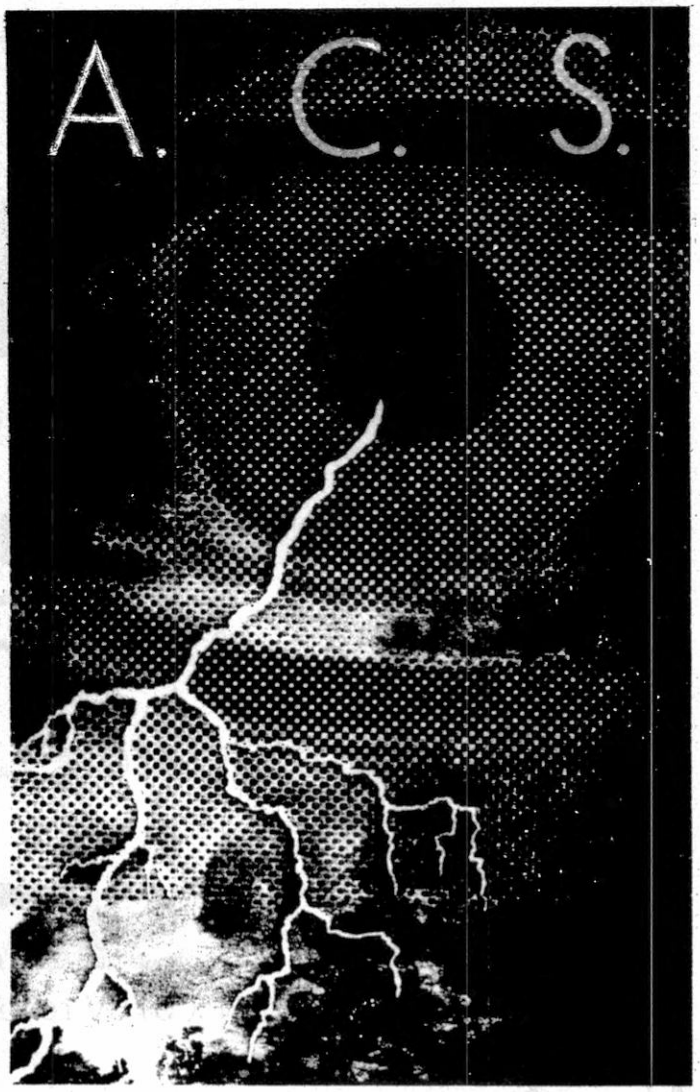

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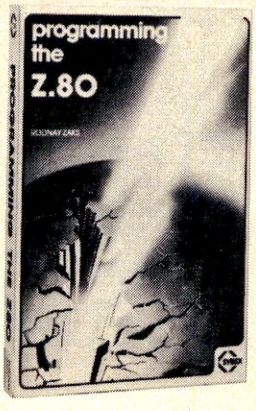

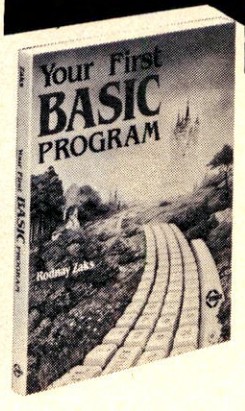

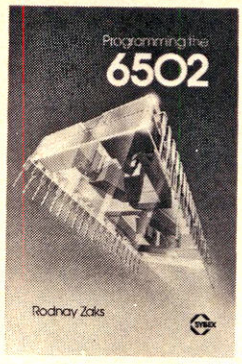

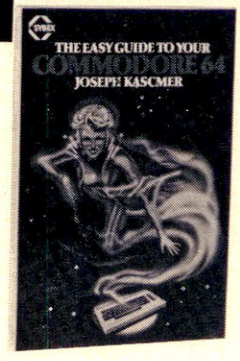

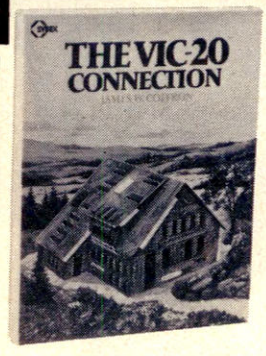

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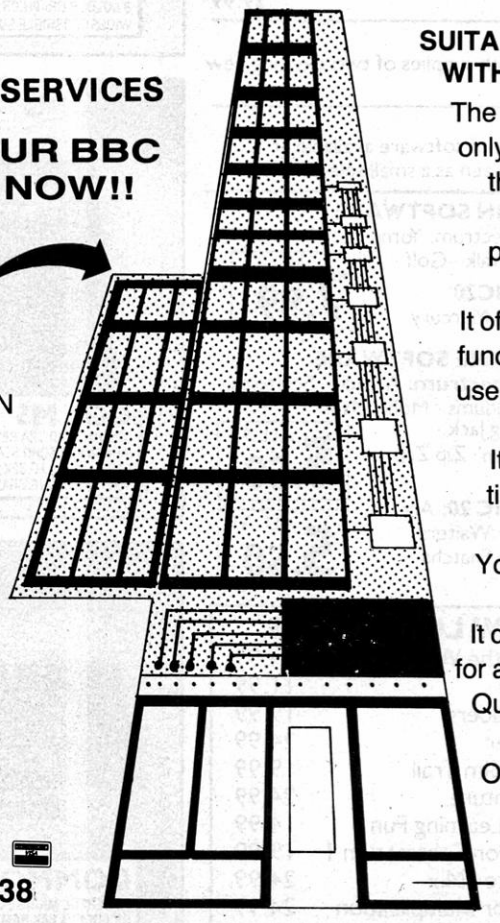

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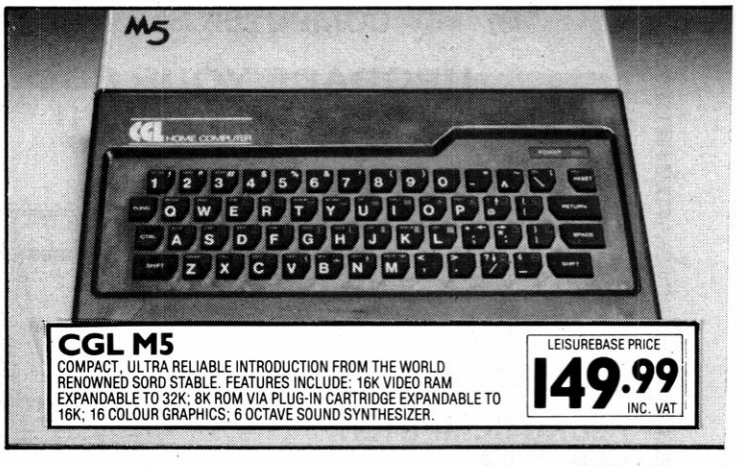

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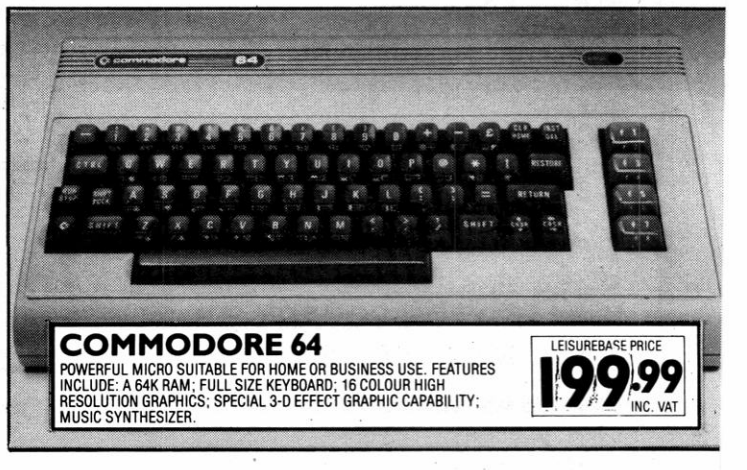

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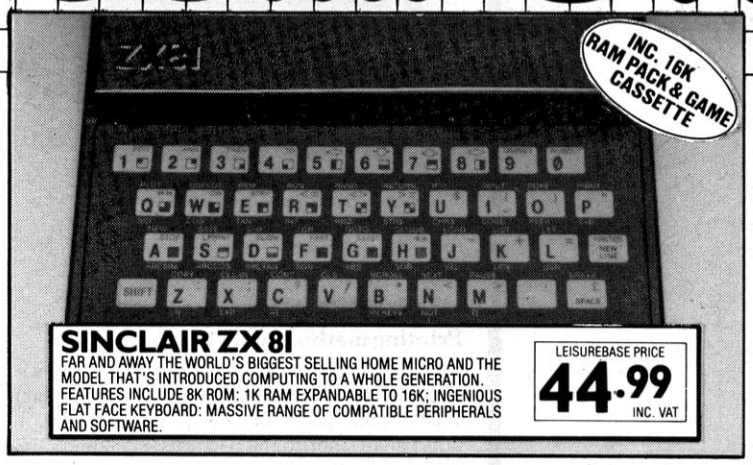

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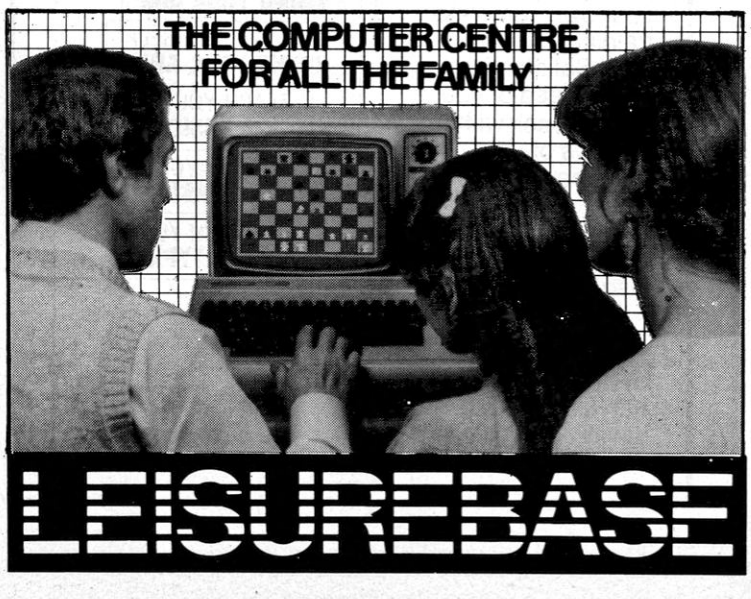

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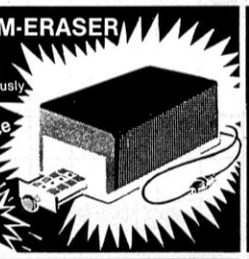

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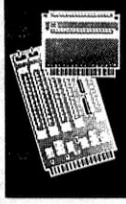

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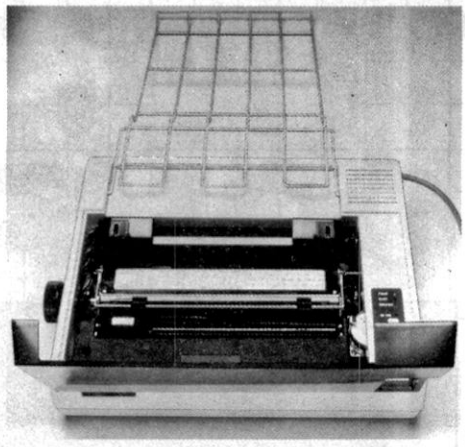

Specifications of the new Walters WM80

Printing method: Impact dot matrix.

Printing format: Alpha-numeric: 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic): 7 x 8 dot matrix. Bit image graphic: Vertical 8 dots parallel, horizontal 640 dots serial/line.

Character size: 2.1mm w x 2.4mm h /7 x 8 dot matrix.

Character set: 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.

Printing speed: 80 CPS, 640 dots/line per second.

Printing direction: Normal: Bidirectional, logic seeking. Superscript and bit image graphics: Unidirectional, left to right.

Dot graphics density: Normal: 640 dots/ 190.5mm line horizontal. Compressed characters: 1,280 dots/190mm line horizontal.

Line spacing: Normal: 4.23mm. Programmable in increments of 0.35mm and 0.118mm.

Columns/line: Normal size: 80 columns
Double width: 40 columns
Compressed print: 142 columns
Compressed/double width: 71 columns
The above can be mixed in a line.

Paper feed: Adjustable sprocket feed and friction feed.

Paper type: Fanfold. Single sheet thickness: 0.05mm to 0.25mm.
Paper width: 101.6mm to 254mm.

Number of copies: Original plus 3 copies by normal thickness paper. (Max 0.25mm. Total thickness of 4 ply).

MTEB: 5 million lines (excluding print head life).

Dimensions: 377mm w x 295mm d x 125mm h, incl. sprocket cover.

Weight: 5.3Kg approx.

Power requirement: 240 v ac.

Data transfer rate: 4,000 CPS max.

Synchronization: By external supplied STROBE pulses.

Handshaking: By ACKNLG or BUSY signals.



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The standard interface is Centronics parallel, RS-232C (SERIAL) is available as an optional extra. Programmable functions include variable margins and line spacing, horizontal and vertical tabulation, and 7 international language character sets. In total, it offers a 228 ASCII character set and has self-test facilities.

Major control codes include NUL, buzzer, backspace, line feed, horizontal and vertical tabulation, paper advance, carriage return, shift in, shift out.

Paper transport is by adjustable sprocket feed or friction. It uses fanfold paper, from 4" to 10" wide, printing up to three clear copies from an easily changed cartridge ribbon. Life expectancy of the print head is approximately 30 million characters.

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The WM80 can be ordered by 'phone on 0494-32751; or by sending this coupon to: Walters Microsystems International, 'Matrix House,' Lincoln Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3RD.

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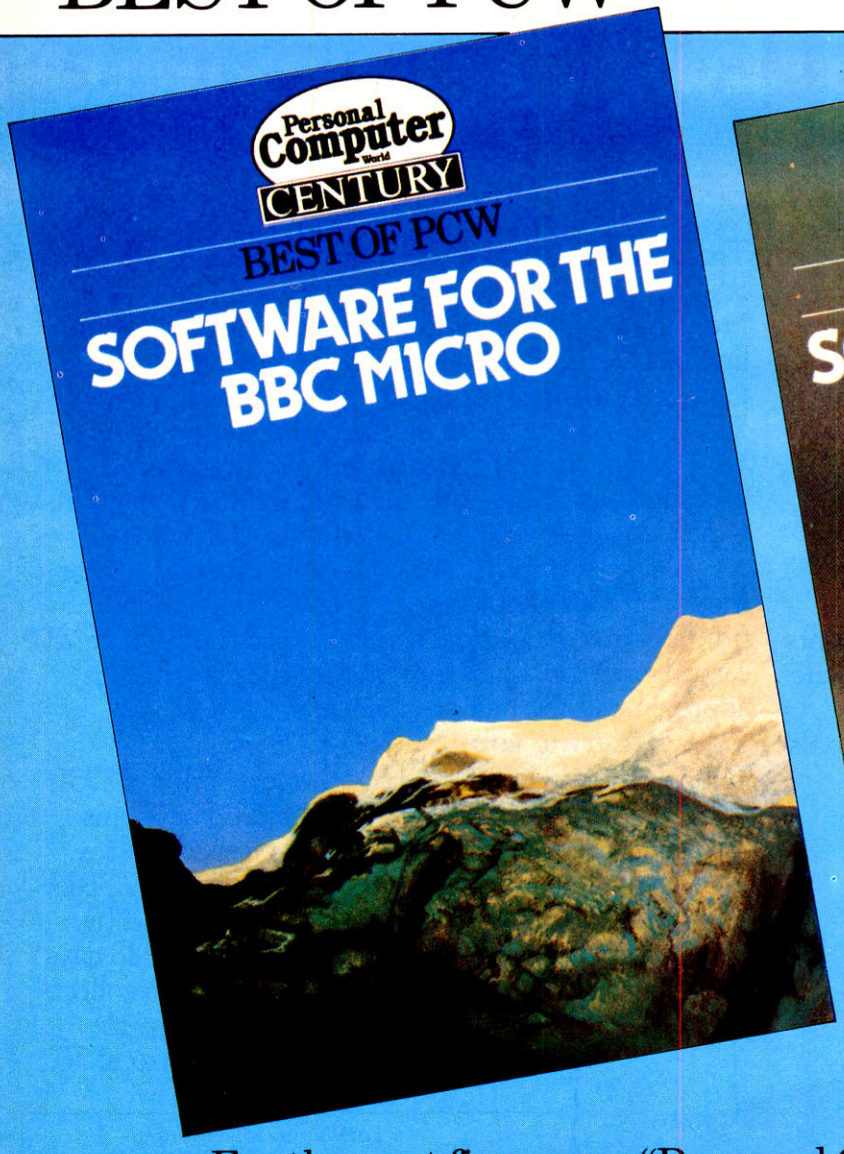

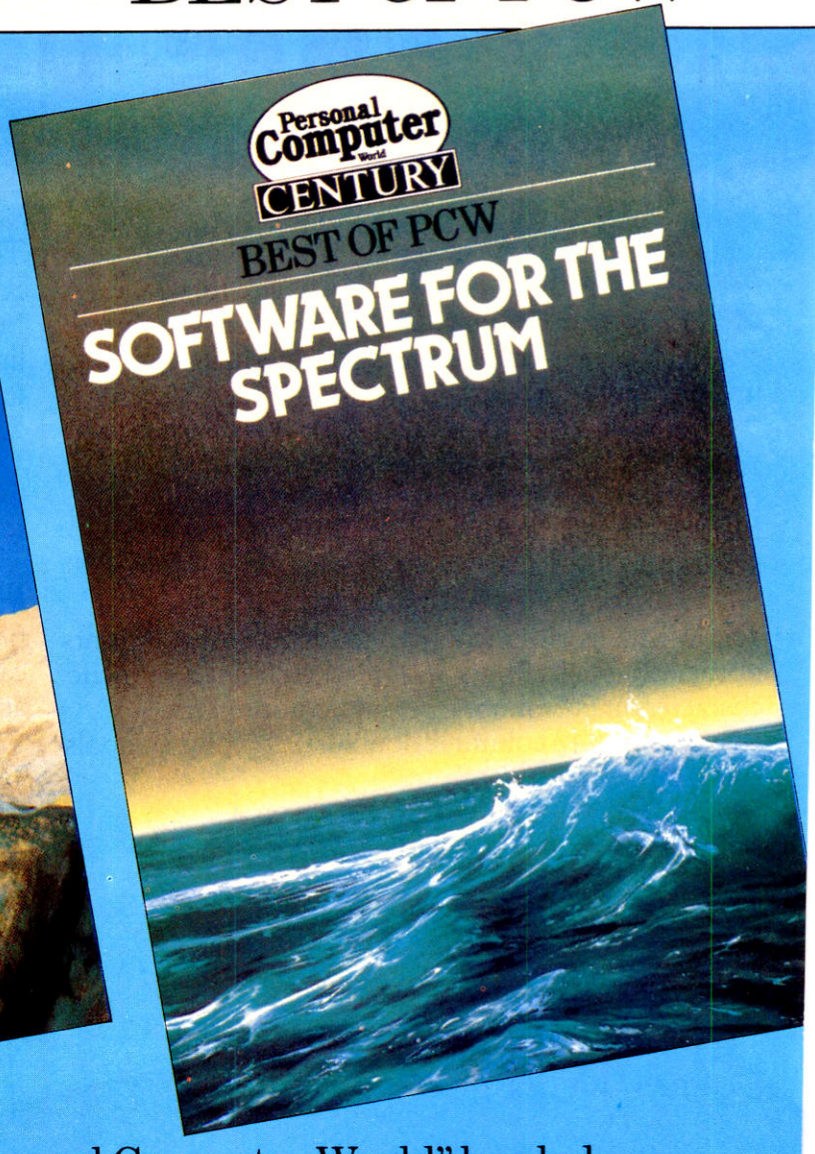

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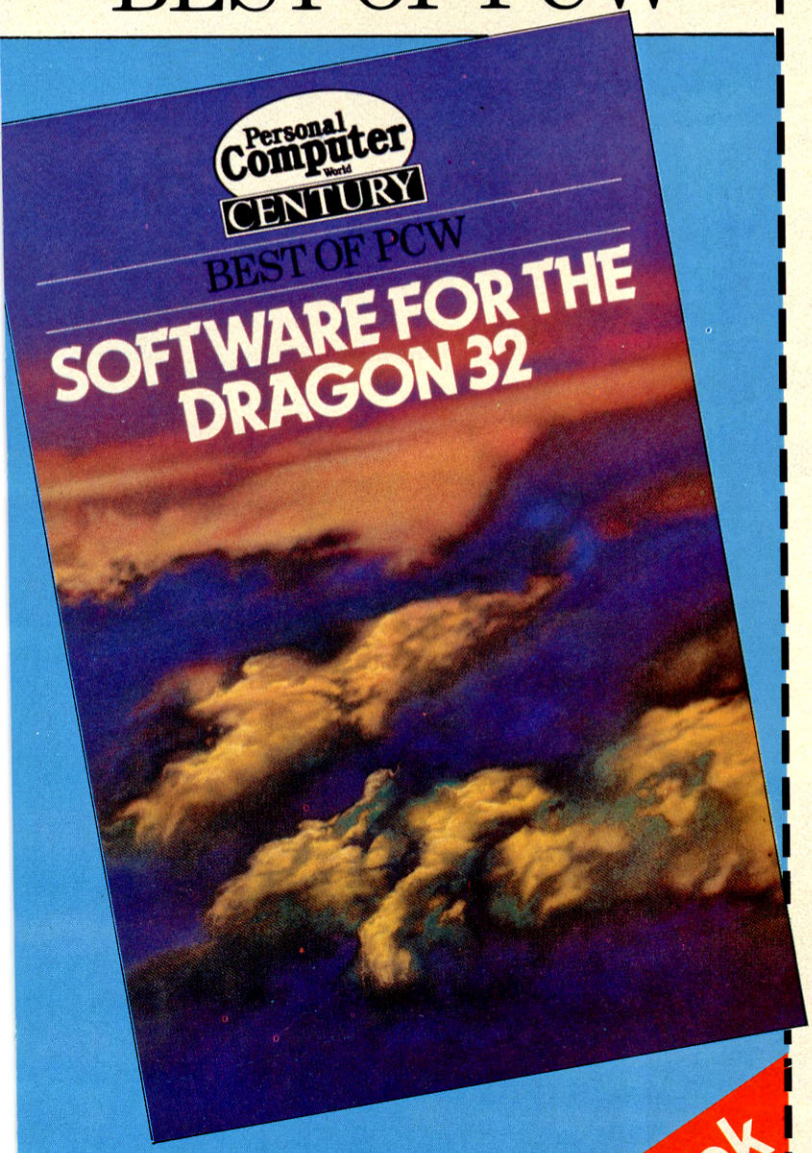

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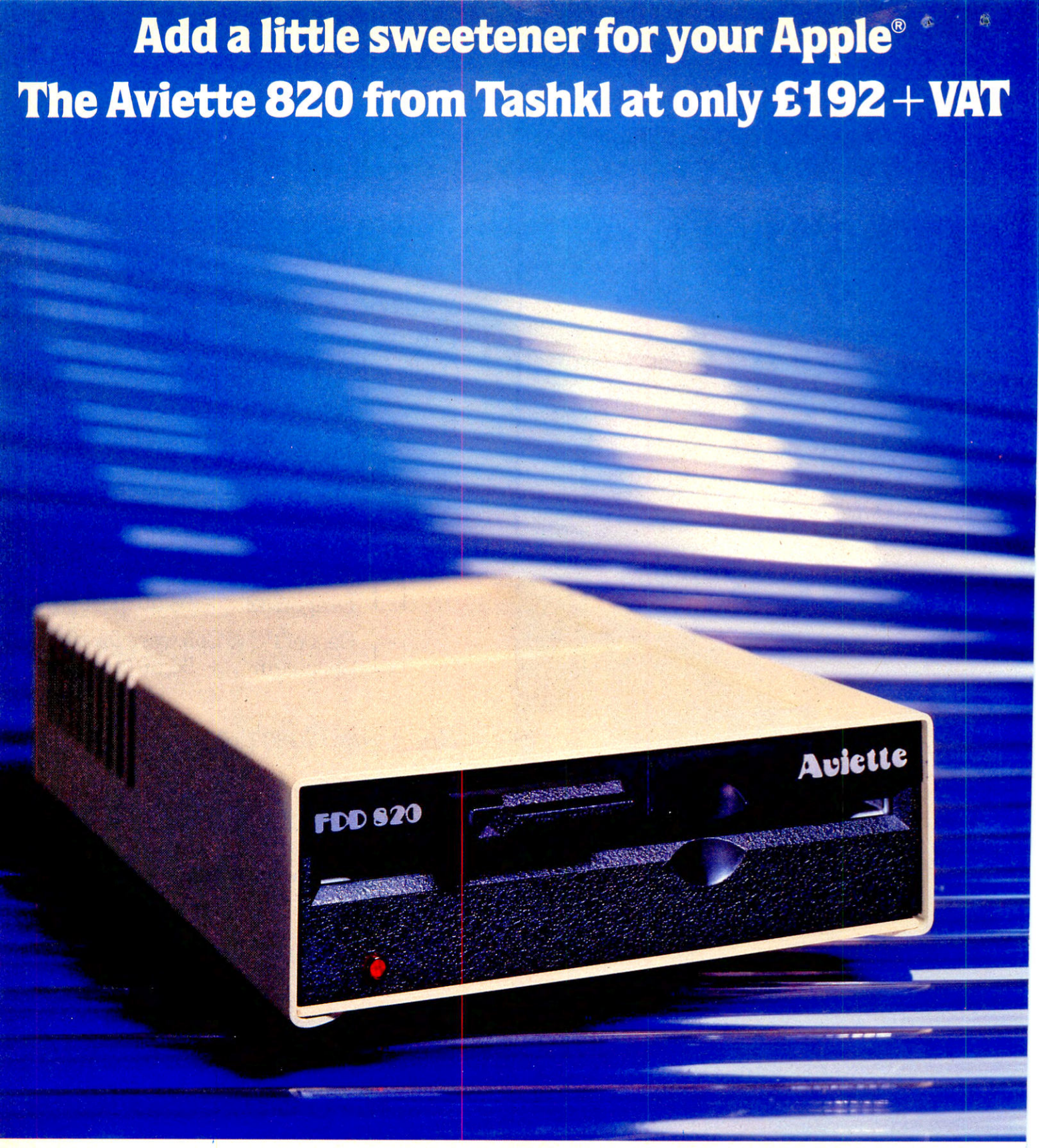

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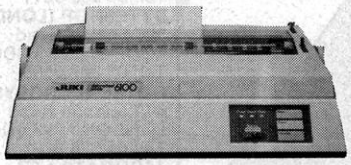

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XLT86	Digital Research	□		
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MP/M II	Digital Research	□	●	
CP/M-86 (IBM PC)	Digital Research		●	
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C COMPILER	Digital Research		●	
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PASCAL/MT+	Digital Research	□	●	*
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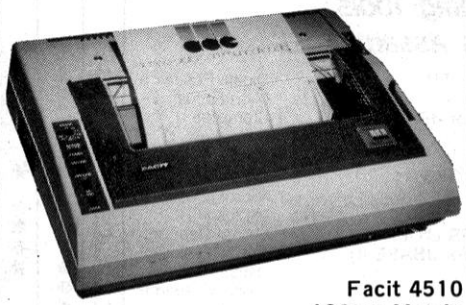

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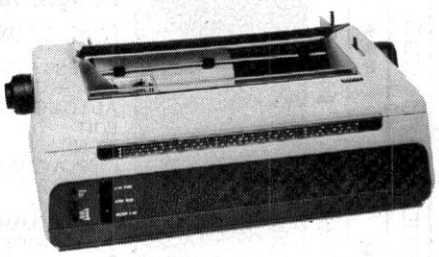

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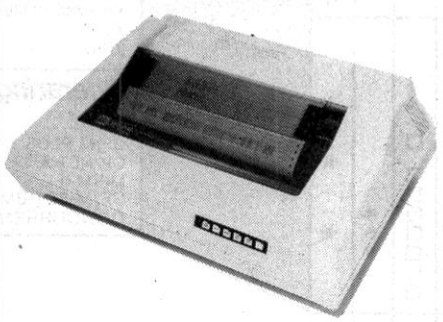

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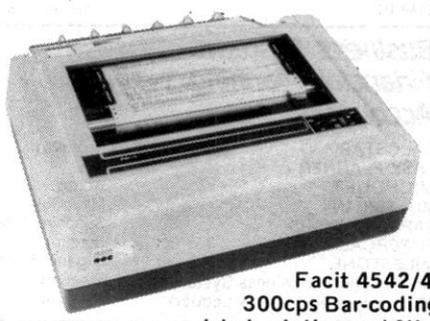

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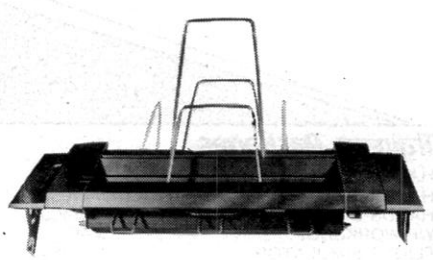

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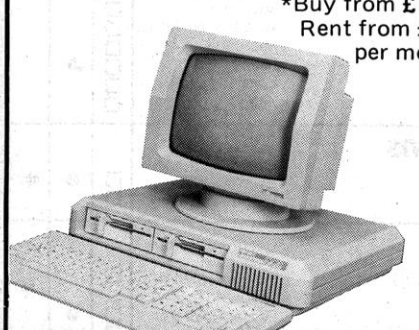

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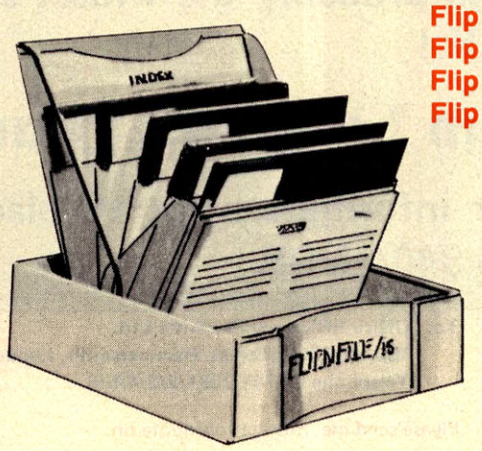

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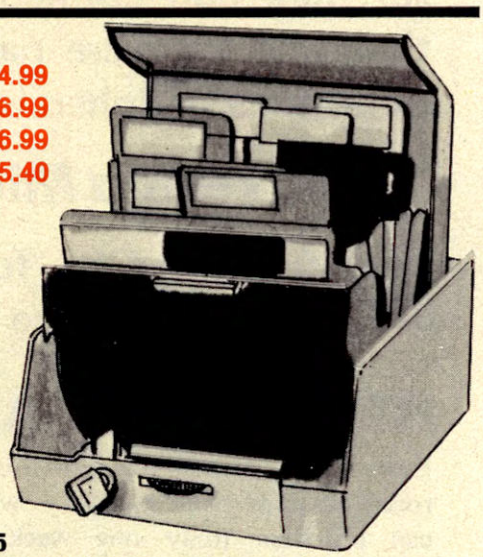

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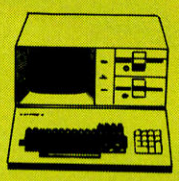

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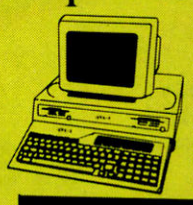

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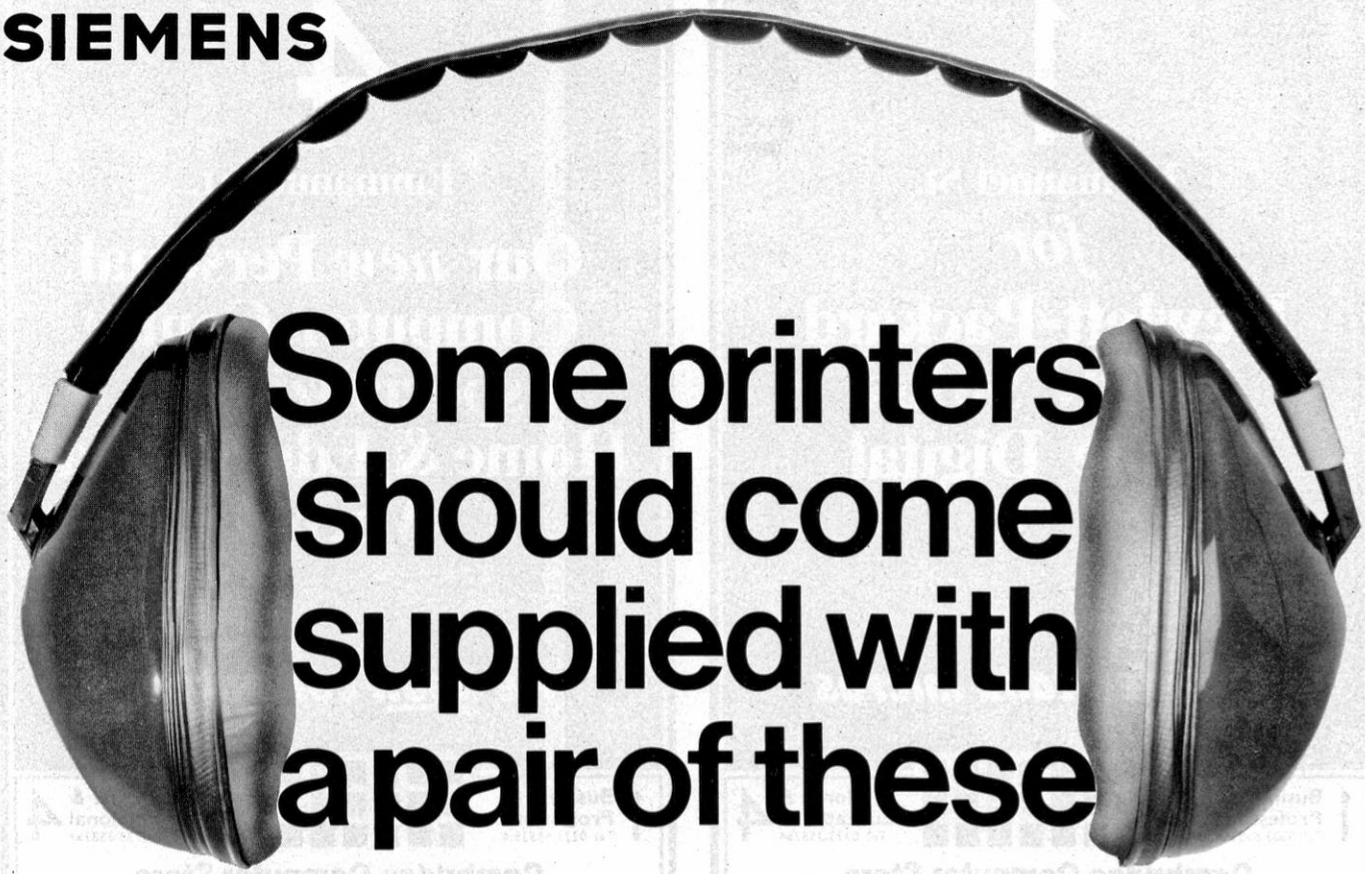

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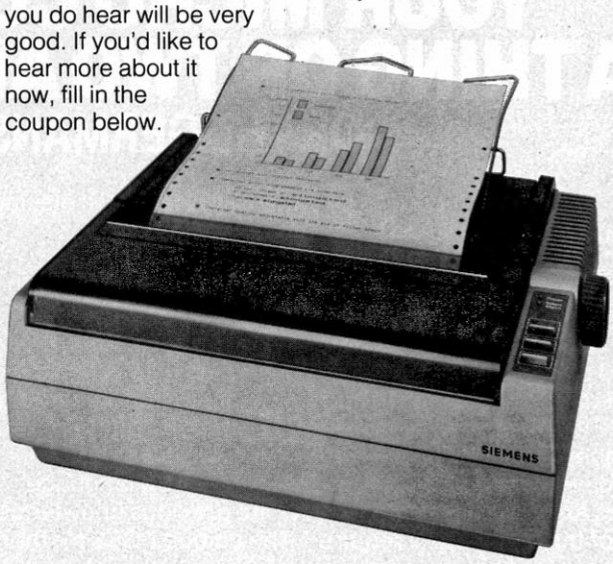

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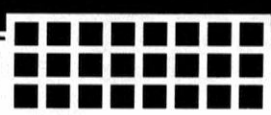

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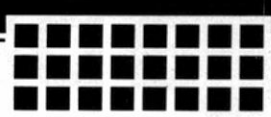

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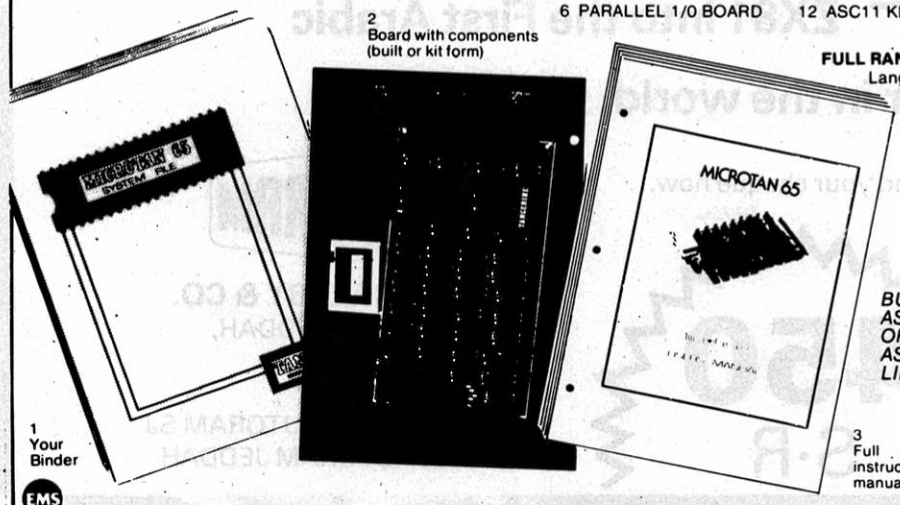

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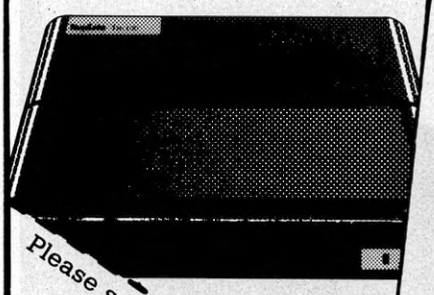

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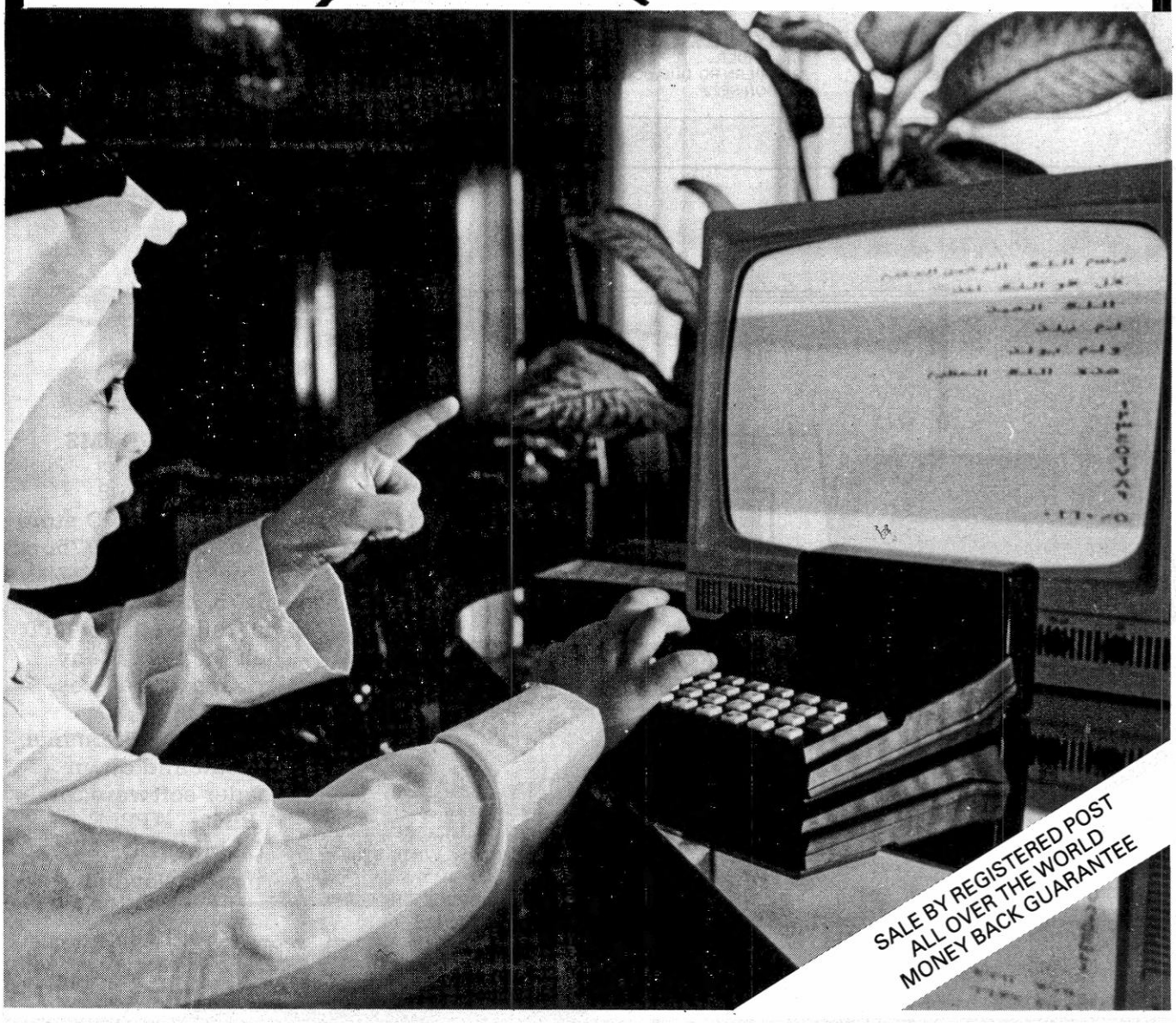

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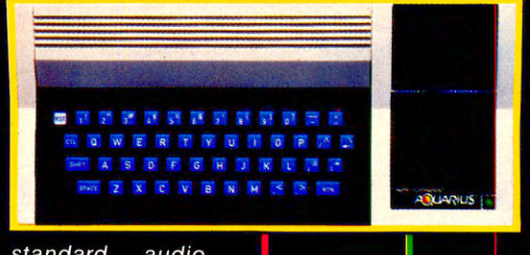
● *Based around the Z80A microprocessor, and utilising Microsoft™ BASIC, Aquarius™ has 8K ROM and 4K RAM resident within its console. It is able to provide up to 16 colours and resolution of 320x192, and generates its sound directly through the television's speakers.*

● *With twin cartridge ports, the mini-expander allows simultaneous use of additional RAM and software cartridges. Twin disc game hand controls are included and the unit provides two additional sound channels. The 16K RAM cartridge plugs into either the console or the mini-expander, increasing Aquarius™'s RAM capacity to 20K.*

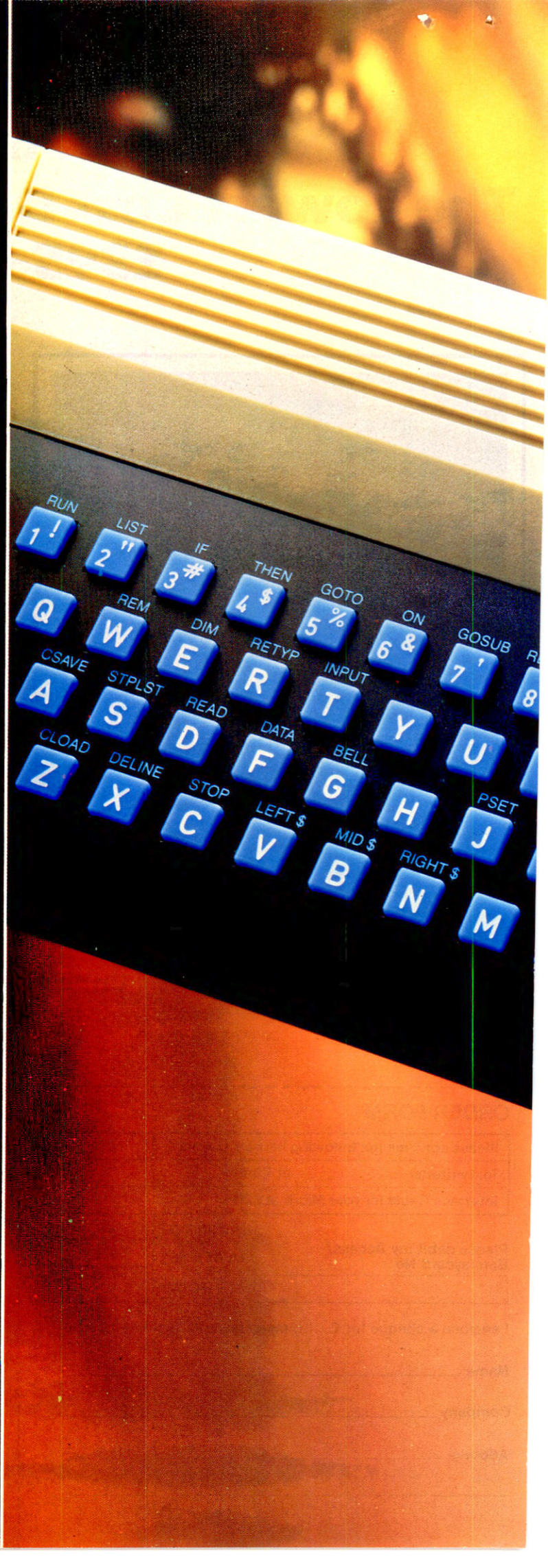
● *With the ability to reproduce the entire graphic and character set of Aquarius™ at 80 characters a second, the printer's 40 column output allows transcription of the complete monitor image.*



● *Using standard audio cassettes, the data recorder provides storage for programs and information, and allows the use of cassette based software. Incorporating a digital tape counter and transmission indicator, it operates sequential searching.*

● *A large number of games, designed to take advantage of Aquarius™'s sophisticated colour and sound capabilities, are available on cartridges that plug into the console either direct, or through the mini-expander. Cassette based games can be used via the data-recorder.*

● *A wide range of preprogrammed cartridges is available, including the LOGO teaching program and practical home data systems like FILEFORM™ and the spreadsheet calculator package, FINFORM.™*



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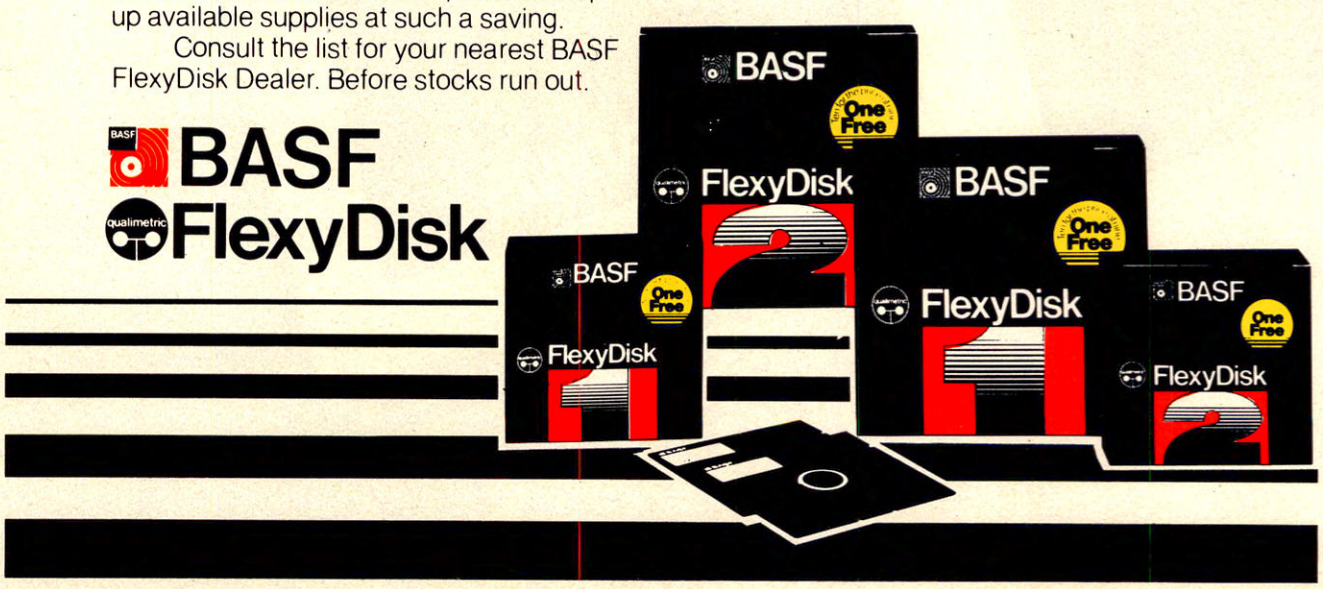

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Full graphic display of cards and table.

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AT LAST, A HOME COMPUTER THAT IMPROVES WITH AGE.



It's surprising how many first-time relationships with a home computer go sour with age.

You buy an attractive, discounted little machine so that you and the children can learn about computers.

Instead, you learn about its limitations: the dull graphics. The plugs that fall out. The cheap power supply. The unalterable "beginners" language. The stiff, fragile keys. No provision for future developments. If only you'd looked around a bit in the beginning...

"Quality costs a little more, but it's usually worth paying for" (Personal Computer News – CGL M5 Review, June '83.)

The CGL M5 is designed and built by Sord, one of Japan's leading computer specialists, with three main ideas in mind.

First, to be easy and fun to learn and operate.

Second, to be rugged enough to last through hours and hours of operation.

And third, to form the basis of a powerful, versatile home computer system that won't need replacing until you're ready for a dedicated business system.

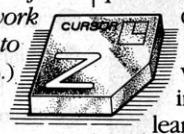
Built to learn

The CGL M5 is designed to be easy for non-geniuses to use.

"On the M5, most of the work is done for you, and all that is left is the need to work out what to do next, rather than how to do it." (Personal Computer News, June '83.)



If you make a mistake, you can correct it with a simple movement of the cursor. So you only correct that mistake, not a whole line; nor do you have to indulge in complex edit commands.



Budding video game designers and computer artists will love to get their hands on the 16 colour graphics and 32 moveable images called "sprites."

"The M5 makes professional graphic effects very simple for even the beginner to achieve." (Personal Computer World, Aug. '83.)

Built to last

"It works first time, doesn't need a lot of mollycoddling and jiggery-pokery to persuade it to continue to do so, and what's even better, it continues to work well. You don't have to balance cold cartons of milk on the top, shove matches in the back to keep the plugs in, or press the keys with several pounds force to make them respond." (Personal Computer News, June '83.)

Being able to build things that work and carry on working without endless maintenance is something at which the Japanese seem to excel.

Built to grow

To be truly versatile, a home computer has to understand very different things.

So you need different "languages," which the M5 provides by supplying part of its memory in plug-in cartridges.

"The M5 eliminates the worst limitations on machines at this level, which is that they tend to be stuck with whatever language is provided by the management." (Personal Computer News, June '83.)

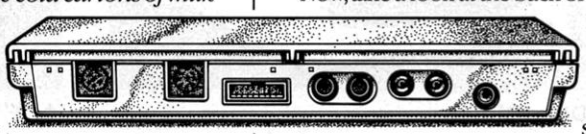
The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

Plug in the Basic-G cartridge, and you can access the M5's incredibly sophisticated graphic and sound capabilities which are far in advance of similarly-priced computers.

Move on to the Basic-F cartridge, and you have scientific, technological and statistical computing power usually available only on big computers with equally big price tags.

The FALC cartridge provides a tailor-made language for data management, spreadsheet accounts and business problems. Combine FALC with a disc and you could *"turn the M5 into a small business machine"*. (Personal Computer Magazine, August '83.)

Now, take a look at the back of the M5.



Notice the sockets (usually an extra) for a standard Centronics-type printer, the separate video monitor and hi-fi sound output.

Even the language cartridge socket has hidden potential:

"Unlike most such sockets, this one has 56 internal lines connected to it giving access to just about every function in the computer. This means that just about everything you can think of can be added onto the computer, ranging from a Prestel interface to second processor to use as an intelligent terminal on a timesharing computer"... (Electronics – The Maplin Magazine, March '83.)

Take a look at the home computer that will improve with age.

For a full technical specification of the CGL M5, details of the wide range of supporting software and to find out where to see a complete demonstration, send the coupon to: CGL, CGL House, Goldings Hill, Loughton, Essex IG10 2RR. Telephone number: 01-508 5600.

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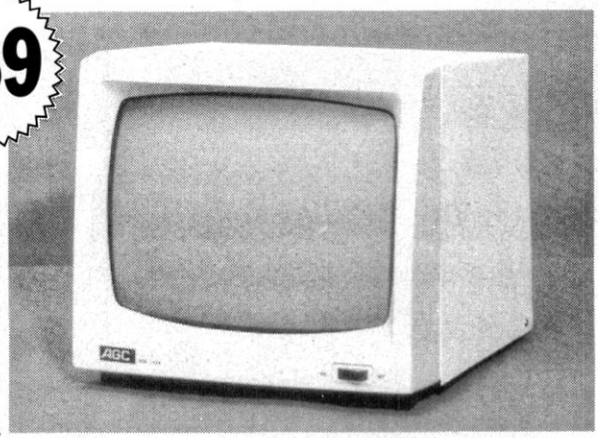

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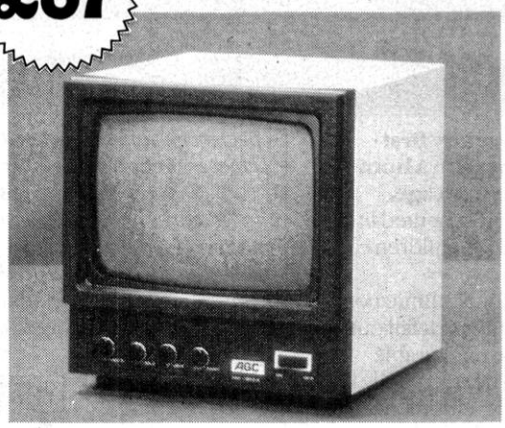

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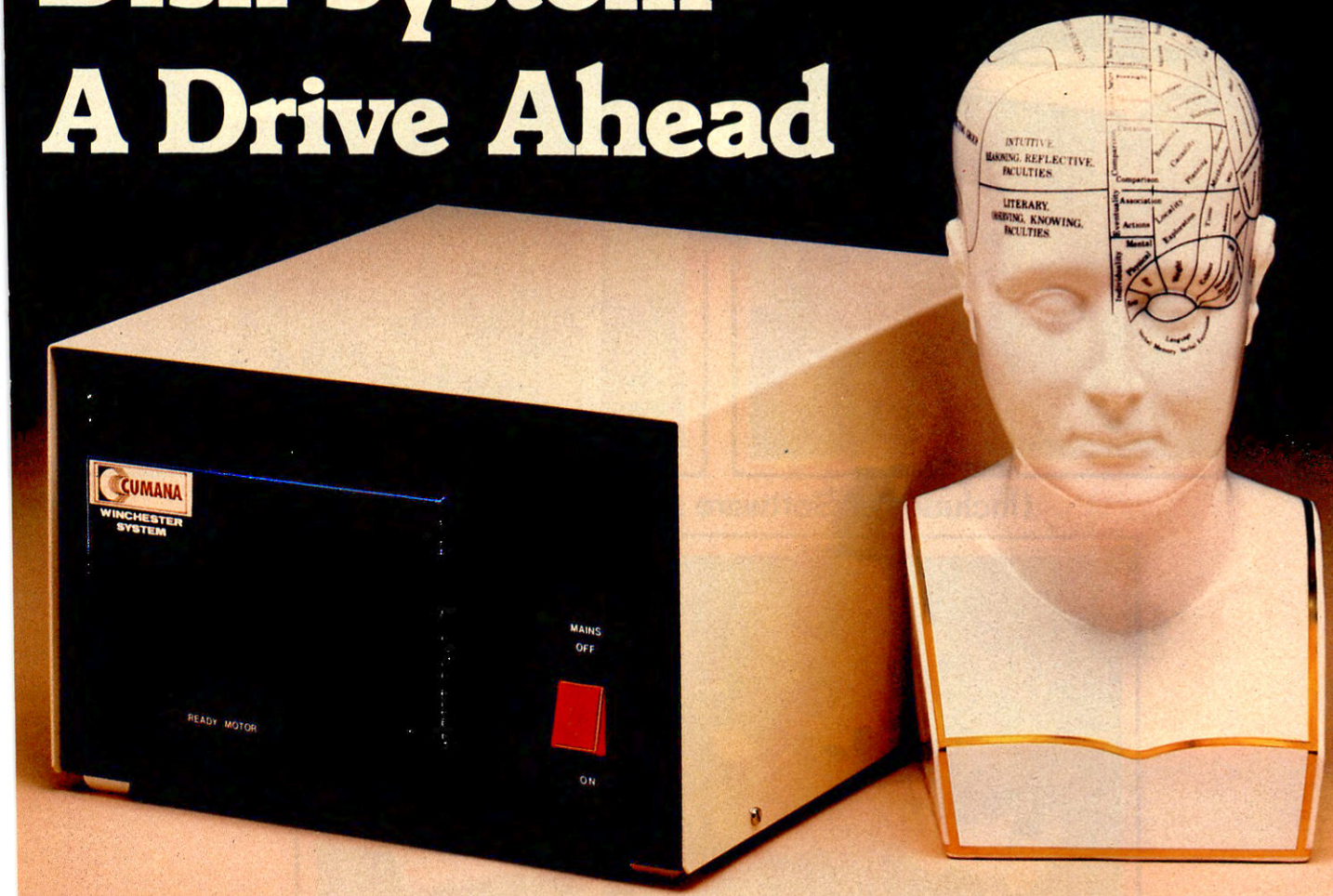

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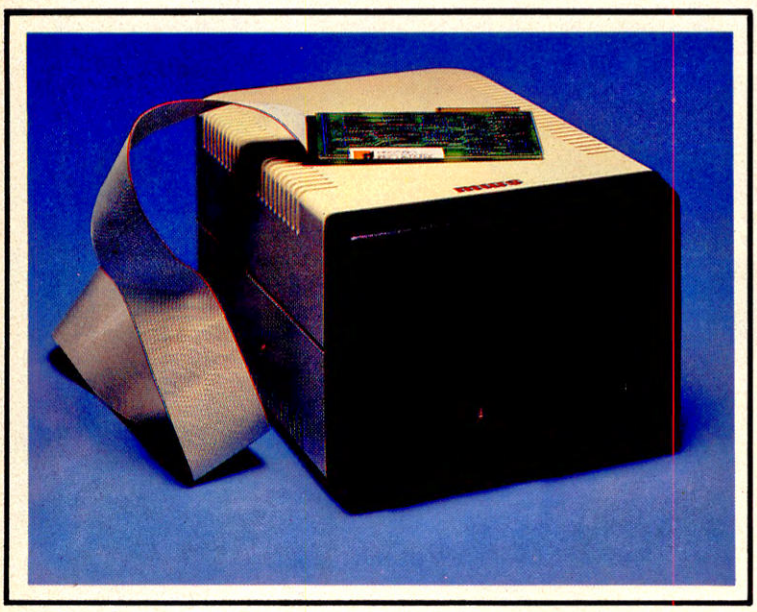

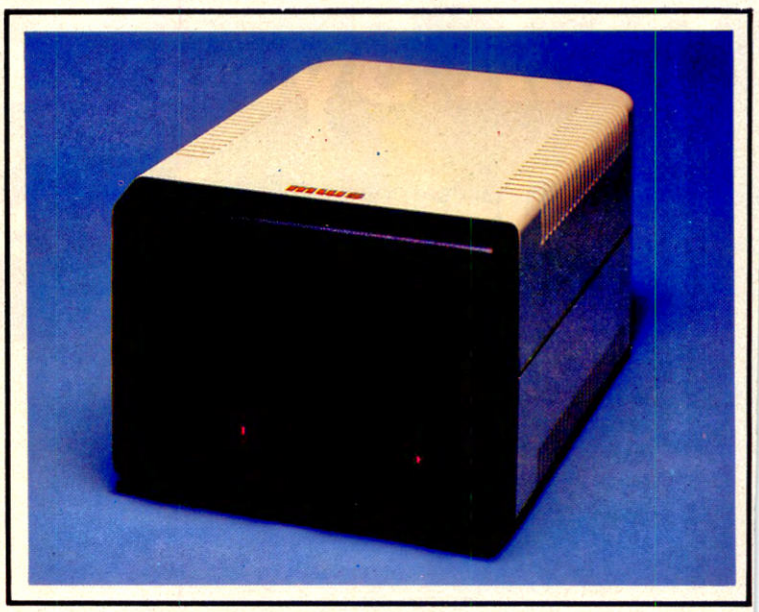

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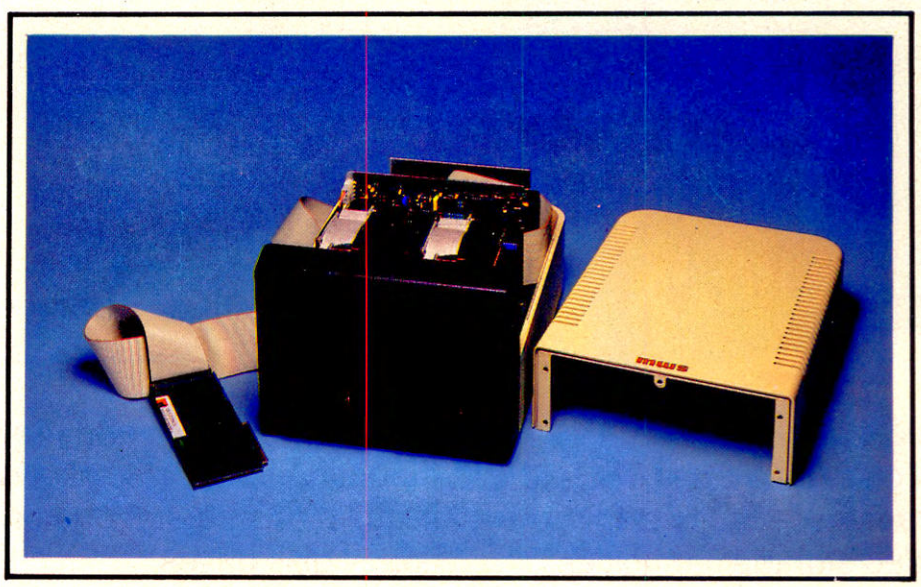

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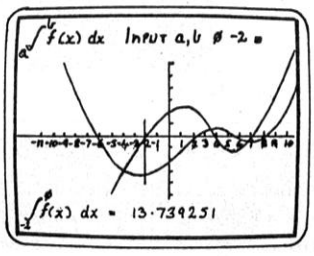

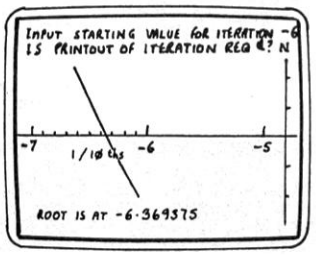

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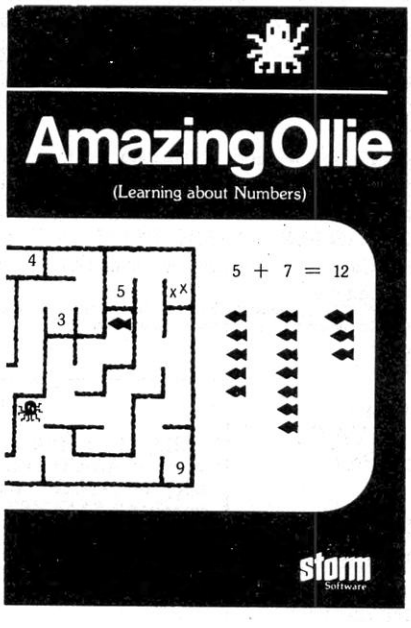

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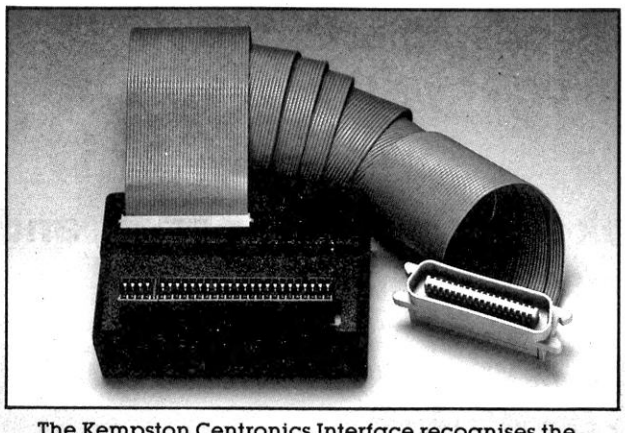

The Kempston Centronics Interface recognises the LLIST and LPRINT commands and will allow print width selection from 32 characters to full width. Word processing is now possible by using a software package such as Tasword Two (Price £13.90), available from Kempston, you can display 64 characters per line on screen which is ideally suited to A4 size paper allowing you to print letters, lists, documents etc.

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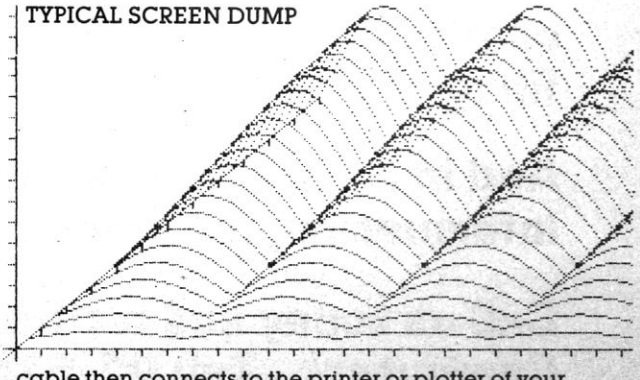

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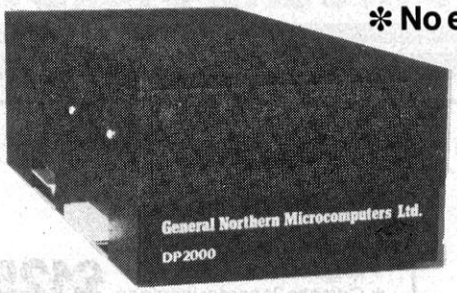

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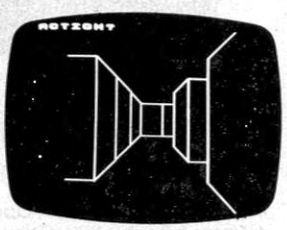

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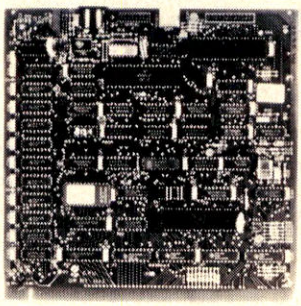

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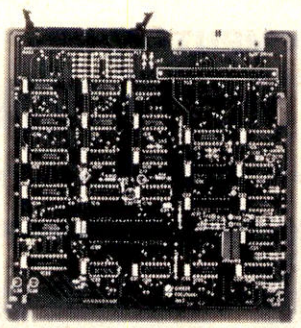

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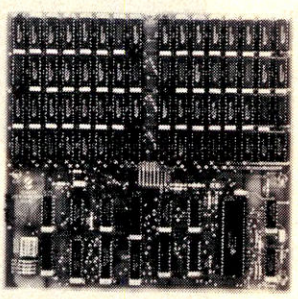

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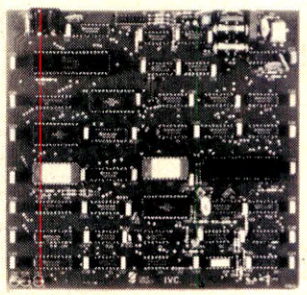

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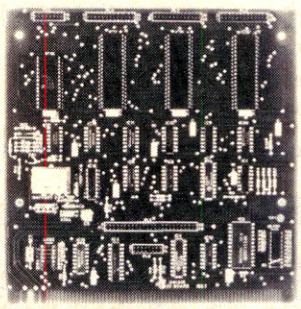

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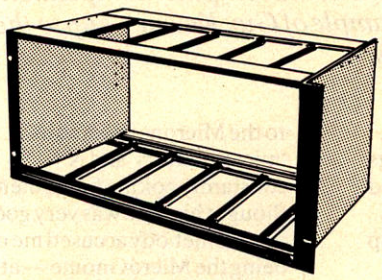

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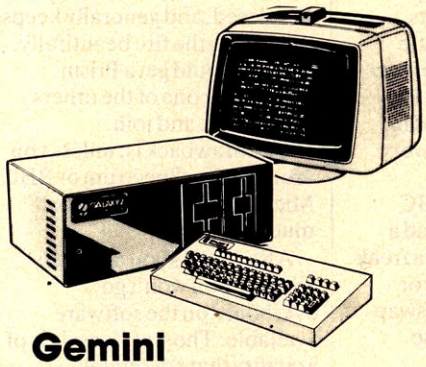

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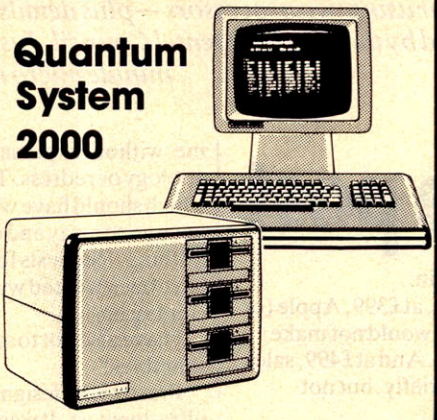

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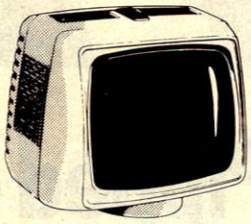

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MicroValue

REAL value — from the Professionals



An add-on card for the Apple II which executes spoken commands plus speculation on the machine's future, the possibility of an ITV micro, Nascom repackaged and re-launched and, straight from Compec, news of a transportable computer using two processors—plus details of a national computer competition organised by the General Dental Council. Just a sample of Guy Kewney's up to the minute micro news.

Pipped at the post

There is a magazine which purports to publish figures showing which machines are selling, and which are not selling.

Actually, there are several such magazines, and they are all quite out to lunch—but one, in particular, has recently been explaining that the Anderson Jacobson Ajile is in the Top Ten, and the Gulfstream Hyperion is not. This is almost certainly incorrect, simply because my figures on shipments from Canada indicate a four-times factor of Hyperion over Ajile imports.

Nonetheless, the magazine in question has also suggested that Sharp is selling more machines than Apple, in the UK. And this is quite correct.

Dealers tell me that they blame Apple's attitude to dealers, and I can see their point. But also, I doubt that's the whole story.

Obviously, it didn't help Apple UK when the company fired most of the small, one-or-two a month dealers which made it a favourite for so long. But equally obviously, the Apple II design is now antiquated, overpriced and has proliferated so many non-standard varieties that it is impossible to be sure whether or not software will run.

Just before Christmas, the plan was to bring the price of the IIe down, sharply. Then, in a panic, Apple told independent dealer distributors like Micro Management that they could, after all, supply non-approved stores with the machine—and the price cut looked to be delayed again, to keep the distributors happy.

I would still buy an Apple if it cost £399. It is a classic. Apple should be able to sell it to people who want a BBC Micro, but whose supplier would rather sell something with a profit margin.

However, at £399, Apple (or the dealers) would not make much profit. And at £499, sales would stir briefly, but not revive.

I don't see much future for the Apple II, which saddens me. I feel that the British have been deprived of it—it was a great machine, which every American middle-class family was able to afford, but which only businessmen in Britain could justify buying.

It also adds a touch of irony to an announcement from Softsel (a software importer and distributor) that it 'has joined forces with Apple Computer as part of a major drive by Apple into the home computer market'.

Softsel does have a wonderful range of Apple (and other) software. But the day is past when that software could turn the machine into the number one seller.

Club competition

Playing with Micronet 800, the Prestel club for people who buy a modem from Prism, has given me more fun, frustration, wasted more time and caused more rage than anything since I first discovered CP/M.

I've played a game called Q-man. There has been a real, old-fashioned, mud-slinging battle between two micro clubs on Prestel. I've met people who will swap their software with mine. I've found BBC Micro programs to unlock locked programs, read tracks and sectors off diskette, as well as programs to turn the whole screen red!

Also, I've had the whole system simply close down on me, without explanation, apology or redress. Things which should have worked, have gone away and done nothing. Requests for help have been treated with condescension.

I have also got to say: 'What a shambles!'

Prestel was designed to be ultra-low cost. It was supposed that anybody with a TV set would be grateful for this ability to press numbers, and get intelligent answers from a computer.

But for people with a computer, it can drive you mad. Of course, this wouldn't matter if it were boring, but it's fascinating stuff. I haven't moved in such circles since micros were the property exclusively of enthusiasts.

The mud-slinging battle arises out of the rivalry of two 'information providers'—Micronet 800, and Viewfax.

Viewfax has started a very comparable service to Micronet, mainly for BBC Micro users. You can read a magazine, published by a freak called the MicroGnome or download programs, or swap information on 'response pages'.

So far so good: but the Gnome has a habit of referring to the Micronet people as 'micrognatters' and is constantly poking fun at them. I thought his style was very good until somebody accused me of being the MicroGnome—at which point I realised it was cruel, arrogant, and snide.

Micronet, however, cannot stand the digs. The constant suggestions that 'you poor fools should stop your MicroGnat subscriptions, keep the modem, and just stay on Prestel, through Viewfax' obviously aren't welcome at Micronet.

And the editor of the Micronet magazine pages on Prestel always rises to the bait, and sends messages to Viewfax saying how wonderful Micronet is, and how vilely he is slandered, and generally keeps the fuel on the fire beautifully.

You should get a Prism modem, or one of the others advertised, and join.

The drawback is: unless you are a Sinclair Spectrum or BBC Micro user, there won't be much for you.

Also, unless you are easily pleased, you won't go overboard on the software available. The stuff for sale is of a quality that adequately reflects the numbers available on Prestel to buy it—average.

Auto manservant

Sun Computing Services Ltd has announced Waldo which is described as being the first computer to control your home from spoken commands. Waldo is, in fact, a card that fits inside an Apple II or IIe which can control up to 16 electrical devices around the home.

Waldo can be pre-programmed from the keyboard or given direct commands via a microphone; so you can control your television, lighting and heating from wherever the microphone is in your own home.

You can also talk to Waldo by telephone if you connect it to an answerphone. It would be possible to phone Waldo on your way home to tell it to put your heating on or even to start cooking your dinner.

There is one final feature which may prove to be a disadvantage: Waldo can talk back to you. Taking into account how irate humans can get and how unflappable computers are, how long will it be until Waldo is relegated to operating garage lights?

Sun Computing Services is on 01-890 1440.

Tony Hetherington

The free stuff is exactly what you would expect to get for nothing.

You can send messages to fellow members—but you can't reply when they send messages to you. Instead you have to memorise their number (a long one) and then find your way through the system to the message pages, set one up, and fill it in.

And the Prestel service is erratic, to say the least.

I can remember, when I was a boy, finding out that, on certain days, one could not make phone calls, because 'the phones are out of order'—and you knew that it wasn't just your line, but the whole exchange in town.

But surely, these days, a national utility like Prestel can't casually jam up all evening, be totally inaccessible, and then restart the next day without comment, apology or explanation?

Oh, yes it can. It did. Tuesday night, 8 November. It did, if you want to have chapter and verse!

It's all great fun, and I wouldn't miss it. I just hope somebody does manage to put a proper system together, soon.

No advertising, please

After the BBC Micro, the ITV Micro.

I think the idea has elements of the daft about it.

At the time of writing the machine concerned is due for private release to the trade around the end of November, and the designer is a consortium of Transam and the Richard Hease empire, through a controlling company called Wren. The Wren is a fairly pretty little CP/M Plus computer, a bit better value than the Osborne Vixen which never was, and with a reasonable range of software available. It's portable: people who have played with it assure me that it's faster than ACT's Apricot although it's about the same size.

And there is a home version, which will load software from Oracle Teletext, and there is a business version.

My anxiety about the project isn't just over the question of whether ITV has any place launching a microcomputer—though that does worry me.

It may turn out to be just my imagination, but 1984 looks like Lotus time to me.

I really do believe that in America, after March (or thereabouts), a machine which will not run Lotus 1-2-3 will be unsellable. And Lotus 1-2-3 needs an Intel 8088 or 8086 processor chip with MS-DOS, and it needs a machine very like an IBM PC. They haven't even managed to get it onto the Sirius, yet.

In Britain, it may take longer before the CP/M market is dead. I think it is good for another nine months, here.

But that is for existing micros, not new ones.

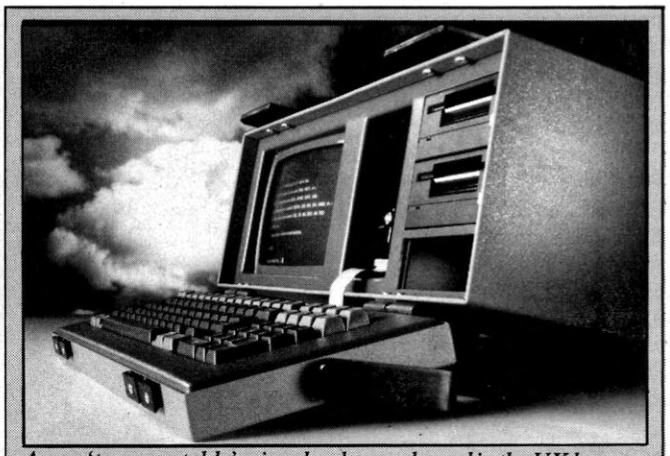
There is one piece of good sense about the idea of an ITV 'own-brand' micro.

If the various ITV channels do want to produce a programme series, showing how to use computers, they face a problem in choosing a system.

Pick a best seller, as would be the obvious choice, and you walk into a minefield. You can't pick Spectrum because the industry will say that it isn't fair to pick the best seller, when other (more worthy?) makers are short of the odd bob. You can't pick the obvious machine, the BBC Micro, for equally obvious reasons!

And you can't pick Commodore, because it's American. Or Bahamian. Or whatever.

So the own-brand machine may even be the sensible way out rather than the deterrent to advertisers which you might think it obviously is. 'Why should we advertise our micro on your channel when you're promoting a rival machine?' 'Well, would you rather we promoted Sinclair?'



A new 'transportable' micro has been released in the UK by Jonos International. Prices range from £2425 for the basic model with dual Sony 2½in floppies to £4295 for the hard disk version.

Designed and developed by Jonos Ltd in Fullerton, California, the machine is available in two finishes—sand cast aluminium for military use or leather-bound for the executive version. It is also possible to attach a specially designed printer as an extension to the metal casing.

The Jonos uses the STD bus system which means that the machine is available in a wide variety of configurations. Each machine uses two processors—an 8085 to control the keyboard and screen and either a Zilog Z80B, Intel 8088 or Motorola MC68000 as the main processor.

Mass storage is provided by either 5¼in floppy disks, 3½ sony Microfloppy disks or a single Rodime hard disk and one Sony 3½in microfloppy—take your pick! The Jonos also supports RAM disks for fast data recall.

The basic machine comes complete with CP/M, Spellbinder/Spellcheck word processing, Multiplan and MBasic. Other operating systems supported include MS-DOS, from Microsoft, MBOS from MPSL and Unix level 5 (on the MC68000 processor). A wide range of applications software is also available.

More information on (07535) 54272.

The other attraction of an own-brand is royalties.

Here, I think, is where avarice may lead the ITV companies into an even bigger minefield.

When the BBC Micro was launched, it was way in advance of anything else on the horizon. If it had been produced with the add-on 6502 processor board (still not available) it would have been an unbeatable system.

But even with the magic three letters (not IBM but BBC), the machine has been extremely hard to sell through dealers. They make such a tiny profit on each sale (because the BBC gets its royalty) that if demand were not absolutely overwhelming, they wouldn't sell it.

Acorn itself pays AB Electronics very close to £200 for each BBC B sold, and the BBC gets 10% of many sales. Acorn's profits, you will have noticed, are healthy. The dealer makes more than £5, usually, but that's about it.

Offer the dealers another royalty-plagued micro to sell, and listen to the raspberries.

And, of course, there isn't the slightest chance that all the ITV stations will network a program about the thing. The Thames has gone on record as saying that it can't and won't play that game.

Central has plans for some magical micro mission, for teenagers, set aboard a

Shakin' Spectrum

'The Bop Won't Stop' is the new cassette album by Shakin' Stevens released on the Epic label and featuring a computer game for the Spectrum called 'The Shaky Game'.

The object of the game is apparently to drive Shaky to his 'ole house' while avoiding clusters of lethal vampire bats which attack the car. Should you get a high score you then earn the dubious honour of appearing in Shaky's top ten.

This cassette produces two areas of concern. Were the vampire bats in the program inspired by the audience at one of his concerts? Let's also spare a thought for the people who will be deafened by the sound of a Spectrum program amplified through their hi-fi system.

Tony Hetherington

spaceship. Granada has a comic half-hour of family video games and occasional brilliant chat from the Editor of *PCW (How acute! — Ed.)*

There's always The Saturday Show (hooray!) and Channel 4.

Do you think . . . no, surely the ITV companies aren't pinning their hopes of an avalanche of Wren/Oracle sales on an educational series on that vibrantly popular media, Channel 4?



Those of you who wish to crow about predictions, made in this column, that the PC Junior would not be launched before January, and probably not before June, had better qualify their bragging.

The machine complete with infra-red keyboard may have been announced on 1 November. But you will notice: no Benchtest in PCW.

You will not get your sticky fingers on one of those, even in New York, until sometime in January. It will be an American standard machine, needing an American standard colour TV display.

As to when there will be a UK version, don't ask me, and don't ask IBM, because neither of us knows. I'll guess March or April. That is when privileged software companies, who have signed away their rights to free speech in order to develop programs for the thing, will get their first ones — I think.

And as to when it will be announced, my guess is next August. And as to when it will appear in British shops, my guess is Christmas.

Christmas 1984, that is. But I don't guarantee it.

Secret knowledge

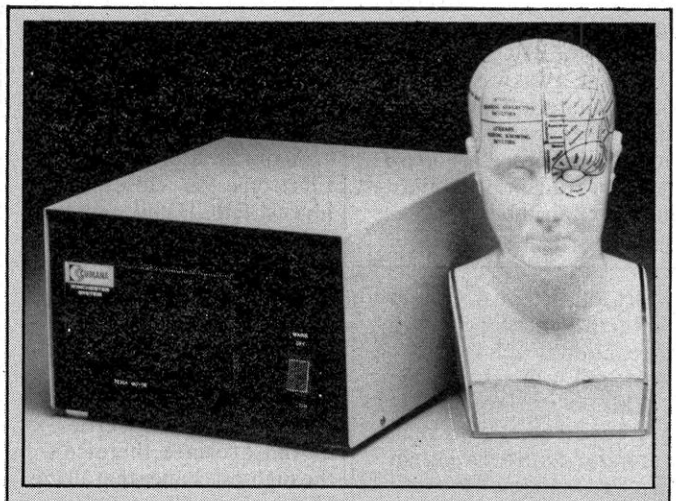
Locked Acornsoft programs supplied on cassette tape are almost impossible to move onto diskette — unless you are lucky enough to be told how.

Here's how. It's a routine supplied anonymously to *PCW*, and not tested yet.

'The addresses given by *OPT 1,2 are not valid on locked tapes. Also the least significant byte of the block flag in the file header is set. This means that an attempt to *LOAD will cause the cassette file system to abort, with the 'locked' message.

So, instead follow these steps.

1. *LOAD as normal (expect 'locked' message)
2. PRINT ~!&3BE This will give the load address in hex. (ssss)
3. PRINT !&3C2 This will give the execution address in hex (eeee)
4. Put in some code to reset the protection bit in the block flag. That is type in:
!&70 = &2903CAAD: !&74 = &03CA8DFE: !&78 = &00DC934C
5. Modify the IRQ1 vector to point to this code so that it is executed after each block is loaded, when the ACIA gives a DCD interrupt — that is, type in:
?&204 = &70: ?&205 = 0
Note: Entering this as one line will minimise the risk of an interrupt occurring while only one byte of the vector has been changed. Even so, the machine may still crash. If it does, press BREAK and repeat this step.
6. Wind the tape back and *LOAD (filename).
Note length of file (BBBB) when last block loads.
7. Save unprotected copy with:
*SAVE (filename) ssss+bbbb eeee
8. Named program can now be transferred to disk, etc.



Up to 80 megabytes of storage for a Tandy model III or IV can be plugged in using a Cumana-built drive. People using these machines don't use the normal disk operating systems of CP/M or MS-DOS, so the main difference between this and any other hard disk is the fact that it works under Dos Plus 3.5 and 4.0 and 'is also being supported by LDos' — which means, one day it will be supported for LDos, but is being prepared.

Working with the Beeb

Sceptical of promises to have Acorn Econet networks clinging like ivy to all our schools, dealer Bill Unsworth has put his U-Net onto the BBC.

Originally, it was an Apple product, linking up to 30 machines to a central disk, or up to six disks.

'The only comparable product for BBC Micro users is the Econet,' he says, 'but that requires a second 6502 processor to run the network.'

And that second processor has been long delayed. Working networks have been seen at exhibitions, but in the meanwhile, Unsworth would welcome enquiries on (0925) 54117.

Nascompromise

The arrival of Pascal as an option for programming the Nascom microcomputer coincides with the disappearance of the Nascom name.

Nascom was, once, the most successful British micro-computer. It collapsed because the company failed to keep the lid on the pot where it was cooking the Nascom 2. The delicious smell reached the potential customers of the Nascom 1, who decided to wait for the improved version; and then the improved version was delayed.

Naturally, the sad story was seized on by the stodgier micro suppliers as proof that you can't sell a cheap system and stay in business.

But the design has kept a lot of people in business ever since. The latest to join the quaint old bandwagon is Mike York, Pascal freak.

York has put the UCSD version of Pascal onto the Nascom range. The range includes the Gemini series, and should extend to the British Micro Mimi, all other things staying equal.

York supplies a p-code interpreter, and his Pascal comes with a typical operating system input-output sub-system, with the disk primitives to read and write disks 'in any format via any combination of Nascom and Gemini Controller cards, and with any mix of 8in or 5in (48 or 96 track-per-inch) drives'.

Details on 01-874 6244.

The Nascom itself is not quite dead, but its new owner, Lucas

Microcomputers, has dropped the word Nascom from its title.

More significantly, it has produced the machine without the Nascom trademark—and by 'trademark' I don't mean a little sign saying Nascom, but the irritating feature of preventing you from using standard CP/M.

Standard CP/M sits in a very specific area of a computer's memory. Nascom used this for the machine monitor.

So the Lucas LX range, in nearly every respect a Nascom, can run bog-standard CP/M—without the normal Nascomplications.

Lucas is on (0926) 497733 in Warwick.

Sound alert

I think I may have found a computer game that blind people (with a good memory) can play.

Blind people of my acquaintance have excellent memories, and can remember where the ashtray was, what's in front of the piano and all the other oddities of their homes, with uncanny accuracy.

So Mined-out (Quicksilva) should appeal.

Here's what happens, for those who missed the reviews.

You are wandering through a minefield, surrounded by barbed-wire fencing. Whenever you get near a mine, the machine beeps.

From the note of the beep, you can tell instantly whether you are next to one, two or three mines. And since you can't move diagonally, three mines is a dead end.

Working out where the mines are is like playing *Mastermind* with those Invicta Plastics pieces: you know where they aren't and what they're near to, but you have to work out where they actually are.

Sighted people have the advantage of being able to see their tracks on the screen, but as the game gets more complex, this advantage is blown away—because on the upper levels, the wind keeps taking the footsteps out.

It's the most compelling game I've played, but I do have a grumble. I do think that a game which takes the best part of ten minutes to load shouldn't crash (on the BBC version) if you accidentally touch the Escape key.

Government backing

A new processor called the Transputer has been announced by the British semi-conductor firm, Inmos.

Listen to the chat in high places, and you might come away with the feeling that nobody actually cares what the Transputer is, or may be.

They are more concerned with a man called Ian Barron, who runs Inmos.

There are a lot of people in this country who reckon that Ian Barron is too clever by half, that he is a self-opinionated squirt, that he aims to become rich, and that he doesn't know a fig about marketing.

The first three accusations, often to be heard in Whitehall, and particularly at Conservative Central Office, are sheer jealousy.

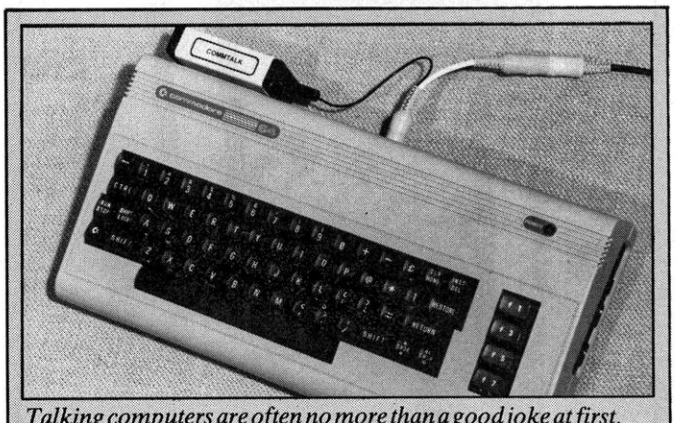
The fourth has some element of truth, and it is the fourth that should bother people who talk about Inmos and the Transputer.

The fact of the matter is that the Transputer is a great idea, and this country is going to end up paying a lot of money for it.

What people don't realise is the simple fact that the amount we have to pay now is peanuts, absolutely peanuts, to what we will have to pay if somebody else gets its, and we have to use it.

The Transputer is a wonder-chip. It's a sort of processor.

At the risk of simplifying to the point of misleading you, it



Talking computers are often no more than a good joke at first. But like the computer itself, a voice is something you only find a use for once you have it.

For Commodore users, there are well-known chips that have their own vocabulary. Creating new words, however, requires a speech chip that produces those special sounds, known as allophones—from which extremely convincing words can be assembled.

For £39, Commtalk is one of these. It plugs into the expansion slot of the VIC-20 or the 64.

Details from AndOr Systems on Dublin 900107.

Aquarius—a new dawn?

On New Year's Day the marketing rights of the Aquarius home computer (Benchtested, *PCW*, November) will pass from Mattel Electronics to the machine's manufacturer, Radofin Electronics UK. This change of management should bring a change of marketing attitude as Radofin says that it will be adopting a more aggressive style of selling.

Radofin has also released advance information about a range of new products, including two new Aquarius computers. Aquarius II, due to be released in late January, is an improved version of Aquarius I. Improvements include 20k RAM as standard (currently 4k is standard), built-in extended Basic and a full-size typewriter keyboard. Hot on the heels of Aquarius II is anticipated Aquarius III which, according to Radofin, will be a 64k powerful model that will be competitively priced. Plans are in progress to repackage the existing Aquarius I into a starter pack called COM/PAC to include the Aquarius, the data recorder, the mini-expander, the printer and some software.

Other hardware releases include a lightpen, a 32k RAM cartridge, a four colour printer, a modem and the master expander to support the forthcoming Aquarius disk drives and a disk drive controller.

Radofin has released the details of the Aquarius's memory map to third party software houses and at the time of writing expects the release of over sixty titles (including 50 cassettes) before Christmas.

Prices of these new releases are as yet undecided except that the new colour printer will adopt the price of the existing printer and the older model will get cheaper. The same is expected for the 32k RAM cartridge but no further details are available.

Tony Hetherington

Ace or bust

Jupiter Cantab, the firm that manufactured the Jupiter Ace, has been put up for sale by the liquidator.

The Jupiter Ace was the first home computer to support a language other than Basic as the language in ROM. Using an implementation of Forth, the Ace was seen by some as the beginning of the end for Basic as the standard micro programming language.

The cause of the company's liquidation appears to be a combination of over-reliance on orders which were never taken up and the departure of one of the directors. A lack of cash prevented Jupiter's planned move into the control and robotics market and ended rumours of an improved Forth-based machine.

Despite the failure of Cantab, the company may still survive if a buyer can be found. Interested parties can contact the liquidator, J D Cross, on Telex 817975 CHAMY G.

Surya

can be called a processor which matches its instructions to the work it is doing. It is a computer which can be linked together with a hundred others, and all will work together on the same task, as one giant super computer.

And it look certain to process the pants off any ordinary microprocessor chip now, or known about, right up to and beyond the level of Intel's 32-bit micro. However, it doesn't exist yet, and if the Government has its way over Inmos, it will be a Japanese product before it is made in Britain.

What the Government is planning to do is 'save' the money needed to boost Inmos up by putting it onto the Stock Exchange. If nobody wants to invest the £35 million a year (which Ian Barron reckons he needs just for capital expenditure) then it proves that Conservative dislike of this controversial man was actually good judgement.

In other words, if Inmos can't stand on its own two feet, after all the money the Government has taken from the taxpayer on its behalf, then it is better dead.

Funny, isn't it, how this argument is never advanced about farmers? If they can't stand on their own two feet, it is the fault of the European Community, which subsidises them.

Quite possibly this is true. But how much more true is the fact that America subsidises its own 'free market' semi-conductor companies by the staggeringly huge budget of the Pentagon?

Sir Ieuan Maddock, former Government chief scientist told me that the Pentagon spends, all by itself, more money than the whole UK budget, every year. And a *very* large part of that budget goes into electronics, to develop faster chips, bigger chips and cheaper chips.

In this country, of course, the Ministry of Defence spends lots of money on electronics.

It goes, mainly, on 'cost-plus' contracts to companies like Plessey, Ferranti and GEC. Cost-plus means they get paid whatever they spend, plus a percentage for profit.

It will be obvious why, a couple of months ago, Sir Ieuan attacked the 'cost-plus' concept. And, knowing that he did so, you will understand why he is in favour of keeping Inmos going.

These cost-plus companies, when Inmos was first proposed, clamoured for the money to do it themselves. 'We are the established electronics firms,' they said, 'and if anybody is going to get support from the taxpayer, it should be us.'

The fact is that GEC, despite its legendary cash mountain, has yet to fabricate something as simple as the Intel 8080 in its own foundries.

The last time I made this observation, a paid flunkey rang me up from GEC in order to be abusive. 'How can you doubt that we will?' he asked. We must assume that the 8080 proved to be an unpopular chip, not worth making.

Similarly hurt noises emerged from Ferranti, inventor of the uncommitted logic array ('ULA'), when people suggested that Ferranti was unlikely to be the saviour of Britain's microprocessor future. It had every intention of 'marketing the F100L aggressively', it said.

In other words, the chance of established British semi-conductor companies getting out into the silicon market with anything like a risk-taking enterprise, is remote.

Should the Government give Inmos, whole and entire, tomorrow, to GEC and Plessey, as a present, you will still find no bookmaker daft enough to challenge the suggestion that the Transputer would vanish for ever.

The reason isn't just inertia. Think of the Texas Instruments microcomputer. If a highly aggressive silicon chip maker like Texas Instruments could scuttle its range of home computers for the sake of its very ordinary minicomputers in 1978, how much more would Britain's very much more patrician club of Purveyors of Quality Silicon to Her Majesty welcome the chance to strangle possible competition for their outdated minicomputers?

No, what bothers me about Inmos isn't the technology. That is a clear leap, as Sir Ieuan put it, across the generation gap.

Instead, I wonder how much money the computer has earmarked for marketing.

Barron says that he has 'a lot of customers for Inmos memory products,' and that 'we will be taking the Transputer to them.'

I've heard that argument from a lot of processor makers, who nowadays have withdrawn their processor for lack of support.

* * *

Tony Hetherington adds his report on the Transputer:

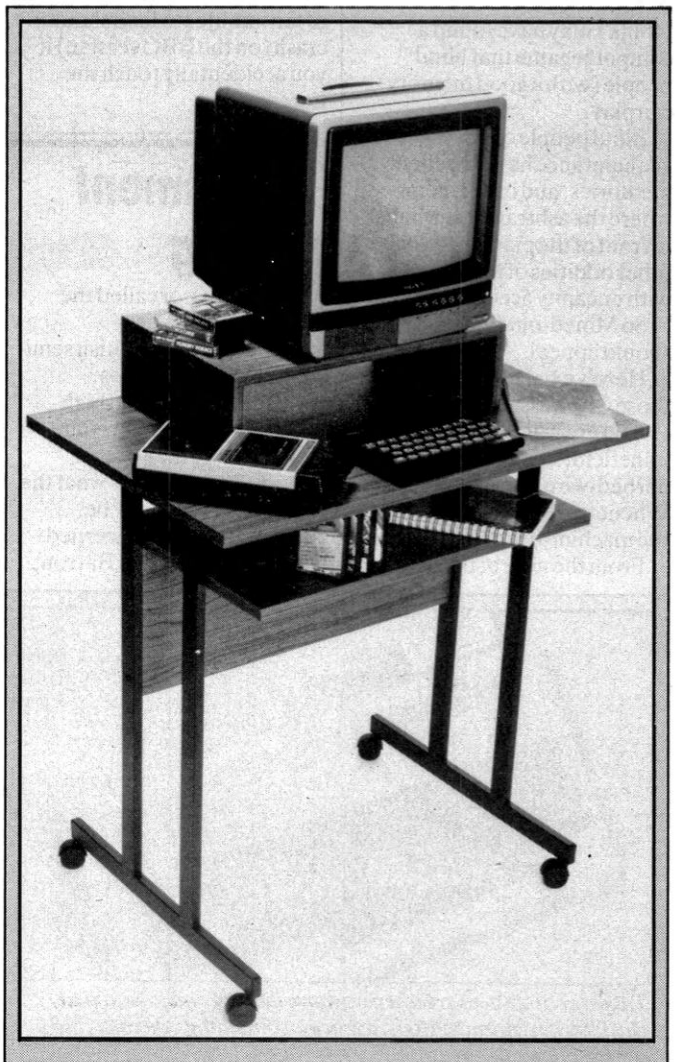
The Transputer is a 32-bit processor which promises processing speeds of 10 MIPS — comparable to the speed of a three-year-old IBM mainframe.

The Transputer is not only a powerful processor but also contains in its ¼in square chip, 4k RAM memory and a multiplexed peripheral interface.

The built-in memory provides a rapid interface between the Transputer and up to 4 gigabytes (four thousand megabytes) of addressable memory at data rates up to 25 megabytes per second.

Almost any industry standard peripheral will be supported by the Transputer via its peripheral interface making it an attractive proposition for computer manufacturers. Also of interest to prospective users of the Transputer will be the ability of one Transputer to be linked via high speed links to up to four others, and so on, which could lead to a new generation of supercomputers.

Just such a supercomputer is being designed by a research group at Imperial College, London. It will incorporate 64



Gallid makes useful computer furniture. It's useful because it's on wheels.

I actually spent my own good money (journalists try not to do this) on its printer trolley; now that it has produced this micro stand, I am tempted to repeat the unpleasant experience.

As you can see, you can move the whole thing away from the living room without unplugging all the wires.

Details on (0788) 74442.

Transputers and will be 100 times more powerful than today's computers!

Inmos expects to complete development next year and plans to have the first production Transputers ready in 1985.

Go forth and multiply

'I honestly expect that when my Spectrum board with Forth hits the market, Jupiter Cantab will go bust,' said David Husband.

He proposes to give Spectrum owners the Forth language for £70—able to run ten programs simultaneously—with a Centronics and a Serial outlet thrown in. And run them *fast*.

As he spoke these words, the makers of the Jupiter Ace were going bust, without any help from him—but I suspect that he was right. I suspect he is offering far more than they did.

Husband already sells a ZX81 with the normal Basic language deleted and Forth plugged in instead.

Forth experts raved about it—even those experts who normally describe micro-Forth as grotty.

One sceptic described ZX81-Husband-Forth as 'a little fragile' but amazing all the same, and another agreed that it was 'much more than FIG (Forth Interest Group) Forth standard'.

His upgrade for the Spectrum is a far more ambitious project than the ZX81.

Apart from the fact that it is a plug-on board, not just a plug-in chip, and apart from the two sockets it gives, the sheer scope of having a Spectrum, rather than a ZX81, makes it much more flexible.

For a start, the Spectrum board, due in December, will not have to stop work every few microseconds in order to give information to the TV display. The ULA chip does all that.

Next, the Basic ROM doesn't have to come out. The add-on board has its memory on the same address lines, but the computer can switch between one set of memory and the next. So Basic can pass messages to Forth, and vice versa.

And there is a lot more memory to play with on the Spectrum than on the normal 81.

The ZX computers, because of their simplicity, are very easy to use as controllers. Ministry of 'This and That' people buy them in hundreds, take the boards out of the boxes, and hide them in 'sophisticated instrumentation because it is so easy to develop software on them.

And Micro Mice with ZXs inside them have won many maze contests.

With Forth, the writing of robotic control programs like micro mouse applications becomes very much more within the reach of you and me.

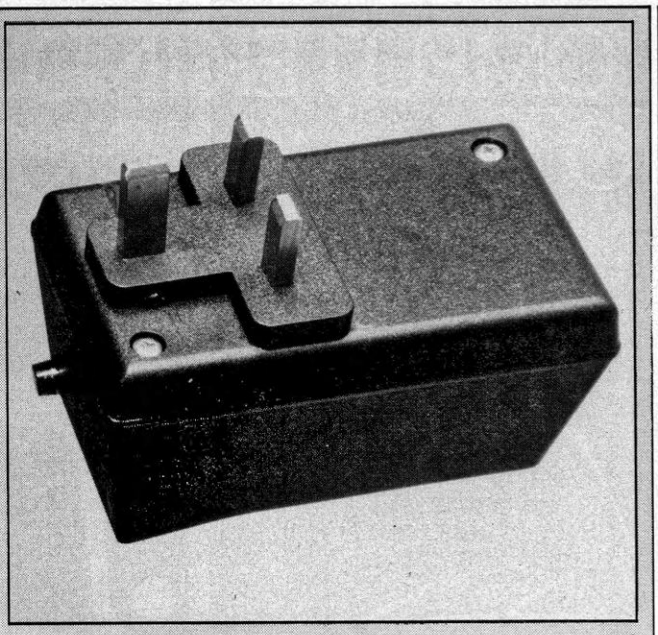
Ten different tasks can run together. One can analyse the maze. One can drive the motors. One can steer.

And, as you will realise from the information that ten tasks run simultaneously, there is a real-time clock, to organise the multi-tasking.

You can write to David Husband at 2 Gorleston Road, Branksome, Poole, Dorset BH12 1NW. I'm not giving the phone number, because he needs the time to polish the thing off.

Last time I spoke to him, he was turning over in his mind whether or not to include a proper RESET key on his £60 board.

I hope he can make it work with a Microdrive.



Don't ask whether it works: ask whether you can plug it in. Of course it works: it's a mains voltage 'spike' suppressor. But in many old houses, the plugs are at carpet level. Anybody planning to buy this thing, called Chips, please measure the space between the plug socket and the carpet. Alternatively, go for the old 'Plug' which has the prongs on the bottom. Details of this from CHIPS on (0274) 834764.

Up for renewal

This is the year (1984) when the BBC must once more make up its mind what sort of computer it uses on the screen.

No, Acorn's contract doesn't run and run. It expires, unless renewed, around August.

Sinclair Research is already talking with the BBC about a 'new design' for the future. If the Advance 86 model C is produced, it will be cheaper than the IBM PC Junior, and an obvious candidate for consideration as a standard BBC Mark II.

The Elan, if it is to be built, would rate very serious consideration. Commodore is now a UK-based company (it will argue). Why not a little acknowledgement . . ?

I don't envy the BBC mandarins their job—on the other hand, I can't pretend to have total confidence in their judgement.

It isn't just a question of their total misjudgement of the size of the market when they launched it, or their rotten software (the BBC's, not Acorsoft's).

I can't even pretend that I will gain anything if they do give the contract back to Acorn (but I think they'd be mad to abandon the BBC Micro).

No, the thing that really made me realise what poor judges they were was the time, a year or so ago, when I offered my own humble (!) services to their TV programmes, and was given an amused 'we'll call you if we need you,' response.

Bias? How can you imagine such a thing!

Smith & Sons?

WH Smith has opened another 23 computer departments in its High Street stores.

The branches involved are at Bradford, Brent Cross, Cambridge, Ealing Broadway, Edinburgh, Glasgow, Hammersmith, Holborn Circus, Hull, Kingston, Leeds, Leicester, Liverpool, Manchester, Newcastle, Nottingham, Plymouth, Reading, Sheffield, Sloane Square, Southampton and Wood Green.

Each branch will sell the BBC Micro, Electron, Apple II, ZX81, Spectrum, Commodore 64 and Oric 1.

Surya

Double your money?

The Dragon 64, long rumoured but brought into doubt by the financial problems of Dragon Data, has been launched.

The machine differs little from the 32 apart from the memory offered. All existing Dragon 32 cassette and cartridge-based software will run on the new machine. The extra RAM is switched on by an EXEC call.

The other differences are the addition of an RS232 port and auto-repeat on all keys. The Dragon 64 is available from most existing Dragon outlets.

I'd like to tell you the price, but Dragon now appears to have an unlisted phone number and, at the time of writing, the

THIS YEAR WILL BE AS IMPORTANT TO THE COMPUTER INDUSTRY AS 1959 WAS TO THE MOTOR INDUSTRY.



1959 saw a revolutionary development in the evolution of the motor car that shook the industry. The launch of the Mini.

Twenty five years later, Sanyo are set to cause a similar stir in the world of computers with the launch of the first ever Small Business Micro. The Sanyo MBC 550. The first machine of its kind to offer the performance, compatibility and range of software of a true business micro for just £699.* Which is considerably less than the cheapest business micro.

So if your business requirements are too great for a personal computer and you can't justify the expense of a business micro, phone Logitek on 0257-426644, or STC on 0279-26777 or ICARUS on 01-485 5574 or clip the coupon and we'll show you the Sanyo MBC 550 or the more powerful twin drive Sanyo 555, two revolutionary new micros that mean business.

See Sanyo's new small business computer at the "Which Computer? Show," N.E.C. 17th – 20th Jan. 1984.



*Single drive excluding monitor.



SEE SANYO, THEN DECIDE

SANYO

Name _____ Address _____

Company _____ PCW1 _____ Tel. no _____

Position in Company _____

Return to: Marketing Dept., Sanyo Marubeni (UK) Ltd., Sanyo House, 8 Greycaine Road, Watford, Herts.

dealers I spoke to hadn't been told the retail price.
Surya

Holmes and dry

Somebody else who likes the Sinclair way of doing ultra-cheap 'disks' (that is, continuous tape wafers) is Salt Lake City's Holmes Engineering.

For $350, this company will sell you a drive, five wafers, battery charger, cable and software to connect to a knee-top Tandy 100 micro for data storage.

'Operation is similar to a floppy disk,' said the official contact, 'with a directory of all files displayed and a file able to be deleted anywhere, and replaced by another'.

The device runs at 9600 baud — by disk speeds, creepily slow, but ten times the speed of the fastest audio tapes.

Details available on (801) 261 5652.

Let the sun shine. . .

An excited publicist from Systems Union informs me that SunAccount 'is the first accounting package for the Apple Lisa'.

Unlike the programs so far offered by outsiders on Lisa, this £1250 suite of accounting software can pass information to Lisa's own word processing and graphics programs.

Full details from Herman Bruce, marketing director at Systems Union, on 01-485 2594.

Fair deal for all

It could be called sheer bad luck that a survey on Acorn — conducted for computer dealers by the Computer Retailers' Association ('CRA') — has just fallen into my hands.

The Computer Retailers' Association is trying to dig itself out of its four-year doldrums by expanding.

It hopes to become the Micro Industry Association, including not just dealers, but distributors, and even manufacturers — and software producers.

Unfortunately, one of the biggest of these previous outsiders, Acorn, was the subject of a very hostile survey of members recently.

The survey showed that Acorn's relationship with shops was not a sweet one.

For example, out of 31 people asked the simple question 'Are delivery promises kept?' only five could say 'Yes'.

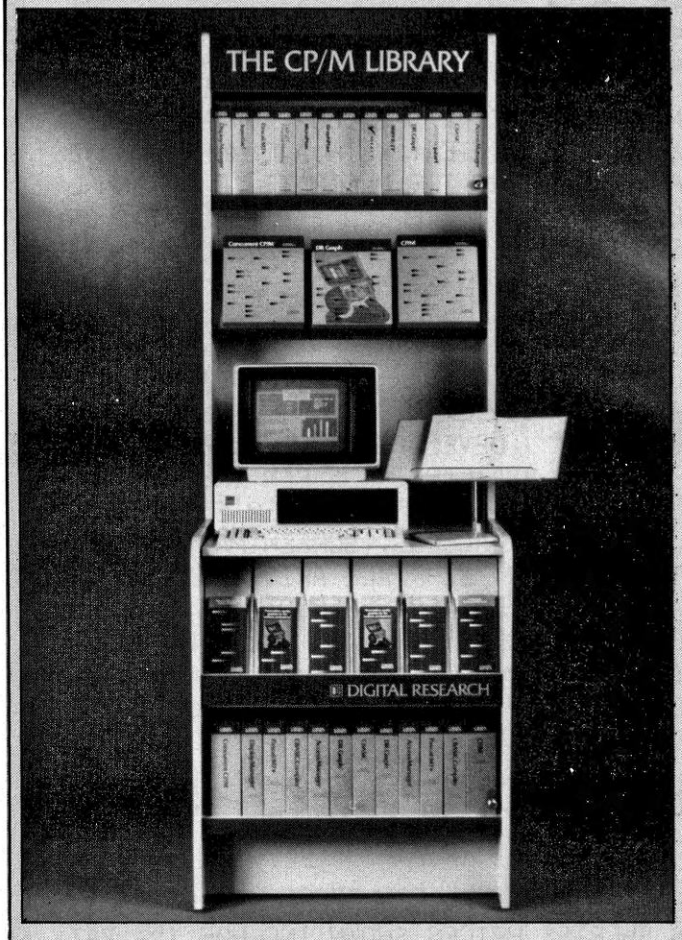
The BBC Micro itself, they loved. Out of 30, only four expressed reservations about the reliability of the machine.

But out of 26, 21 claimed that there was 'a difference between the information given direct to the end users, and the information given by Acorn to the dealers'.

If the BBC and Acorn do draw up a new contract (see 'Up for renewal'), one important factor must be a better deal for the dealers. They do have to stay in business to repair the beast, after all.

Never mind. Perhaps Acorn will forgive the CRA, and make friends.

The CRA has served a long apprenticeship in the wilderness, and the officers have learned several tricks of the trade, without having the distraction of being a useful platform for amateur politicians. First thing to do, of course, is to clean up the 'Top Ten' lists of hardware and software, by monitoring the figures. But more of that, another time.



Do not for a moment make the mistake of believing that you have already heard of 'The CP/M Application Library'.

This time, it's about IBM, not CP/M. The Application Library is not the old user group with a new label: it is a bid for survival by Digital Research, in the IBM 16-bit market.

It refers to 16-bit CP/M, or CP/M-86, which is busily scoring triumph after triumph in the rock pools of the world's non-IBM suppliers; and presumably it totally eclipses the small-time contract that rival Microsoft has with the one-off personal computer supplier, IBM.

Yes, things look serious for CP/M-86 unless it can get software running under its own banner, rather than MS-DOS or PC-DOS.

To illustrate it: I have a fanatical belief in the urgent need of most users for concurrent software. I believe that Concurrent CP/M-86 (or something like it) is necessary to free us all from the tyranny of 'load-and-run' followed by 'log-off and remove disk' whenever we want to switch from accounts to deleting or copying files.

In order to test Concurrent CP/M-86, you need two (or preferably more) programs, to run concurrently.

Writer and *PCW* contributor Dick Pountain and I have been trying to arrange this demonstration for several months. We have the IBM PC, and we have Concurrent CP/M-86.

But of diskettes which will load under that operating system on the IBM, we have only promises.

Hence the new Speed-Start — an abridged version of the CP/M-86 operating system. You put your application program diskette into your IBM micro, and CP/M-86 is loaded with it. You don't have to buy CP/M first.

So far there are nine programs: WordStar, Select (text editors), SuperCalc (spreadsheet) plus Move-it for comms, Personal Pearl, Target, MicroPlan, GraphPlan and DR Graph — a Digital Research product, the last.

It's a start. When I see four running under Concurrent on the IBM and the Sirius, I'll know they're getting somewhere.

Welcome intervention

Hewlett Packard ('HP') will invest around £10 million in Britain over the next few years when it sets up its first research and development

Superbase 64

TRANSFORMS THE COMMODORE 64 INTO A FULL-FEATURED AND PROFESSIONAL DATABASE SYSTEM! WITH UP TO 1000 CHARACTERS PER RECORD ON UP TO 4 SCREENS... AND UP TO 128 ITEMS PER RECORD, DEFINABLE AS KEY, TEXT, NUMERIC, CONSTANT, RESULT OR DATE... IN FILES OF UP TO 16M CHARACTERS! SUPERBASE EVEN HAS SPREADSHEET AND CALCULATOR CAPABILITY, CALENDAR FUNCTIONS, EASY INPUT FROM WORDPROCESSOR/DATA FILES, BOTH MENU-DRIVEN AND PROGRAM OPTIONS, SORTING/SEARCHING, FULLY DEFINABLE OUTPUTS... SUPERBASE 64 IS ESSENTIAL IF YOU WANT THE MOST FROM YOUR 64! SUPPLIED ON CBM 1541 DISK WITH EXCELLENT TUTORIAL/REFERENCE MANUAL. EX-STOCK NOW!

● OUR PRICE ONLY ~~£99.95~~ £88!

VIZAWRITE 64

NOW AVAILABLE ON CARTRIDGE, VIZAWRITE 64 IS A HIGH-PERFORMANCE, LOW-COST WORD PROCESSOR, WITH ON-SCREEN FORMATTING, THAT TAKES FULL ADVANTAGE OF THE 64'S COLOUR, GRAPHICS AND MEMORY FEATURES... AND SUPPORTS VIRTUALLY ANY PRINTER! WITH A COMPREHENSIVE AND EASY-TO-FOLLOW USER MANUAL, VIZAWRITE OFFERS THE ULTIMATE IN PERSONAL COMPUTER WORD PROCESSING! ALSO AVAILABLE ON DISK (OUR PRICE ~~£79.35~~ £65!), OR COMBINED WITH VIZASPELL (OUR PRICE ~~£99.00~~ £85!).

● OUR PRICE ONLY ~~£79.95~~ £68!

Master 64

MASTER 64 IS A TOTALLY NEW CONCEPT... A COMPLETE PROGRAM DEVELOPMENT PACKAGE, THAT'S AVAILABLE NOW FOR THE CBM 64. MASTER HAS 85 NEW COMMANDS... AND BASIC IV TOO! PLUS PROGRAMMER'S TOOLKIT, MACHINE CODE MONITOR, BUSINESS BASIC, KEYED DISK ACCESS, SCREEN MANAGEMENT, USER-DEFINABLE INPUT ZONES, REPORT GENERATOR, 22-PLACE ARITHMETIC, DATE CONTROL, STRING FUNCTIONS, DISK DATA COMPRESSION, SCREEN PLOTTING, SCREEN DUMP, OPTIONAL SOFTWARE PROTECTION KEY, AND MORE... IN FACT EVERYTHING YOU NEED TO PROGRAM YOUR 64 TO TOP PROFESSIONAL STANDARDS! MASTER 64 COMES WITH A FULL USER REFERENCE MANUAL, QUICK REFERENCE GUIDE AND DEMO PROGRAMS. ALSO AVAILABLE FOR CBM 700 (£339.25) AND CBM 4032/8032/8096 (~~£339.25~~ £225!).

● SPECIAL OFFER PRICE ~~£143.75~~ £115!

THESE ARE JUST SOME OF OUR FINE SOFTWARE PRODUCTS FOR COMMODORE COMPUTERS... PLEASE TELEPHONE OR WRITE FOR FREE DATA SHEETS! PRICES SHOWN INCLUDE 15% VAT AND ARE CORRECT AT TIME OF GOING TO PRESS. ORDER BY POST/TELEPHONE/PRESTEL, USING CHEQUE, ACCESS, BARCLAY CARD OR OFFICIAL ORDER. TELEPHONE 01-546-7256 FOR SAME-DAY DESPATCH! POST FREE EXCEPT ON CREDIT/OVERSEAS ORDERS. (REF A23)

Calco Software

LAKESIDE HOUSE, KINGSTON HILL, SURREY KT2 7QT TEL 01-546-7256

division outside the United States.

The company chose Britain after evaluating other countries in the free world with high technology capability, including France, West Germany and sites in the US outside California. HP managing director, David Baldwin, said that a major reason for selecting Britain was 'the UK reputation for applied research and the quality of your university and technical college graduates'.

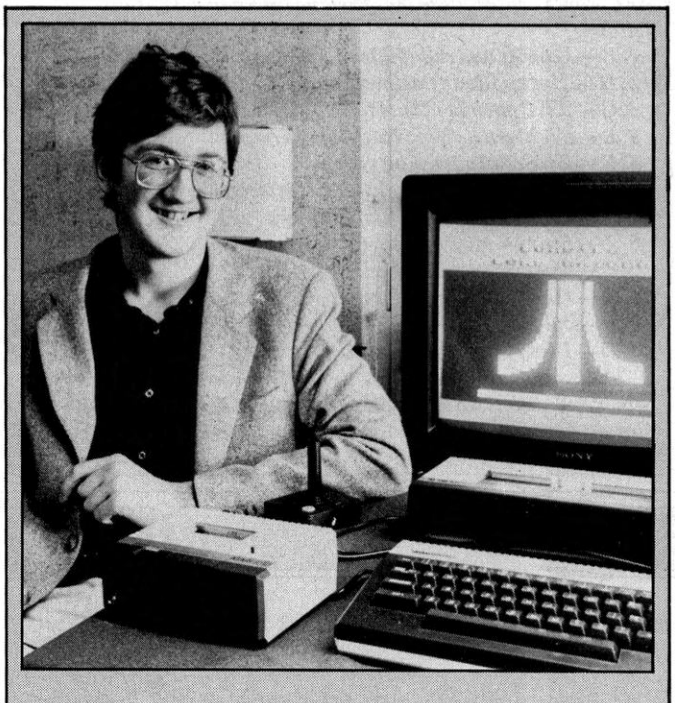
Research staff are already being sought and it is intended that 50 will be recruited in 1984 and 200 by 1987 plus 100 other employees.

The new division will be located on the same site as HP's recently established disk memory division near Bristol.

Don Hammond, currently head of HP's Physical Research Centre in California, will be the first director of the new division. He and an American project leader are the only US employees who will work in Bristol. 'The rest of the staff will be recruited in the UK and Europe,' said Baldwin. He added that a UK national is already being sought to replace Hammond who is 56 and will only remain at the Centre for two to three years.

Welcoming the HP announcement, industry minister Norman Tebbit said HP's decision 'confirms Britain as the free world's second most important place after the US itself for high technology'.

Margaret Spooner



A couple of months ago, one might have sighed heavily at the sight of this eager young man, who has just had a computer game accepted by Atari.

Since IBM launched the PCJunior, however, people in America are suddenly starting to make hopeful noises about the survival of Atari.

The point is that IBM has ended the price war. Everybody feels that the typical IBM PCJunior owner will have spent close to $1800, and so a Commodore 64 with diskettes at less than $1000 will suddenly look over-cheap.

And the same goes for Atari, Coleco Adam and several others—all of whom have announced price rises!

The increases started in November, and nobody in the UK has announced anything to go with it yet—but you can bet that they will.

And if Atari get more money for its computers, it may become profitable, and this young man may sell a few copies of his game, The Lone Raider.



Apricot competition winner

'It's a winner'—that's how Jon Semple described the Apricot he won in the PCW *Show competition. Jon, who works for British Telecom, is pictured receiving his prize from Derek Swindell, Marketing Director of ACT (UK) Ltd. Jon plans to use his new machine for work and play: BT management looks kindly on home-working and Jon is used to working from home on his RML 380Z machine. Since he works in the BT 'Spectrum' group responsible for controlling Telecom Gold, he is used to communicating with BT by computer link.*

'The competition took a day's research to complete,' said Jon. 'The one I nearly didn't get was NLQ. I'd never heard of it, but eventually found a printer ad in PCW *which talked of Near Letter Quality output.'*

Brushing up on computers

GENERAL DENTAL COUNCIL
COMPUTADENT
A NATIONAL SCHOOLS COMPETITION FOR 12 TO 18 YEAR OLDS

The appeal of home micros to youngsters has not been lost on the General Dental Council 'GDC', which has launched the first dental care competition to involve the use of computers.

'Computadent', as the competition is known, is open to secondary schools throughout the country. Children between the ages of 12 and 18 are eligible and what they have to do is either use a computer to undertake a survey on the state of the nation's molars or else write 'a computer program on dental health'. The second of the two options is quoted from the competition details and isn't a good example of a program specification, so I decided to come up with a more accurate account of what a good program on dental health might achieve.

I am currently trying to introduce my daughters, aged five and 18 months to the delights both of computing and tooth-brushing. My problem is that Emma, the elder, hates me scrubbing her gums and little Melanie is addicted to the flavour of toothpaste which she sucks off her baby toothbrush as fast as I can squeeze it on. She only has four teeth anyway! So if a school can come up with a game which will keep a toddler away from the toothpaste tube and at the same time turn an infant into a jaw-cleansing junkie, I would award it (if *I* were among the judges) one of the £5000 worth of prizes on offer from

NEWSPRINT

leading computer manufacturers. In fact the judges include six dental experts and only one computer-in-education man. I hope the latter will be able to hold his own—a good original set of ivories will be a great comfort to him on judgement day.

If you want some more details to chew over before getting your teeth into the competition, write to 'Computadent', General Dental Council, 37 Wimpole St, London W1M 8DQ. The closing date for submissions is 30 March, 1984.
Jerry Sanders

Sinclair expansion

Sinclair Research, manufacturer of the UK best-selling ZX Spectrum, is planning to increase its overseas sales—hoping for a share of the estimated £1.5 billion European computer market.

Sinclair already manufactures 40% of its ZX81s and Spectrums for the export market, and recently invited 54 overseas distributors to Cambridge for a three-day conference on the company's overseas marketing plans.

Sinclair managing director Nigel Searle said that the company 'places tremendous importance on exploring new markets for Sinclair products'. Sinclair has now sold over 1.5 million personal computers, and its monthly production is now in the region of 100,000 units.
Surya

Don't miss. . .

The Chip Shop is Radio 4's exciting half hour computer programme starting on Saturday, 14 January at 5pm. It will be presented by film guru turned micro freak Barry Norman and will feature special input from *PCW*.

The programme investigates many aspects of computers, including micros. One key element will be Softspot—a software broadcasting service for six popular computers including the BBC Computer.

The 'Chip Shop Take-away Service' will broadcast software for six minutes after the shipping forecast on Radio 4 on Saturdays, Sundays, Tuesdays and Wednesdays.

The Chip Shop will go out on Saturdays for ten weeks at 5pm long wave, VHF and medium wave. It will be repeated every Tuesday at 11pm on Radio 4 VHF only.

Jane Bird



APC competition winners

The judges of the NEC sponsored competition 'Win an APC' absconded from their onerous duties for a few brief minutes to be photographed.

They are, Alan Strawbridge, NEC's software division manager, our ed, Jane Bird, and Ronald Young, director of Systematics International which supplied the applications software for the prize machines.

After heated debate (and the judges' decision is final), the result was decided. The order, in which the 12 key features of the APC would contribute to the efficiency of a business, is as follows:

1. E—Quality and reliability
2. H—Unequalled price/performance
3. G—NEC packaged business software
4. L—Eight-inch disks: 1Mbyte per drive
5. K—Choice of operating systems
6. F—Extensive communications facilities
7. B—22 programmable function keys
8. J—True 16-bit processor (8086)
9. C—Memory expandable to 64k of RAM
10. A—High resolution graphics
11. I—Colour option
12. D—Programmable character set

The three closest entrants, who each win an APC complete with applications software, were: Fergus O'Rourke from County Cork in Eire; R R Jackman, Worcester; A J Nobbs, London W3

LEISURE LINES

by JJ Clessa

A happy and prosperous new year to all. Here's our first quickie of 1984.

Quickie

If you pay as much percentage income tax as you earn in pounds per week, what is the maximum take-home pay you can get? (For example, if you earn £100 per week, then income tax is 100% and take-home pay is nil.)

Prize Puzzle

The divisors of 66 are, 1, 2, 3, 6, 11, 22, 33 and 66. The sum of these is 144, which happens to be a perfect square.

I want you to find a 7-digit number with the same property — that is, the sum of whose divisors is a perfect square.

October Prize Puzzle

An average response for a puzzle which was not too difficult, but was ideal for solution by micro. Almost 180 entries, of which 20 came from overseas (not including N Ireland).

The furthest solution arrived from Brazil. Another came from Iceland. Both of these contained correct solutions, but the winning entry, randomly taken from the heap, came from CC Hamling of Romford, Essex.

There were several correct solutions (ignoring the trivial solutions of 1, 2, 3, 4, 5, and 6), and I confess I had overlooked the smallest of these. There may be others, of course.

Base 10	Base 7	Base 9
31	43	34
248	503	305
731445	6134331	1334316
811518	6616641	1466166

Anyway, congratulations, CC Hamling — your prize will be forthcoming.

Micropuzzles *by JJ Clessa, published by Pan Books, is now on sale at all leading booksellers.*

It contains Leisure Lines-type puzzles, past and present, including quickies with answers.

END

BRITISH MICROCOMPUTING AWARDS 1984

THE SUNDAY TIMES



2 Orics and software to be won. Enter your nomination now!

All correctly completed nomination forms will enter a free draw. Winners will be announced in the March issue.

1984 will see the advent of one of the most important events in the microcomputing calendar, The British Microcomputing Awards, which is being supported by The Sunday Times.

PCW will have a key role in this event as it will be hosting two of the most important awards in the microcomputing world.

We are looking for the best software and the best micro of the year and we are seeking nominations from *PCW* readers.

Which of the new machines is your favourite, and why? What software do you think outstanding. Tell us about it and we might agree. Here are some general guidelines on what we're looking for:

Category 9. Software of the Year

The 'Software of the Year' award will be presented to the software house which, in the opinion of the judges, has published the most user-friendly software providing the simplest means to reach an effective solution. The software will be judged as a user aid and a tool, so we will be looking closely at how it carries out the task the user wants to complete. Flexibility and value for money are key requirements for the winner.

Category 10. Microcomputer of the Year

'Microcomputer of the Year' will be awarded to the machine which, in the opinion of the judges, is the best to have appeared on the market in recent months. The judges will be considering how user-friendly the micro is, the extent of its flexibility, the range of supported software, expandability, design and price. Machines must cost less than £8000 and the version entered for the award must have first appeared on the market between 1 November, 1982 and 1 November, 1983.

PCW will extract four nominations from each category and forward them to a central judging panel of eminent individuals who will choose their top three nominations. The prizes will be awarded at a glittering event next spring. The major sponsors will also be presenting a top overall award for the most outstanding contribution to microcomputing.

Readers may also submit nominations for the categories being hosted by *PCW's* sister publications*. Official nomination forms are to be found in current editions of the magazines but these are the other categories.

Category 1. Business Microcomputer
Category 2. Business Software.
Category 3. Home Microcomputer.
Category 4. Home Software.
Category 5. Creative Software
Category 6. Game.
Category 7. Consumer.
Category 8. Peripheral of the Year.

***Personal Computer News, Computer Answers, What Micro?, Micro Decision and Personal Computer Games.**

Rules:
Manufacturers may nominate their own product which need not have been made in Britain but must have been available for purchase from retail outlets in the UK between 1 November, 1982 and 1 November, 1983.

Employees of VNU Business Publications BV, the sponsors or any individuals associated with the British Microcomputing Awards are ineligible to place a nomination with the exception of the six VNU title judging panels who may each nominate up to six entries.

The decision of the judges is final and no correspondence will be entered into.

All nominations must be received by noon on 5 January, 1984.

Personal Computer World

Nomination Form
Please enter below your nomination for the following categories. In not more than 30 words, please give the reason for your choice.

Category 9 | Software of the Year

I nominate .....

Reason for choice .....

.....

.....

Category 10 | Microcomputer of the Year

I nominate .....

Reason for choice .....

.....

.....

Name .....

Address .....

.....

.....

Send your nomination(s) to: VNU Business Publications BV, British Microcomputing Awards, FREEPOST 38, London W1E 6QZ.

YANKEE DOODLES



Up to the minute news from Sol Libes in stateside . . . six Taiwanese IBM PC clones expected . . . first optical storage disks launched . . . discounted video games . . . Wang to publish optical disk dictionary . . .

Random rumours

Commodore is expected shortly to announce a new disk drive for the C-64 which uses the user port rather than the 488 serial bus interface thus speeding disk I/O, the slowness of which has long been a complaint of C-64 owners . . . Videobook Corp, Seattle, WA, is rumoured readying a $600 personal computer that runs Apple, Commodore 64 and IBM-PC software . . . AT&T is said to be about to enter the personal computer market via its Information Systems division . . . MicroOffice Systems Technology, which introduced the 'RoadRunner' knee-top computer last fall (with an 8-line by 80 character LCD display and running CP/M) is promising to introduce units with 16 and 25-line displays by mid-year . . . At least six IBM-PC clones are expected from Taiwan during the first quarter of this year . . . Apple is expected to switch to the Sony microfloppy in its forthcoming MacIntosh micro computer, a less-pricey version of the Lisa . . . Microsoft is expected finally to release its new version of MS-DOS, which it has been working on for almost a year. The new version will have multi-tasking ability (*à la* Concurrent CP/M) and networking support . . . Adam Osborne is apparently about to start a new venture based on software publishing . . . Sources report that IBM has delayed introduction of its local area networking system because of problems with the interface chips being furnished by Texas Instruments . . . There is speculation that Wang Labs may be readying a dictionary on optical disks since it has purchased exclusive electronic publishing rights to the *Random House Dictionary, Concise Oxford Dictionary of English, Roget's International Thesaurus, Black's Law Dictionary* and the *Chicago Manual of Style*.

Apple news

Dealers, despite Apple's attempts at preventing discounting of units, are offering discounts on the IIe. Most dealers attempt to conceal the discounts by bundling the unit with peripherals and software. However, there are dealers selling the basic unit unbundled for well under $1000. And Apple is expected shortly to reduce the list price of the IIe to just under $1000.

IBM introduces PC-Junior

IBM finally introduced the 'PC Junior' on 1 November after several months of rumours (under the name 'Peanut') that appeared in the press. The unit turned out pretty much according to rumour and in line with predictions that appeared in this column several months ago.

The unit, with a base price of $670 (dealer cost about $480) contains 64k of RAM, two slots for plug-in ROM cartridges and three expansion slots. The keyboard is cordless and communicates with the main unit via an infra red link. The unit includes three expansion slots which are dedicated to RAM expansion (64k), a floppy disk controller and modem card. A unit with a slim-line floppy and 128k RAM will cost $1270 (dealer cost about $860). The unit will run MS-DOS version 2.1. Bus expansion is provided that can expand the unit by attaching modules. I/O is provided for joysticks and cassette storage. The unit drives a colour monitor with better resolution and more colours than the PC.

Industry pundits speculate that IBM will corner 20% of the under $1000 home computer market this year with its PC Junior system. And, they expect this to rise to over 30% next year. They predict that IBM will take first place away from Commodore, with Coleco in second, pushing Commodore down to number three.

Dealers received initial limited shipments of the PC Junior in November but it will be January before any significant quantity becomes available. Predictions are that IBM will produce one million of them this year and probably over three million next year.

The question now is what will be the impact of this unit on the sales of the PC?

Bad times

Atari, which had expected to ship at least half a million of its new XL series of computers by the end of last year is rumoured actually to have shipped only a little over 100,000 units. Shipments, which were supposed to begin in September did not begin until mid October.

Atari is rumoured readying a new high-end computer that is IBM-PC compatible. If true it may signal a move by Atari away from the low-end home computer business in which it has, as yet, to show a profit.

Warner Communications, Atari's parent, reported a loss for the first nine months of '83 of almost $425 million. While the company's profits from other businesses rose by 32%, the Atari video game and computer divisions produced a loss of over $536 million on sales that dropped from $1.41 billion to $753.6 million.

And Coleco Industries, which promised to start shipping its Adam system by the end of last August did not actually begin shipments until the end of October. Thus it is expected to ship far less than the half million units promised by the end of '83.

Predictions are that the first quarter of 1984 will see a lot of distress sales of inventory by companies leaving the business.

Also, the video game boom of the last few years appears to have run its course as game module sales dropped last year to less than six million from eight million the year before. Further, it is estimated that 15% of the 10,000 game parlours closed their doors last year as revenues and profits dropped. K-mart, which at one time had video game rooms in 200 of its stores has phased them out in favour of selling home computers and other electronic products. Arcade operators are hoping that the new video disk-based games now becoming available will improve their situation.

Home video game units are now being sold at bargain-basement prices and some are used as loss-leaders being sold below cost. Also the sales of cartridges has become a commodity business where price is everything.

IBM demos LAN

IBM demoed a prototype Local Area Networking system at the Telecom '83 show held in Geneva in October. This indicates that IBM is very close to introducing its long-awaited LAN system. The system used a token-passing ring architecture to communicate among word processors, file and printer servers and PC workstations.

The top 10 micro makers

Future Computing Inc, a marketing research firm in Richardson TX, has released its chart of the top ten personal computer manufacturers in the US and their anticipated personal computer sales (in millions) for 1983 (including hardware and software). It is as follows:

IBM	$1400
Apple Computer	1100
Radio Shack	1100
Commodore	800
Hewlett-Packard	550
Texas Instruments	450
Atari	350
Digital Equipment Corp.	200
Victor	150
Televideo	100

1983 represents the first time that any company has done more than $1 billion in personal computer sales . . . and last

year three companies passed the mark. Total retail sales for personal computer hardware and software for 1983 is expected to exceed $10 billion. It is also interesting to note that three of the top ten are newcomers to the microcomputer field having introduced their first machines last year. They are DEC, Victor and Televideo. This year is expected to see even greater success by these companies as it has been estimated that fewer than 7% of US office workers currently have personal computers, and less than 10% of US homes have a home computer.

Intel delays 186 & 286

Intel Corp is reportedly having trouble delivering the 80186 and 80286 top-of-the-line microprocessors and this is expected to delay the introduction of the more powerful versions of the PC/XT expected from IBM. Intel has acknowledged that early shipments of these units contained a microcode bug that rendered the units using these chips incompatible with the PC/XT which uses the 8088 chip.

Intel reports that it has encountered a much higher demand for these parts than it had anticipated. This is expected to cause shortages in the market-place for some time to come. Advanced Micro Devices, expected to second source the chips, is still some time away from production.

Intel is reportedly also encountering problems in making 286 chips that run above 4MHz. Thus the supply of 6MHz units are in very short supply and the 8MHz are scarce. Intel is attempting to ramp up to producing 100,000 286s a month.

First optical storage devices come to market

Shugart has released its Optimem 1000 1-Gbyte optical disk drive priced at $6000. The device uses a laser to write indelible information on a pre-formatted 12-inch removable cartridge optical disk. This is now the second such unit to become available, the first being from Panasonic. Panasonic is also shipping a 7in video disk which some customers are using for data storage. An erasable version is expected next year.

Units are also expected shortly from the following companies. Storage Technology is expected to introduce a 4-Gbyte unit using 14in medium and a technology similar to that used by Shugart. The unit will be designed for use with IBM mainframes.

NEC and 3M Co. are cooperatively developing a unit using 12in disks and a technique using a laser to burst preformed blisters. NEC is expected to start shipping units shortly. Phillips, Sharp and Sony are also known to be working on systems even though no formal announcements have been made. Hitachi, Toshiba and Sanyo are all currently beta testing small low-cost units and announcements are expected shortly.

AI, where are you?

AI (Artificial Intelligence), long the province of academia, is beginning to move out of the research facilities and into the practical world. However, it is still more promise than product. It is currently very expensive and limited to very select and sophisticated markets. However, it is expected that by 1987, and possibly earlier, we can expect to see AI products running on personal computers.

An estimated 50 institutions are currently engaged in AI research and development. This includes companies such as IBM, Xerox, General Electric and Texas Instruments. They refer to their work as 'knowledge engineering'.

The primary areas being worked on in AI include expert systems, intelligent robots, natural language processing and Lisp machines. Lisp is the most widely used language by AI engineers and limited implementations of the language are already running on many microcomputers. Expert systems are knowledge-based and are capable of making conclusions and recommendations based on partial information. Expert systems have already been developed to do medical diagnosis, find mineral deposits and design computer systems.

IBM reports record profit increase

IBM reported that third quarter '83 net income rose 25% to £1.3 billion. According to John Opel, IBM chairman, IBM sold 850,000 PC/XT units in '83 and expects to sell about two million this year. Personal computer sales accounted for 2-4% of IBM's sales and this year are expected to rise to 6%.

Incidentally, IBM's income from interest on bank deposits and securities tripled to $232 from $80 a year earlier. In other words IBM has a lot of cash sitting in the bank and is therefore looking to spend it increasing its outside holdings in suppliers (for example, Intel).

More bad news

After a year of sustaining losses of more than $500 million in its home computer operation, Texas Instruments has decided to stop production of its TI-99/4 home computer and pull out of the business completely.

Digital Equipment Corporation, for the first time, announced a decrease in earnings and disclosed that it is having trouble selling its personal computers in the 'office systems' market. DEC disclosed that it had sold about 19,000 micros in the last quarter, about 30% less than it had expected to sell.

Apple Computer disclosed that earnings for the last quarter dropped by 73% despite an increase in sales of 55%. This sales increase, however, reflected a considerable decrease in Apple's growth rate. In the meantime its expenses for research and development and marketing and distribution soared.

Osborne Computer, which filed for protection under chapter 11 in October, still has not found a buyer or been able to get into production on its IBM PC-compatible version of the Executive. Further, Osborne dealers with stocks of Osborne Executive machines have been offering them for sale at well below their cost. I recently saw an ad offering the Executive for $1475, which is about half its list price.

Random news bits

Xerox, which only two months ago boasted that it planned to open 50 computer stores a year for the next few years, has sold off 43 of its current stores and shut the remaining 10 stores. Rumours are that it always operated in the red . . . Visi On, the much-touted Lisa-like, front-end program manager for the IBM-PC, which was first demoed in November 1982, should finally be in the stores by the time you read this column, only about six months behind the promised delivery time . . . Intel has introduced a non-volatile byte-wide 4k RAM. Its secret is an EPROM shadow memory that retains the data when power is turned off . . . Docutel/Olivetti has introduced a knee-top computer. What is interesting about the unit is that it is the third such unit (the other two are from Tandy and NEC) designed and made by Kyocera in Korea . . . Advanced Matrix Technology, Newbury Park CA, has announced a letter-quality printer that prints in four colours and can also print on acetate film for overhead transparencies.

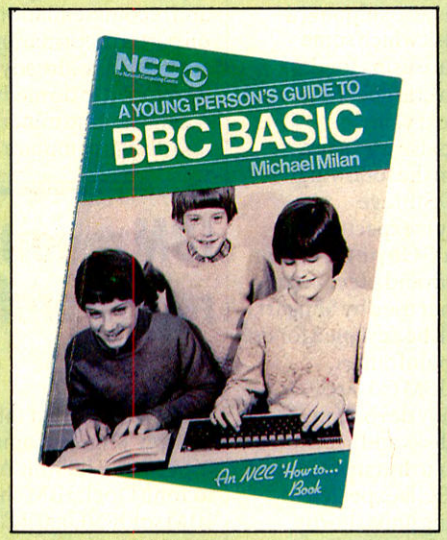
Quotation of the month

'The shake-out of 1985 is happening now'. Steve Jobs, Chairman of the Board, Apple Computer Corp. END

BIBLIOFILE

Linnet Evans raids the bookshelf for this month's selection on the BBC Micro and its Basic.

A YOUNG PERSON'S GUIDE TO BBC BASIC



OK, so what's this on the jacket — smiling boys, things to make and do . . . the sons of wowie-zowie-computing-can-be-fun meet the Meccano generation.

Michael Milan plainly knows, and feels for kids very well. He offers, within a fairly slim volume, a general intro to the machine and its dialect whose practical encouragement more than compensates for any shortfall in factual coverage. His own writing style is sensible and straightforward without being in the least cramped or patronising. At the same time he offers his readers — very much 'young people' rather than 'schoolkids' — plenty of free rein for themselves.

Tellingly, he allows us the licence to gaff and fudge from the start, always coming back at the right moment with a hint or helpful comment. Unusually — commendably too — for writers aiming at this level, he presents us (in the nicest possible way) with good, commonsense arguments for program structure and management. (Yes, the NCC flowchart template makes a guest appearance, as early as page 43.)

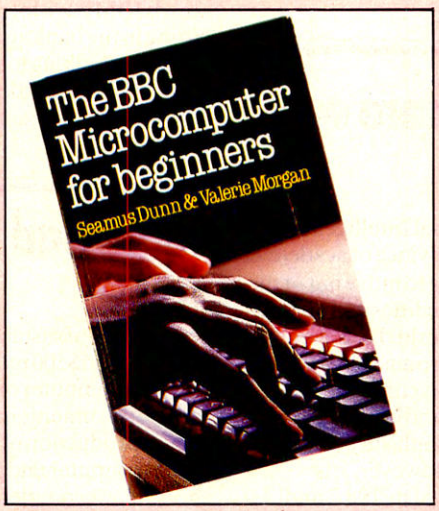
Milan's examples and illustrations are both easy to understand and realistically helpful. A few shorter examples might have retained a better pace towards the end of the book, and also enabled introduction of a few more functions and/or techniques. Many of the programs that are given were written by one of the author's own two sons, suitably annotated by Dad. (Mind you, it didn't go unnoticed that Mrs M is credited with the status of computer widow. Maybe she's into vintage Hornby Dublo.)

Lack of reference back into the User Guide is perhaps a weakness here, even after training in survival techniques. This latter includes a special cut-out-and-Blutack strip carrying sample definitions for the micro's function keys. Milan keeps his own integrity to the end, however, closing with the observation that it's possible only to prove that a program is wrong, never that it's right — which seems a primarily adult sentiment.

It also seems that you shouldn't judge a book entirely by its cover.

A young person's guide to BBC Basic
Author: Michael Milan
Publisher: NCC Publications
Price: £4.50

THE BBC MICROCOMPUTER FOR BEGINNERS



Perhaps with an eye to the British in the Beeb, a very high proportion of the publications dedicated to this particular marque have been eminently sensible (if not always sensibly eminent). Notably there's been, to my mind, a thankful absence of the horsetrading that many of their transatlantic opposite numbers feel is needed to get their message across. (Moot point: what will the Chinese do?)

However, *The BBC Microcomputer for Beginners* graciously tops the lot. It's a fairly substantial (c300 pages) volume, and on page one the prolific Mr Dunn says that it *must* be read and used definitely in conjunction with the micro and *not* off-line. In fact the subsequent 299½ pages are so densely-packed that it's hard to imagine how to get your typing finger in at any later stage.

Starting from absolute scratch, new topics are introduced at a steady pace with a goodly mix of basic/Basic principles and BBC specials. Plenty of coded examples are provided, and the screen 'displays' are depicted in a particularly useful way. Little reference is made to the User Guide, and arguably only the lack of function tables prevents it from being stand-alone.

The book may well be an appropriate choice for a new entrant looking for a stable, classical approach with a distinct emphasis on good programming manners and standards. Even in this context, however, a little more discussion on alternate approaches (for example, between GOSUB and PROC) might have been helpful. Some readers, too, may legitimately prefer a more off-the-wall, empirical approach to Dunn & Morgan's drystone didacticism. The very tight-woven structure renders (whoops!) it probably not the best choice either for anyone with prior computer knowledge simply wanting to brush up on the BBC.

But these are relative criticisms.

The BBC Microcomputer for Beginners
Authors: Seamus Dunn & Valerie Morgan
Publisher: Prentice Hall
Price: £6.95

THE BBC MICRO BOOK: BASIC, SOUND AND GRAPHICS

Many BBC machines will be bought, borrowed or otherwise acquired in large part for their graphics and/or sound capabilities. The minimal coverage given in the User Guide to these matters, particularly sound, is in itself an open invitation to outside publishers to chase up these areas with alacrity. None have to my knowledge matched Jim McGregor and Alan Watt who have produced what is likely to be a real classic in times to come.

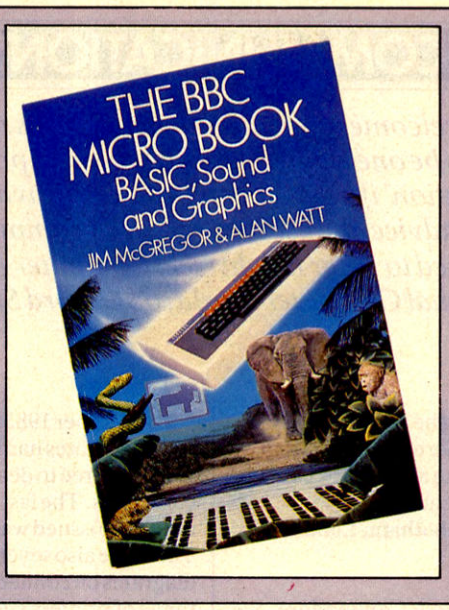
Despite the absence of the buzz-word 'beginners' in the title, *The BBC Micro Book* is still one for all-comers. The strong-hearted newcomer could at a pinch pick up from page one, though s/he may nonetheless still prefer to have David Smith's book or an equivalent alongside as an absolute starter. On the other hand, the experienced micro-bod won't have to

suffer an excess of pavement cycles and roller skates before getting on the road with the Kawasaki of what this book is really about.

Whoever the readers, the authors truthfully drive them at a smart pace with a plethora of curt, trenchant examples and some pretty high rewards at the end. Visual presentation is once more fairly clear and direct with a few bonuses. One is the obvious novelty (or novel obvious) of oscilloscope soundwaves. This leads straight into a detailed breakdown of sound characteristics related to individual instruments and a quite ceremonial opening of the ENVELOPE function. On the flip side is a fair bit of work with animation and some seductive (even in b&w) special effects — for example, palette changing in a spinning disk.

Not every BBC owner is going to want to run the full gamut of *The BBC Micro Book*, either in terms of application or of pure machine-knowledge. Those who do will probably feel that (a) they've worked hard for their money; (b) the thing's been worth its weight in silicon. Those who don't may still feel that the authors' calm, sturdy, on-line style leaves future options open (among which is the same authors' *Advanced Programming Techniques*). The trump card is of course that it's a pretty good encouragement to go forth and buy a BBC.

A cassette is also available with the longer programs on it.



The BBC Micro Book: Basic, Sound and Graphics
Authors: Jim McGregor & Alan Watt
Publisher: Addison-Wesley
Price: £7.95

BBC BASIC FOR BEGINNERS

It would be a gross exaggeration to say that David Smith's *BBC Basic for Beginners* is everything that the similarly-titled Dunn & Morgan offering reviewed above is not, and vice versa. But it's a tender trap, so here goes . . .

In presentation, *BBC Basic* is an entirely readable if slightly untidy book with a slight drift of having been put together in rather a hurry (but such is the pace of life today). (Physically, my review copy is already threatening to fall apart.)

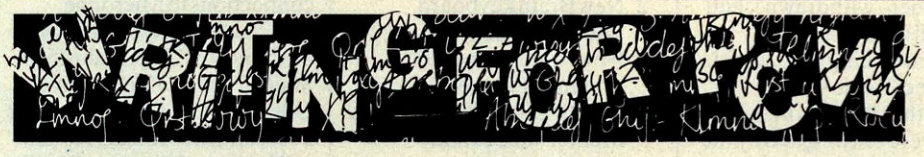
Smith's approach is itself in parallel vein. He uses rather more practical, suck-it-and-see tactics with, in some cases, rather slight coverage of first-round functions. Against this, any patchiness is largely smoothed over by the gunnings of an eager, supportive writing style. And — an interesting point this — Smith does actually explore several dark corners which are otherwise left largely alone by Beeb writers. Notable among these are data file I/O and sort techniques.



As with the other titles under review here, the pitch is first and foremost to Model A. Owners of Model B's will know already that 'money don't buy everything'.

Unlike Dunn & Morgan's book, *BBC Basic* could not and should not be expected to stand as a complete guide in any sense. A stronger role is probably as an introduction to the vagaries of the language for BBC owners who are (or have been) primarily concerned with using published software and simply want a lively, general background to programming. Alternatively, it might make a valid real-time *entrée* to the arena for anyone intending to advance fairly rapidly into higher echelons (such as the User Guide!) Between the two, that's a fair number of punters.

BBC Basic for Beginners
Author: David Smith
Publisher: Melbourne House
Price: £6.95



PCW welcomes approaches from would-be writers, even those who have never appeared in print before. In this game it's often those with practical experience who have important things to say so we don't mind if your prose is less than perfect — providing submissions have a sensible structure and follow a logical sequence, we can take care of the polishing.

If your article is already written, send it in — taking care to ensure that your name and address, together with a daytime phone number if possible, appears on both the covering letter and the manuscript. Manuscripts should, preferably, be typed or printed out (dot matrix output is quite acceptable) but *must* be double line-spaced with ample margins top and bottom and on each side. Make sure you keep a copy of *everything* you send us.

We can now accept articles on a limited number of disk formats: standard IBM 3740 single-sided, single-density 8in, and the following 5¼ in formats: Superbrain SSDD 35-track; RML 380Z SSSD; Sharp MZ-80K/A DSSD, Cromemco SSSD, Nascom DSSD, Rair/ICL DSDD, SD Sales SSSD, Triton 35 track SSDD and ACT Sirius 1 (CP/M-86 or MS-DOS) single-sided. By prior arrangement we can accept stuff over the phone by modem using BSTAM at 300 baud but as we can only do this during office hours (10am to 6pm) it's not exactly a cheap way of getting your article to us! In the near future we hope to be able to accept material by The Source and Rewtel. Please note that if you want to send your article in this way, it should be as an ASCII file rather than as a 'work file' for any one type of word processor — ie, use your word processor to print the text to disk instead of to paper.

Please note that we cannot undertake to return manuscripts, diagrams and photographs, although we always try to return the latter. We can only return disks if they are accompanied by adequate postage *and* packaging.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one- or two-page synopsis giving the proposed structure, sequence and content is what we're looking for. But before you send anything to us, take a good look through *PCW* to see what sort of articles get published and to see what style of writing we prefer (basically, avoiding promposity at one extreme and flippancy at the other). Also take a look through the Back Issues advert to see what sort of things we have already published — no point in re-inventing the wheel.

Once you've sent off your article or proposal, please don't hassle us for a decision. We receive far more submissions than we can ever use and it takes us a while to sort through them, acknowledge receipt and give an opinion one way or the other. Please be sure to tell us if you've sent the article to another magazine — it would be very awkward indeed if the same article appeared simultaneously in two publications! Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work but please be patient! Payment *normally* follows about 4-6 weeks after publication.



COMMUNICATIONS

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 Peter Bright (see 'Computer Answers' page). Address letters to 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

Commodore 700 range

About a year ago I wrote to Commodore Information at Slough for information on the 700 range and was sent leaflets, but no prices. Now the Centre has suddenly sent me revised leaflets, and a list of prices, from the 500p at £695 to the 750BX at £1995. Naively I took this to mean that one might be able to buy the machines, but when I telephoned I was told 'You ought to be able to get hold of the 710 and the 715, but the built-in disk models and the second processor will perhaps be available next year.'

I really think Commodore owe their clientele a clear and definite statement of what they are up to. Do they realise the harm they are doing to their image by putting forth this skunk-like fog of misinformation? I went round the Personal Computer Show enquiring about the 700 range. Some of the more printable comments were 'Commodore are devious' and 'Don't let anyone fool you into thinking the 700 range is ever going to appear'. Might I ask you, *PCW*, to put your weight behind a few simple questions, for the benefit of many like myself?

1. Who are currently stockists, with stocks for sale, of the 710 and the 715?
2. Are Commodore in fact developing the 720, 730, 740 and 750? Or have they, as is widely rumoured, abandoned them in despair?
3. Can they, if they are developing them, give realistic launch dates; by which I mean months or years, not decades?
4. If they are not selling the 710 and 715, and not developing the more expensive models, what is the purpose of: (a) sending out price lists through the post; (b) giving coy little 'pre-launch' previews to selected journalists (such as recently appeared in 'Commodore Computing)?.

It might be as well if Commodore realised that misleading advertising can, in the UK, lead to trouble.

R N Higinbotham, London SE11

(Over to you, Commodore. See 715 Benchtest in this issue, page 224— Ed)

Text encoding

Your readers will be saddened to learn that they will not, after all, be able to purchase a copy of the patent specification in which was defined Dennis Andrews' text encoding system as described in the article 'Cramming it in' (*PCW*, September 1982).

Under normal circumstances this specification would have been published round about August/September of this year —but, for reasons known only to themselves, Keele Codes Ltd, the applicants, withdrew the Application (or failed to take some action resulting in it being taken to be, or treated as having been, withdrawn), and so we will never have the pleasure of seeing what it said.

I suspect Keele Codes decided that the advantages of a patent were outweighed by the disadvantage of everyone knowing how it is done — and under the circumstances I can't say I blame them!

J P L Hooper, Langham, Essex

Inside story

In your October issue you published a letter from R J Williams who had several complaints about Grundy Business Systems and the NewBrain. Since the demise of GBS I hope you will publish this letter from an ex-employee. It is also possible that one of the complaints (on how to achieve the BBC EVAL function, which I recall answering for someone) is directed at me.

By October 1982 a set of 12 technical notes had been available free to dealers and customers. The last technical note to be issued was no. 18. There are also several technical diagrams on connections to a range of printers and on communications to other computers. The majority of questions asked of the technical support staff were capable of being answered by these notes. The £58 for the Technical Manual (which also had a complete set of Technical Notes) was a ridiculous price, and its author repeatedly asked for the price to be cut to £25 or less. Originally the manual was photo-copied from the hand-book produced for the Lesco VBrain. This was corrected and improved and in January several thousand copies were printed; the majority are now piled on the floor at the Cambridge Offices. However, only the OEM user could claim to require more than the FREE technical notes. The Technical Notes are:

1 VF display character set
2 NewBrain keyboard codings (UK)
3 NewBrain keyboard codings (France)
4 NewBrain printer interface
5 Memory allocation (un-expanded)
6 BASIC — general description
7 IOS
8 Use of own memory by standard device drivers
9 Patching a device driver
10 Operating system routines (very useful for Z80 coding)
11 Access to screen display characters
12 NewBrain BASIC reserved words
13 Keyboard sequences
14 NewBrain BASIC — technical specification
15 The NewBrain Graphics package
16 Screen Editor — technical specification
17 NewBrain Keyboard codings (Norway)
18 Production of user defined characters
19 NewBrain Keyboard coding (Sweden)
20 NewBrain Keyboard coding (Greece)
21 NewBrain Keyboard coding (Denmark)
22 NewBrain Keyboard coding (Finland)

In addition the Technical notes (still not finalised) for the disk controller, CP/M and Expansion interface which were issued from Cambridge in August:

101 CP/M utilities
102 CP/M system
103 DISCIO system
104 CONFIGURE program
105 KBBFIO
106 SSEIO
107 Paged memory operating system
108 System Page Description
109 BASIC extensions with peripherals
110 ACLPIO and ACVIO
111 Centronics Printer Device Driver
112 Z80 Port Device Driver
113 Serial Memory Device Driver

Technical Diagrams included connections to Microline 80,82A, Epson MX80, FX80, Walters WM2000, Facit 4510, Smith Corona TP1, Penny & Giles, Olivetti DY211, Amber 2400, and the Adler DRM80.

There are 5000 sets of the first 16 technical notes somewhere in GBS, intended for free issue.

My suggestion for the EVAL function (not being a user of the BBC machine I was informed by the caller that it evaluated a function from the string, eg x=0.5:a$="123Xsin(x)") is to merge the code into a BASIC statement as follows.

```
10 CLOSE#1:OPEN#1,0,1,"5"
20 LINPUT("Input function ")f$
30 GOSUB 1000
40 PRINT FNf(1),FNf(2);"etc."
50 LIST3200:END
1000 PUT#1,31,10
1010 PRINT#1,"32000 DEF FNf(x)=";f$
1020 PUT#1,13,27,4,3
```

```
1030 MERGE#1
1040 RETURN
32000 DEF
      FNf(x)=x^3+x^2+exp
      (x)
```

The function is merged from stream 1, a small 40 column screen. This can also be done using the VF display, but only with the intervention of the user. ON ERROR GOTO has to be set and it would be sensible for the programmer to add validation checks on the function string at input. However the Merge on NewBrain destroys the compiled code and I advised the caller to interpret the string and restrict the range of functions and operators (+,−,X,/,^ etc) allowed. The maths pack can also be accessed from machine code and a Z-table set up for the functions, mimicking the way the NewBrain OS works.

The documentation for the CP/M system is even worse than that of the handbook for the NewBrain. However, nearly every question I have been asked about the CP/M system showed that the user (mostly dealers) did not bother to a) read the Disk Users Handbook and b) to find out what 188k of programs on the 200k diskette and over 400k of programs on the 800k diskette did. To transfer BASIC programs from cassette to diskette TRANSFER.BAS was provided. To read Superbrain diskettes data files, instructions and programs were provided to facilitate this. A full demonstration, DEMO30.BAS, was also provided with news items and information on software. The system could be run and listed to see how to write your own programs.

The biscuit is awarded to the expansion interface. These were sold with no documentation at all (exactly the same lack of information as supplied with the battery modules. The set of instructions was not included with the units, although dealers were supposed to be given these. The biscuit tins (modular housings) given free (at least no one dared charge for them), were supposed to be a stop gap until the correct housing could be supplied. The foot-breaker power supply (very useful to keep your coffee warm on, or to dice cucumbers) should never have been sold.

Will the full truth of GBS ever be known? I don't believe the Directors at Cambridge knew everything, and they certainly did not have full control over the company as the Grundy Group always had the last say in decisions. More important to NewBrain owners (myself included; I ordered my NewBrain in July 1980 and paid for it in April 1982, about three months before I joined GBS), is what will the new owners do? What, in fact, have the new owners purchased rights to? Without the research and development and technical backup to the disk and expansion modules the system is a lame duck. Sound is available on the expansion module, but the first 2000 units were not fitted with it. The analogue ports work, but the components were not fitted. Colour modulators, modems and network modules were all under development as was a word processor, assembler, COMAL, FORTH, Pascal, MP/M and CP/net. The new owners will have a hard time convincing people in the UK, and may not even bother with the UK market.

G Mc Mullon (Software Engineer), Grantham, Lincs.

68000 v Z8000

This letter was sparked off by 'Yankee Doodles' (*PCW*, November 1983) and fuelled by 'Newsprint' (*PCW*, October 1983).

In 'Yankee Doodles' it is rumoured that Commodore is to release a 16 bit micro using the Z8000. This is good news for computer users—the Z8000 is a very powerful processor.

In 'Newsprint', specifically 'Supersonic Retort', Guy Kewney states (not suggests) that the 68000 is a 'very much more powerful' processor than the 8086. Talk like that has been around since before the 68000's release. People expected it to be more powerful so therefore immediately believed it to be.

Personally, I did too. So I decided to learn more about it. I hate to disillusion people but the 68000 is very slow. For example, supporters of 16 bit processors will tell us they are ideal for processing large amounts of data. So, let's move a large block of data up in memory by N bytes. This is a very common problem (scroll a screen).

I invite you to write a 68000 program which will do it faster than the Z80's LDIR instruction. You'll be lucky to do it in less than 1½ times the number of cycles.

But the 68000 can address 16 Mbytes per space. So what? So can the Z80 with an 8 bit page register. But the 68000 can multiply and divide. I must admit that the 68000 has the edge there, so let's try it against the Z8000. I'll tell you what a 68000 can do that a Z8000 can't and vice versa, also what a 68000 does faster.

A 68000 can move a word of data from a directly addressed space to another using any registers, a Z8000 can't; a Z8000 can do 32 bit multiply and divide, a 68000 can't (although it may be able to in the future). A 68000 does 32 bit additions and subtractions faster. Everything else the Z8000 does faster.

In fact a Z80 does most things faster than a 68000. Now I don't know much about the 8086 but I do know about the 68000, and my view is the 8086 must not be very powerful compared with the 68000.

I am glad that one of the major computer manufacturers is going to use the Z8000. This will make it 'respectable' in the eyes of the press, as it is a very good processor. After all, which computer running at 4MHz runs fastest? What processor does it use? Answers: Olivetti M20; Z8001.

On the subject of concurrency (see Newsprint November 'Elan Vital'), who needs concurrency at £6500 (Apple Lisa) when you can have two computers for £400? Sorry Guy, but it's just not worth the price.

L Dundon, Tidworth, Hants.

Taken to task

Among the most interesting features of your magazine are the tests on latest computer introductions.

Surely though, in the several pages you devote to each item, you should ensure that every possible feature or non feature is on a check list for at least a brief mention.

Your Electron Benchtest made no mention of the fact that it can't have joysticks without adding a £60 interface, something I discovered in the same issue by reading the Newsprint feature. What an omission in a review of a home computer, and what a mistake by the makers.

Incidentally, the totally conflicting conclusions about the Electron between Guy Kewney and Steve Mann inspire little confidence in a potential buyer looking to you for guidance (I favoured Guy Kewney's views).

Also, your review of the Apricot simply didn't bother to raise the issue of non-availability of colour for this machine. This may well be important to some buyers, even on business applications. And what about whether it has multi-user potential?

Vic Lewis, Carisbrooke, Isle of Wight

(Conflicting views reflect the very real diferences which the user *can make to a particular piece of hardware. If you thought we doctored our contributors' views you would have even less confidence in our impartiality—Ed.)*

Weather forecast

I am currently setting up a weather station project in conjunction with the two upper classes of my daughter's junior school. We are using a program first printed in an American magazine which will enable us to store data collected, display norms for the area, and give a forecast for the following day. We are using the version for the Timex Sinclair 1000 with 16k, running it on a Spectrum. If any other school or individual would like a listing of the program please send a SAE to the above address. There are also versions for the Commodore 64, all PETs, (40 and 80 cols) and Apple.

We are all very enthusiastic about this project and would welcome collaboration with other school weather stations in the UK and abroad. The weather should be increasingly interesting in the next few years, with the recent volcanic activity and the powerful effects of the

Walker Cell. Please write to me if you are interested in taking part in the project.
Theo Wood, 151 Grove Lane, London SE5 8BG

What is it

Have a careful look at the photo in the top left-hand corner of page 123 of *PCW* September 83. The picture of the APS battery adaptor is not what it seems! It is either an empty box, or the wrong photo (though I have seen it used elsewhere). If the unit converts DC to AC mains, then why is it equipped with a mains *plug*? Anything supplying mains has a *socket*. The writing on the box is a little suspect also: 220-240 volts 50-60Hz? That is hardly an output specification! So what does the real article look like? What do APS say?
Steven Weller, Totton, Southampton

Praise indeed

Peter Tootill's excellent article on Bulletin Boards (*PCW*, November 1983), omitted to mention the many bulletin board operators who, through their own enthusiasm, provide modem owners with an interesting extension to the computing hobby. This omission is probably due to modesty, since Peter runs one of the best boards around.

A vote of thanks is due to the many gentlemen who provide this service, a cry which I am sure British Telecom would echo.
David Law, Ludlow, Shropshire

Public service

I have recently started buying your magazine again as suggested reading for one of my degree courses.

I enjoyed the October issue, but was saddened to notice that the feature on programmable calculators ('computers') has gone.

As the owner of a HP-41C I found this disappointing. Also, considering that Hewlett-Packard has closed the User Program library, there seems to be little public service to owners and users of such machines.

Are you, or would you, consider re-introducing such a feature? Or could you recommend an independent source of software and hardware information.
R Bloom, University of Warwick, Coventry

(Hewlett-Packard will be able to put you in touch with an alternative source of information — the number to ring is 0344 773100 x 3432 — Ed)

Energetic

With regard to 'Sinclair's flat screen TV' (Newsprint, *PCW*, Nov 83, page 123), please let us know what else can be powered from a flat battery.

The energy problem may at last be solved.
NB: My initials really are PCW.
Peter C W Taylor, Redhill, Surrey

All in one

In the third paragraph of his review of the Lotus 1-2-3 software (*PCW*, November, page 132), Mike Liardet implies there are at present no other packages available which handle word processing together with spreadsheet and information management.

What about Tmaker? This is advertised elsewhere in the same issue (page 366) as 'word processor, spreadsheet organiser, list processor and file-handler'; it has been around and developing for some years, like WordStar, and is known to work well. It runs under CP/M-80 and MS-DOS, to my knowledge, and costs less than £200.
J P Ross, Edinburgh

Green cheese

Full marks for spotting the plagiarism in 'Micro User' (*PCW* November 83). The perpetrator should be sentenced to a job on the 'Sun'.

However, at the beginning of the same Chipchat there is mention of a proposed advertising campaign by Audiogenic, involving soot bombs launched at the moon to spell out the company name. Obviously a tongue in cheek suggestion, yet by coincidence a similar scheme, and characters expressing sentiments similar to Martin Maynard's, appear in the short story by Robert Heinlein entitled 'The Man Who Sold The Moon', which first appeared in 1953.

No, I'm sure they arrived at it independently. No-one would accuse such a fine company as Audiogenic of plagiarism!
Ed Matthews, Kingston upon Thames, Surrey

(We received several letters from sharp-eyed bushey-tailed PCW *readers who also spotted this 'coincidence' — Ed.)*

No ROMs

I read with interest your article on the Tandy Model 100 (*PCW* October 1983), in particular the information that the various software 'bugs' will be overcome and new ROMs made available to owners of existing models.

I contacted the Tandy Consumer Services department and was told this was not the case, and no such ROM update was contemplated.

I would be very grateful if you could clarify the position on this subject as the few, but irritating, software problems do mar an otherwise excellent computer.
George Kermez, Bedford

(We have tried to contact Tandy and got the same answer — 'What ROMs?' It sounds as if a senior executive has some explaining to do — how about sharing the secret with us, Tandy? — Ed)

CP/M from ADDS

My company owns an ADDS Multivision I microcomputer, which we are currently using to run the Micromodeller program. We would like to branch out into using CP/M based programs, but have found that our ADDS dealer, and ADDS themselves, have been less than helpful in aiding us in this move. I would be very pleased to hear from any of your readers, particularly in the Midlands area, who use the ADDS Multivision I computer to run CP/M programs, in the hope that we might be able to benefit a little from their experience.
R P Phillips, Miller Buckley Group Services Ltd, Rugby

Rats

After reading the letter by Keith Ollett about his Rat File on the Oric, I would like to contribute.

Not only have I had a long wait for repair followed by two faulty computers, but no written communication at all. I also paid a subscription for the magazine but made four telephone calls before I received the first two issues, one of which was free. Since then there has been a lack of success in obtaining further issues.

No reply has been received in reply to two requests for a refund, consequently there is no chance of my buying any further Oric products.
T Chaplow, Birkdale, Southport

Comparing processors

Your recent review of the Tandy MC-10 (*PCW* November) states that the 6803 processor is almost identical to the 6809. In fact, the 6803 is almost identical to the basic 6800 CPU in software terms and not the enhanced 6809 CPU. I suspect that one of the reasons for choosing this processor is that Tandy may be considering putting the Basic on-chip with the processor in the form of a mask, programmed 6804 CPU.

Here is a brief summary of the 6800 processor family:

6800	original CPU (requires separate clock)
6802	6800 with on-chip clock + 128 bytes RAM
6801	6800 single-chip microcomputer ie CPU + clock + 128 bytes RAM + mask programmed ROM + i/o ports
6803	6801 with no ROM ie 6800 CPU + clock 128 bytes RAM + i/o ports
6809	greatly enhanced version of 6800 with on-chip clock (no RAM or ROM)

Others
6808 as 6802 with no RAM
6804/5 special mask programmed single chip microcomputers
6301 CMOS versions of 6801
68701 EPROM version of 6801

The above is an over simplification, in that 6802/6808, 6801/6803 may contain a few extra instructions over the basic 6800 instruction set.

It is not always realised that comparing clock speeds between the 68xx range of processors and the 8080/8085/Z80 processors is not very informative, since many 6800 instructions are executed in two or three cycles, as opposed to instructions which take many more cycles on the 8080/Z80 processors.

Simon Sondergaard, Edinburgh

Understanding Basic

Don Milne's (*PCW* November, 'Basic challenge') comments on my letter (*PCW* September, 'Back to Basics'), merely repeat some of the clichés about the superiority of Pascal without showing, in any way, that he understands the nature of the problem previously described.

High level languages and operating systems are designed to ease the work of programmers. By their use much time and money may be saved in the writing of programs. This ease is normally at the expense of added run time costs which is balanced against the saving in software costs. However, language and system designers tend to assume that they know all the ways their software may be used and often, deliberately or by omission, bar the full use of the CPU. Pascal is such a language, and whilst excellent for many purposes is very inflexible and inefficient for others.

I write critically of Pascal because I have tried it and found it wanting. I had several years using Algol which allegedly had some influence on Pascal. It too is a compiled language but suffers from some of the same difficulties. Programs ran *100 times faster* when a few time critical routines were optimised in machine code.

My 'long winded' remark referred to running time. The Pascal code may well be shorter. It certainly was in the Algol program, due to each bit having to be handled separately. In addition the arrays were many times larger, which led to memory difficulties. One run might take several days even with an efficient program and perhaps months otherwise.

The published routine has been simplified to show the essential problems. In practice it would have many extras such as loops to repeat parts.

The routine is designed to sum sequences of 16 bit 'integers' but without permitting any carries between bits of higher or lower significance. Each bit is an independent data item which must be kept unaffected by any other bits. In line 1000 S1, S2, S4 and S8 are counters for each power of 2 in the total. For the example, they are preset at −6 and total up to 12 'integers'. A wide range of values would be possible in practice and S16, S32 etc might be used.

Lines 1010-1030 take pairs of 16 bit 'integers' from an array S( ). Each pair is masked with R and NOT R (does Pascal allow Masks?) and ORed to give a single 16 bit word. R is produced by other routines to complex rules and is highly variable.

If S8 is non zero this indicates that some bit counts have negative values. Lines 1190-1280 convert any negative values to positive absolute values. Lines 1210-1225 separate positive and negative counts by masking to the sign bit. Lines 1230-1250 convert negative counters to their 2's complements. Line 1260 masks any spurious bits and line 1270 combines the counters again. Other masking code, not given, would access the counter totals whenever required.

In Pascal these 16 counters would have to be handled in sequence rather than in parallel and the lack of masking facilities would also make the value extraction time consuming. The bits would have to be treated as 16 separate variables.

I would repeat my earlier remarks that I would be pleased to see the problem written in effective Pascal.

I would also like to point out that compiled Basic is frequently used in business programs with some success. Since many smaller systems do not support Pascal, life would otherwise be difficult for any business with such an installation.

R G Silson, Tring, Herts.

More delays

Now that complaints in the computer press about delivery problems with the BBC micro have diminished somewhat, I feel I must point out the remaining problem with Acorn's Teletext unit and the telesoftware that was/is/might be broadcast by the BBC.

I placed an order with Acorn in early 1982, the exact date being lost in the mists of time. A phone call in August to Acorn elucidated the information that the backlog was now being cleared, but apparently I still couldn't expect delivery until October. Needless to say I had also been told to expect delivery in December 1982, not to mention May and August 1983.

One wonders what sort of 'production line' Acorn has; visions of a forgotten Cambridge graduate in the depths of Acorn HQ, breadboard in one hand, soldering iron in the other, puzzling over a faded circuit diagram.

I dare say that Chris Curry et al had more important and lucrative things to worry about with the Electron's launch, but it does seem a pity that the telesoftware aspect of the Computer Literacy Scheme has been so interminably delayed in this way.

Calum Steen, Dunbartonshire

(Acorn has now begun to deliver, so let's have less grousing and more constructive criticism — Ed)

Sort problem

I was interested to see the piece about 'The Micro User' in Chip Chat, as I am a subscriber to that magazine as well as *PCW*.

Admittedly the cribbed piece about the Flood did not affect me personally but their review of VU-FILE in the November issue did — in that I went out and bought a copy, only to find that it would not sort as the manual and the review claimed.

I quote from the review:
'In addition, the order in which the file is presented can be changed by sorting it according to one or more fields.'
'Sorting can only be into ascending order of character codes, but may be on more than one field at once. Thus the file could be presented in ascending age order, and within that, in alphabetic order of surname.'

I consequently wrote to Psion to tell them the BBC VU-FILE will not sort as above, and a couple of days later had a phone call from a Mr P Norman of Psion who said that I was right, the manual was wrong, and I could have a refund if I sent the program back. He also said there were no plans to re-write the program.

I then wrote to *Micro User* to explain that reviews are only credible if they are written after testing the software, and that anyone can write a review from the manual without even switching the computer on.

A couple of days later I got a phone call from their Mr Cook, who immediately leapt in saying he did not like people saying such things about their reviews, and that the writer of the review (Ken Garret) and the author of the software told him it would sort properly, and the software author could not understand why I was offered a refund.

After I got him to admit he had not tried multiple field sorting with the program himself, he said he would do so and try to phone me back — which he did not do. After that I wrote another letter to *Micro User*, spelling out the facts as I see them and, as yet, have heard no more.

If VU-FILe has been implemented on other computers (eg Spectrum) why, if my copy is anything to go by, is it not properly implemented on the BBC and why, if the story from *Micro User* about the software author saying it does sort properly is true, do not Psion offer to exchange my copy for one that works properly?

Paul F Tolson, Dewsbury, W. Yorks END



COMPUTER ANSWERS

Send your queries to Peter Bright, PCW, 62 Oxford Street, London W1. Please note that Peter cannot answer questions on an individual basis, so please don't send an SAE with your query.

Spectrum command

I read somewhere recently that the following direct command returns the amount of memory used by a program on the ZX Spectrum.
PRINT PEEK 23627 + 256 ★ PEEK 23628 – 23755.

Since I have a 16k machine, memory space is fairly important. When writing a program recently I discovered I had used all the available memory, but this direct command only returned approximately 8000 bytes. Is it the way that I only have 8k RAM and 8k ROM, or that the value returned should be doubled — I have been unable to discover which. Could you help?
Kevin Barrett, Ireland

Your 16k Spectrum has in fact 32k of memory, but the first 16k of this is the ROM and includes the Basic interpreter. The other 16k is called the RAM but not all of this is available to you for your programs. This is because the Spectrum needs this space to store the contents of the display file (the screen picture), the printer buffer and the system variables. These are the machine's own variables and store information which describes the current state of the system. Some of these variables are pointers to the start of the flexible areas of memory, for example, the area set aside for your program.

Incidentally, the names of these variables are meaningless to the machine and shouldn't be used in programs, and only exist for our benefit since it's easier to refer to VARS than PEEK 23627 + 256 ★ PEEK 23628.

Taking into account all these overheads the amount of RAM available for your programs is about 9k.

To find out just how much of this precious memory you have used, you PEEK the values of the relevant system variables. To determine the memory used by a program = PRINT (PEEK 23627 + 256 ★ PEEK 23628) – (PEEK 23635 + 256 ★ PEEK 23636).

To determine the memory used by a program and its variables PRINT PEEK 23641 + 256 ★ PEEK 23642) – (PEEK 23635 + 256 ★ PEEK 23636).

Finally, to discover how much memory is spare use the command PRINT 65536 – USR 7962.

This is, in fact, a routine in the ROM memory and is used because there is no convenient system variable.
Tony Hetherington

ROM cartridge

Can a ROM cartridge that was designed to be used in a Tandy Colour Computer be used in my Dragon 32?

I am especially interested in the Logo cartridge for the Tandy Colour.
F Wright, Canterbury

The simple answer is, I'm afraid, try it and see! The Tandy Colour Computer and Dragon are almost, but not quite, identical.

It is the 'not quite' that causes the problems. Although the actual capabilities of the machines do not differ in the slightest, some of the addresses are different.

I asked a Tandy spokesman about the problem, and was told that Tandy cartridges may run on the Dragon but there's no way of telling without trying it, and Tandy makes no guarantee.
Surya

ASCII code

Would you kindly solve the following problem I have referring to Spectrum.

What is the ASCII code for 'Break'? Is there any way to detect this interrupt so that something can be done to protect your listing against 'PEEKing'?

If not, would you suggest a way to achieve this security?
P Lee, London N4

The ASCII code for break is in fact 2 but this will be of little help to you since, by the time you have tested for it, the program will have been broken.

There are, however, several ways of protecting your listings — the choice of which is determined by how nasty you want to be to your victim.

One of the less subtle methods is to have POKE 23613,255 as the first line of your program. Then save it so that it autoruns. This poke makes the computer crash if any report code other than O ok is required, which includes pressing the break key or entering stop to an input request.

Similarly, POKE 23659,0 sets the number of lines in the bottom half of the screen to zero which means that if a report code is required, there is nowhere for it to go — which crashes the machine.
Tony Hetherington

Apricot compatibility

I have just finished reading your piece on the new ACT Apricot. As I already use a Sirius for my business, I would like to add to my computing power by buying an Apricot. My only query is about compatibility between the two machines — are they totally compatible?
J Bennett, London E11

One of the major selling points of the Apricot is that it is largely compatible with the Sirius. Having said that there are some important differences. The most obvious difference is that the Apricot has 3.5in drives whereas the Sirius uses 5.25in. This obviously means you won't be able to take disks off your Sirius and put them into the Apricot. The other major difference is that the Apricot uses a liquid crystal display on the keyboard. Programs written for the Sirius will not drive the Microscreen. Other than that, programs written for the Sirius should run on the Apricot provided they are supplied on 3.5in disks.

Actually getting the two machines to talk to each other should not be too much of a problem if you use one of the proprietary communications packages.
Peter Bright

Mail order cassette deck

I am considering whether or not to buy a Video Genie 1 micro, but have heard that the internal cassette deck is faulty. Could you please state whether or not this is true? Also, if the above case is nothing but a rumour, and I do decide to buy one, could you please tell me whether or not it is wise to purchase it by mail order. Would everything that ought to be sent to me be sent, and how long would I have to wait for it to be delivered?
K Munro, Glasgow

The Video Genie was the first micro I ever used, and I found it to be reliable in each of its incarnations. Any cassette-based system is prone to saving and loading problems from time to time, but I have not found the Genie a particular offender.

Whether to buy from a dealer or via mail-order is a question of priorities. Certainly, you should receive all the necessary bits and pieces, though delivery times vary so always get a written guarantee if time is of the essence. There is, however, another factor to consider. Buying direct from a manufacturer or — in the case of the Genie — importer is cheaper than buying from a dealer, but you then have to go back to the supplier whenever you have any kind of difficulty. A local computer shop is a real boon when it comes to help with debugging and minor problems which do not warrant returning the machine, and I've always found Lowe Computers extremely helpful and efficient.
Surya

Small business choice

I am thinking of offering a limited service to small businesses and possibly accountants, in providing facilities for the operation of PAYE and word processing, addressing envelopes, and later, operation of VAT.

With the proliferation of hardware and software available, it is proving extremely difficult to decide on equipment needs.

I will need a computer, double disk, printer and software to suit, plus a monochrome monitor, and have so far considered Apple II, TRS and BBC but wonder if the new MTX512 might fill the bill.

I will not have more than £1500 to spend but now wonder if this will be sufficient.
R Moyes, Bury St Edmunds, Suffolk

Here we are again back at the old problem of which hardware and software is best. There is no easy answer to this problem because the answer will vary with every application. Of the machines that you mention the Apple has by far the largest list of software, but the disk capacity on the standard Apple disks is not very high. This need not be a problem because there are lots of non-Apple add on products which can be used to increase the disk capacity. The Tandy TRS80 range of micros has also been around for a long time. Tandy tends to go its own way on software so you might have problems finding software to match your needs exactly. The new Memotech MTX512 could be the answer to your problems. The only trouble is that it is a very new machine (we are about to Benchtest the 512 as I write this), and the trouble with new machines is that the list of software that will run on them tends to be quite short.

Your budget of £1500 is a bit on the low side, therefore much depends on the amount of word processing you will be doing. If you are going to do a great deal of word processing then you will need a high quality printer. The usual way of getting high quality print is to use a daisywheel printer. Although these are getting cheaper the very least you can expect to pay is £400. This would buy you something like a Brother or Corona, which are cheap but very slow, but like the man said: 'Speed costs money: how fast do you want to go?' Assuming that you spend £500 on a printer, this leaves you only £1000 to cover the computer and software. This would mean buying one of the 8 bit CP/M machines, which include bundled software such as the Osborne. Even this does not include PAYE software.

Your best bet is to find a good local dealer and see what he can offer. It cannot be stressed too highly that it is very important to buy your equipment from a dealer who will give you good after sales support — there is no doubt that at some time you will need it.
Peter Bright

Which typewriter?

Can you please advise me which typewriters to consider buying as part of a basic word processor? — Permit me to expand on my own requirements; I know they come close to those of many other small users.

My small business handles a lot of multi-page texts and I need a robust electric typewriter, which will mildly impress customers and not drive me up the wall with servicing problems. We have budgeted a thousand pounds or so to buy a good keyboard typewriter, and will buy a basic microcomputer and floppy disk unit to drive it when the money becomes available later. We don't want a turnkey word processor system with opaque software and non-adaptable hardware, so we shall probably go for a PET, Tandy, Apple or such market leaders, plus a commercial work processing program package. Therefore, the typewriter must be readily connectable to such machines.

Please interpret typewriter to include daisywheel machines, but to exclude dot-matrix printers.
Anthony Durham, London SE10

There are any number of typewriter/printers available. One which would seem to meet your requirements is the Olympia ESW Compact, which uses a daisywheel, has a choice of serial or parallel interface and has the option of a 64 or 128k print buffer. There are, however, many other machines which would prove equally suitable; just look through the ads in *PCW*! As with any computer equipment, I recommend going to an independent dealer who will be able to offer unbiased advice on your particular requirements.
Surya

Colour display

I am considering buying my first home computer which would be used for games and hobby, but it must be capable of giving sharp, clear, steady display on the screen, preferably in colour.

Could you please advise if my Sony 18in colour TV — which gives excellent definition — would give equally good display from, say, a Video Genie games program (if available in colour), or colour graphics.

Alternatively, would a 12in VDU give a higher quality display than a 12in TV in the same price range?
D F Kerr, Fife

Unfortunately, matching up TVs and micros is very much a hit-and-miss affair. In my experience, Sony sets seem to work with just about any machine.

A colour monitor would undoubtedly give a better picture than a television set since monitors accept a direct video input, whereas a TV set needs to be tuned in. Monitors give a steadier picture, sharper definition and more accurate colours. And TV sets are — after all — designed for use as TV sets, not as computer monitors.

Not all machines have a video-out line for use with a monitor, so you will need to check whichever machines you have in mind. There are also TV sets with a direct video input as well, these having a 'monitor channel'. You need to tread carefully here, however, since some TV sets have a channel marked 'video' or 'monitor' which turns out to be nothing more than an extra TV channel.

Assuming your machine has a video output, the choice is very much a personal one. Try your TV set first, and if you're not happy with the quality then try a monitor. Monitors do not, however, come cheap. They generally start at around £300 and cannot — of course — double as TV sets.
Surya

TI99/4A software

Could you please tell me the names of any companies that produce software for the Texas TI-99/4A, as I have not seen any advertised.
N Burgoyne, Nottingham

A number of software houses now produce software for the TI-99/4A. If you write to software houses and ask for their catalogue, you should find something for the Texas machine. Virgin and Softsel are among the companies who produce programs for the TI-99, and Texas Instruments itself offers a wide range of software, though at quite high prices (see Screenplay, September '83 for a review of TI software).
Surya

Mancunian Oric-1

Could you tell me of any stockists in Manchester of the Oric-1 home computer? And can you list some of the features of this computer, as many advertisements don't explain much about it.
Simon Dawson, Manchester

The Oric is a low-cost (£99.95) machine supporting sound and colour graphics. For a full review of the machine, refer to the Benchtest in the April '83 issue.

For dealers in the Manchester area, the *Yellow Pages* should be a good source of addresses.
Surya

END

IKON'S HOBBIT

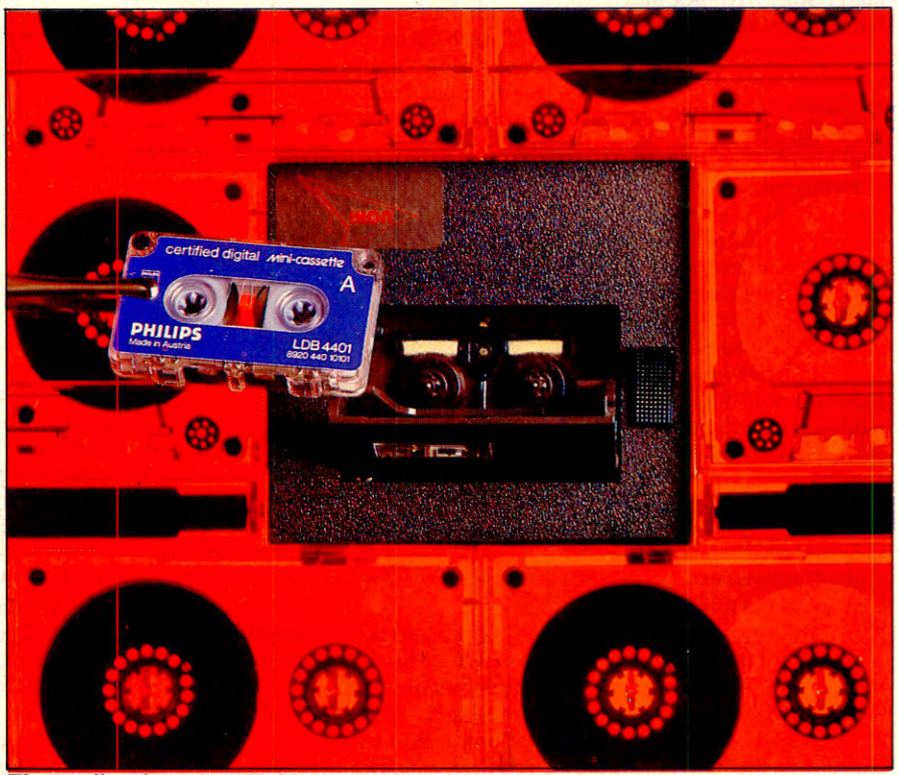
Surya examines Ikon's 'Hobbit'. A low-cost alternative to floppy disks on the BBC Micro?

Any micro — whatever its power or cost — needs some form of permanent program and data storage device. With most home micros the choice comes down to cassette tape — cheap, but slow and not always reliable; or floppy disk — faster and more reliable than cassette and supporting random access files, but costing in the region of £300-£400. BBC owners, however, have a third alternative: the Hobbit.

The Hobbit is not, despite appearances, a floppy-tape drive. It is, in fact, a high-speed mini-cassette unit using standard Philips mini-cassettes. But with its own operating system, rapid access times and file-handling capabilities, the Hobbit is presented as a kind of floppy-tape emulator.

Floppy-tapes are cartridges containing a continuous loop high-quality recording tape. The long-awaited Sinclair Micro-Drive is an example of a floppy-tape. It offers only serial access — that is, the tape must be wound past the read/write head until the required section is reached. Disk drives, on the other hand, move the head directly to the required track and then wait for the appropriate sector to pass by. But floppy-tapes can achieve fast access times by driving the tape at high speed. Since the tape is a continuous loop, there is never any need to stop the tape in order to reverse direction; floppy-tape drives generally only stop the tape after several seconds of disuse. The drive divides the tape into blocks or sectors which it then allocates in the most efficient possible way as programs and data are passed to it.

The Hobbit does not use continuous-loop tape, but in other respects closely resembles a floppy-tape drive including the method of formatting tapes for efficient file storage.



The small and compact Hobbit

Setting up

Physically, the Hobbit is an 11×9.5×8.5cm metal box. It has the mini-cassette housing and tape-eject button at the front and parallel port and five-pin DIN power socket at the rear. Also supplied are an erasable programmable read only memory (EPROM) chip, two cables, a blank mini-cassette and the operating manual.

Page one of the manual contains a checklist of all the items the purchaser should have in his possession. The manual itself is included in this checklist, but then we all have our little eccentricities! This page also advises you to send Hobbit, Beeb and £5.75 to Ikon if you want it to fit the EPROM for you, though this would normally be carried out free of charge by the dealer who sold you the unit.

For those who are fitting the EPROM themselves, installation instructions are given in the form of an eleven-step procedure. The old adage about a picture being worth a thousand words is especially true of circuit boards, and a nice, friendly diagram would have been reassuring if not helpful. Installation is, nevertheless, simple and takes only a minute or two. Incidentally, the Hobbit manual instructs you to unscrew and remove the keyboard in order to locate the EPROM socket. While this would no doubt make it easier to see what you are doing, I found that it was perfectly possible to push the chip into its socket with the keyboard in place. Either way, the Hobbit operating system is now resident in your micro.

Next item on the agenda is to connect the Hobbit itself to your Beeb. The Hobbit takes its power supply directly from the Beeb exactly as would a disk. It does so through a cable which plugs into the BBC's power outlet at one end and the DIN socket on the Hobbit at the other. A ribbon cable connects the Hobbit's parallel port to the Beeb's user port. A minor, though irritating, complaint is that the connector on the Beeb end of the cable is not deep enough to be held in place by the plastic clips on the user port. After it fell off several times, I finally resorted to jamming it in place with a folded cassette inlay card.

Having installed the EPROM and connected the cables, the Hobbit is ready to go. Switching on your Beeb, you should see a greeting along the lines of:

HOS V1.8 (C) L.J. & A.A.WANT 1983
IKON .. TEL 099 421 515

As it happened, when I switched on the *PCW* Beeb, I got the same old 'Acorn DFS' banner, but then the Hobbit is designed for cassette-based machines rather than disk-based systems. Simultaneously pressing H and BREAK produced the elusive HOS banner.

Formatting and cataloguing

Before they can be used, Hobbit tapes — like disks — must be formatted. This process marks the block divisions on the tape which the Hobbit uses to organise its files. To format a tape, you simply enter '*FORMAT tapename'. The tapename, referred to in the Hobbit manual as the volume name, is simply an eight-character label to identify the tape. Apart from

enabling you to check that you've got the right tape, the volume name allows the Hobbit to find out whether the tape has been changed when it is producing tape catalogues and so forth. Each side of the tape must be separately formatted with its own volume name.

Using the Hobbit

To find out what is on a tape, you use the '*CAT' command also used for cataloguing disks and — for more patient people than I — ordinary cassette tapes. '*CAT' produces a display listing the volume name, drive number (0 or 1; 0 for a single-Hobbit system), the number of free blocks remaining, a list of filenames present on the disk and a menu of four single-key commands. Cataloguing an unformatted tape results in the error message 'HEADER'.

Each file on the tape is listed by a number (the first file saved being numbered 1), the filename, file-type (P>rogram or D>ata) and file-length in blocks. The four single-key commands are space-bar, to scroll through the file directory if it is too large to be displayed on the screen at one time; RETURN, to return to BBC Basic; f8, to LOAD a program from tape and f9, to CHAIN a program from tape. To load or chain a program, you indicate the file by typing in either the full filename or simply the file-number, and then pressing the appropriate function key. You can also issue standard BBC and Hobbit OS ('*') commands from the catalogue screen.

'*CAT' checks the volume name by reading the first block on the tape. If this name agrees with the last volume name catalogued, the Hobbit appears to retrieve the catalogue from memory, displaying it virtually instantly. If the volume name is a new one, the Hobbit shoots through tape in search of filenames; this takes around fifteen seconds. Despite being accustomed to using a disk system, I found this kind of delay quite acceptable.

One of the first things that any Hobbit purchaser is likely to want to do is to transfer existing programs from ordinary cassette to Hobbit mini-cassette format. I decided to give this a real test and attempted to transfer a commercial machine-code program. Did I have fun!

The problem was that I was trying to tell our long-suffering DFS Beeb that it was a cassette-based system ('PAGE=&EOO') in order to load the program from cassette. This it accepted quite happily, and then, having got the program safely into memory, I wanted to tell it that it was now a Hobbit-based system ('H' & BREAK) in order to transfer the program to the Hobbit. Being asked first to become a cassette-based machine and then boot-up the Hobbit OS, all the while trying to hang on to a machine-code program in a constantly shifting memory, left our Beeb understandably confused. Having, I think, decided that I had finally flipped, it retorted with a curt 'Bad program' and refused to discuss the matter further.

All this is by way of an aside, as owners of cassette-based machines will have no such problems. The process to transfer programs from cassette to Hobbit is pretty straightforward and is detailed in the manual. '*TAPE' followed by '*LOAD filename 1C00' loads the program into a safe area of RAM. When the program has been loaded, you note the address given alongside the program name (you'll have noticed that, when a program has loaded, you are given the filename and address (for example, STARTREK OE6C). '*HOBBIT' followed by '*SAVE filename 1C00+address' then saves the program onto a Hobbit tape.

To save a program written with the Hobbit installed, simply 'SAVE "filename"'. You can then LOAD or CHAIN it as you would a cassette.

The Hobbit supports a number of control codes relating to filenames. Normally, if you attempt to overwrite a file (that is, save a program using a filename already present on the tape), the Hobbit will ask you if it is 'OK TO REPLACE?'. Pressing 'y' overwrites, any other key aborts. If you wish to update a program, replacing the old version on tape with the new one, you can skip this check by prefixing the filename with an ampersand (@), thus 'SAVE "@filename"'. This tells the Hobbit OS that you want to place the new file @ (at) the position presently occupied by the old one.

Another option is to append the file to one already in memory. Notice the phrase 'append to' rather than 'merge with'. To add the program in memory to a program on tape called, say, PROGRAM, you would state 'SAVE "PROGRAM:A"' — the suffix ':A' instructs the OS to A>ppend the program to the existing file.

I draw your attention to the wording for a very good reason: the append option literally takes the program in memory, turns it into a tape file and tacks it onto the end of the existing file. I discovered this by accident, while trying to find out if the OS would warn me if I tried to overwrite existing program lines. I wrote program (a), saved it on tape, then wrote program (b) and appended this to program (a):

Program (a)
10 PRINT "PROG1, LINE 10"
20 PRINT "PROG1, LINE 20"
30 PRINT "PROG1, LINE 30"
Program (b)
30 PRINT "PROG2, LINE 30"
40 PRINT "PROG2, LINE 40"
The result was the program below:
10 PRINT "PROG1, LINE 10"
20 PRINT "PROG1, LINE 20"
30 PRINT "PROG1, LINE 30"
30 PRINT "PROG2, LINE 30"
40 PRINT "PROG2, LINE 40"

I tried running it and, yes, it actually executed both line 30's!

I repeated the experiment with two programs, each numbered identically and it appended the second to the first, executing the first program completely before going onto the second one.

File handling

It is file-handling that sorts out high-speed cassettes from true file-servers. The file-handling capabilities of the Hobbit are impressive. Up to five files may be open at any one time (though this does require a fair bit of memory juggling on the part of the user), and each file may be set to read/write, read-only or write-only. As well as supporting standard BBC OS commands, the Hobbit also supports some extra '*' commands of its own. This includes file and tape deletion, in addition to copying (either from one Hobbit to another or between filenames on a single Hobbit). Most of the file-handling commands are standard, though considerably more flexible than standard cassette.

Documentation

The 27-page manual assumes a working familiarity with both the BBC OS and BBC Basic. The Hobbit manual is intended only to supplement the disk-handling section of the BBC Handbook. The explanations are quite terse, but I found them adequate. It is, however, reassuring to see Ikon's telephone number appear on the screen every time you switch on!

Prices

	£
Single Hobbit	158.82
Second Hobbit	141.18
Box of six certified data cassettes	20.58

All prices inclusive of VAT. Hobbit prices include OS chip, cables and documentation.

Conclusions

Anyone who can afford disk drives is not going to waste time looking at the Hobbit, likewise people perfectly happy with cassette storage. I suspect that a lot of BBC owners find themselves between these two positions: fed up with cassettes, but without the necessary bank balance to invest in a disk system.

At £160 for a single drive and £300 for a pair, the Hobbit doesn't appear to be much cheaper than the cheapest disk drives available, but those £200 disk drives you see advertised usually cost closer to £300 by the time you've added on VAT, OS, cables, and so on. All the same, the Hobbit seems overpriced at present.

In the time I have had to play with the system, it's difficult to assess long-term reliability but certainly I experienced no loading difficulties. The unit gives the impression of a well-engineered product built to last.

The Hobbit is comparable in performance to the floppy-tape drives I have used and is simple to operate. I would have thought it worthy of consideration by anyone finding themselves in the uncomfortably large gap between cassette and disk.

The Hobbit is available from BBC Micro dealers or directly from: Ikon, Kiln Lake, Laugharne, Carmarthen, Dyfed adding £3 p&p. Hobbits will soon be available for the Electron, Dragon and Oric; the Electron Hobbit being upwards-compatible with the BBC. END

CLASS BEYOND COMPARE

An international microelectronics buying bonanza is upon us with British educational software and expertise in great demand worldwide. Derrick Daines reveals his private vision of the role that British teachers and schools will play in maintaining their lead in educational theory and practice.

At shows I so often hear the complaint that there is '. . . no software available for secondaries; it's all primary stuff.' But secondary computing got off the ground two or three years before primary, with people like John Coll and Charles Sweeten hard at work for some time before computing began in the primary sector. And, the DOI scheme of provision applied to secondaries a full year before it was extended to primaries, so what were all the complaints about?

But looking at the commercial software available, there certainly does appear to be more primary software than secondary. Why? For one thing, the software needs of the primary school are seen to be mainly concerned with simple things such as drill-and-practice routines in Maths and English. I think that vision is quite inadequate, but nevertheless, that is how it is seen. (Such programs are desperately easy to write!)

Looking at it commercially, the primary market is much bigger than the secondary, with perhaps five times as many schools, so the market is that much more attractive to a supplier.

Probing deeper, I suspect that the secondary schools have only themselves to blame. There has been an almost universal tendency for computers to disappear into the Maths or Computer Studies departments, never to be seen again. I am sure that secondary computing will never really get off the ground unless, and until, all other departments also use computers on a regular basis. Here, of course, we run into problems. One cannot share a single computer among the many departments and hundreds of pupils in the school, so I suppose what we are saying is that a wide variety of software will not easily become available until most secondary schools have several — or many — computers.

There is actually a lot of software about written by and for secondary schools, but you have to probe for it. Schools ought to join Micro-Users in Education (MUSE), which has a whole library of software obtainable at virtually give-away prices. Write to MUSE, Freepost, Bromsgrove, Birmingham for details of membership fees and benefits. MUSE caters for all sectors of education. A similar organisation catering only for primaries is Micros and Primary Education (MAPE). Write to Don Walton, Houghton CP School, Houghton, Cambs, for information, or to Barry Holmes, St Helens CP School, Bluntisham, Cambs, for a membership form. These are voluntary organisations so you may need to be patient waiting for a reply.

Getting back to software provision, I am happy to reveal on these pages that there is an enormous demand worldwide for British educational software, both primary and secondary, with some nations requiring more of one than the other. For example, one country might have a particular shortage of primary teachers; another might wish to improve the expertise of its school-leavers — hence its place in the manufacturing world. And where do they do their shopping? Right here, in Great Britain! It is a widely-acknowledged fact that when it comes to educational computing, we have a two to three year lead over the rest of the world.

For instance, at the South-East Asia Didacta (conference-cum-trade fair) held in Djakarta a few months ago, deals were struck that would make your eyes pop! (A DES spokesman has promised figures shortly — which we'll publish later.)

'It is a widely acknowledged fact that when it comes to educational computing, we have a two to three year lead over the rest of the world.'

From all around the world — Australia, New Zealand, Singapore, Hong Kong, South Africa, West Africa, The Gulf States, Spain, Scandinavia, Canada — orders have been flooding in to UK suppliers, particularly Microelectronics in Education Programme (MEP). Even the United States has been caught up in the buying bonanza, anxious to get its hands on our software and expertise, and has just signed a contract with MEP. Even countries that have not yet signed contracts, like Israel, are keen to get started, despite terrible currency problems. One highly-placed official in The Gulf States has said the countries wish to leap the typewriter age and plunge straight into the computer age. And guess where they are doing their shopping?

Shopping lists start with teaching materials: books, distance-learning (London to Newcastle?) packages and the like. They go on to include hardware and software, and before you know it, millions of pounds are changing hands.

All this is great news for Britain. As far as we personally are concerned, it means that there is a world-wide clamour for our experience, software and ideas. This underlines the piece I wrote a couple of months ago (*PCW*, A Lesson in Self-Defence, November 1983), about selling bits and bobs of software and especially, ideas. It means that British schools are at the cutting-edge of a worldwide revolution in educational theory and practice. What teachers and pupils are discovering today, the rest of the world wants to know about, and is willing to pay for.

For the Government — and especially Richard Fothergill's hard-worked team — this sudden success means more problems. Currently, they are hard-pressed indeed in just coping, which is why they have been expanding recently. Another problem is archaic — the historical fact that public bodies such as local education authorities, hospitals and the like — almost any Government department — cannot be seen to make a profit. So what does a Government department like MEP do, faced with this sort of worldwide demand? Does it give it away? Of course not; that would be political suicide. What they *are* doing is 'going private'. I have it on very good authority that MEP is currently investigating the setting-up of a private company expressly designed to handle these dramatic sales and plough the money back into MEP, or something like it.

That too is good news. It answers the question that has been hovering in everyone's mind for some time: 'Is there life after MEP?' Or, to put it another way: 'What happens after the £14 million has been spent?' The answer is clear; we then start spending the profits!

For years I have had a private vision of three or four computers in every classroom. A couple of years ago I doubted if I would live to see it, but now I have a sneaking suspicion . . .

PS: I wrote about the difficulties of finding software a little while ago (*PCW*, A Lesson in Self-Defence, November 1983), and suggested that readers should get a copy of a catalogue from Tecmedia of Loughborough. I am now told that this catalogue has grown so much that it has been taken over by MEP. So far, I have not seen a copy. I'll let you know when I have.

END

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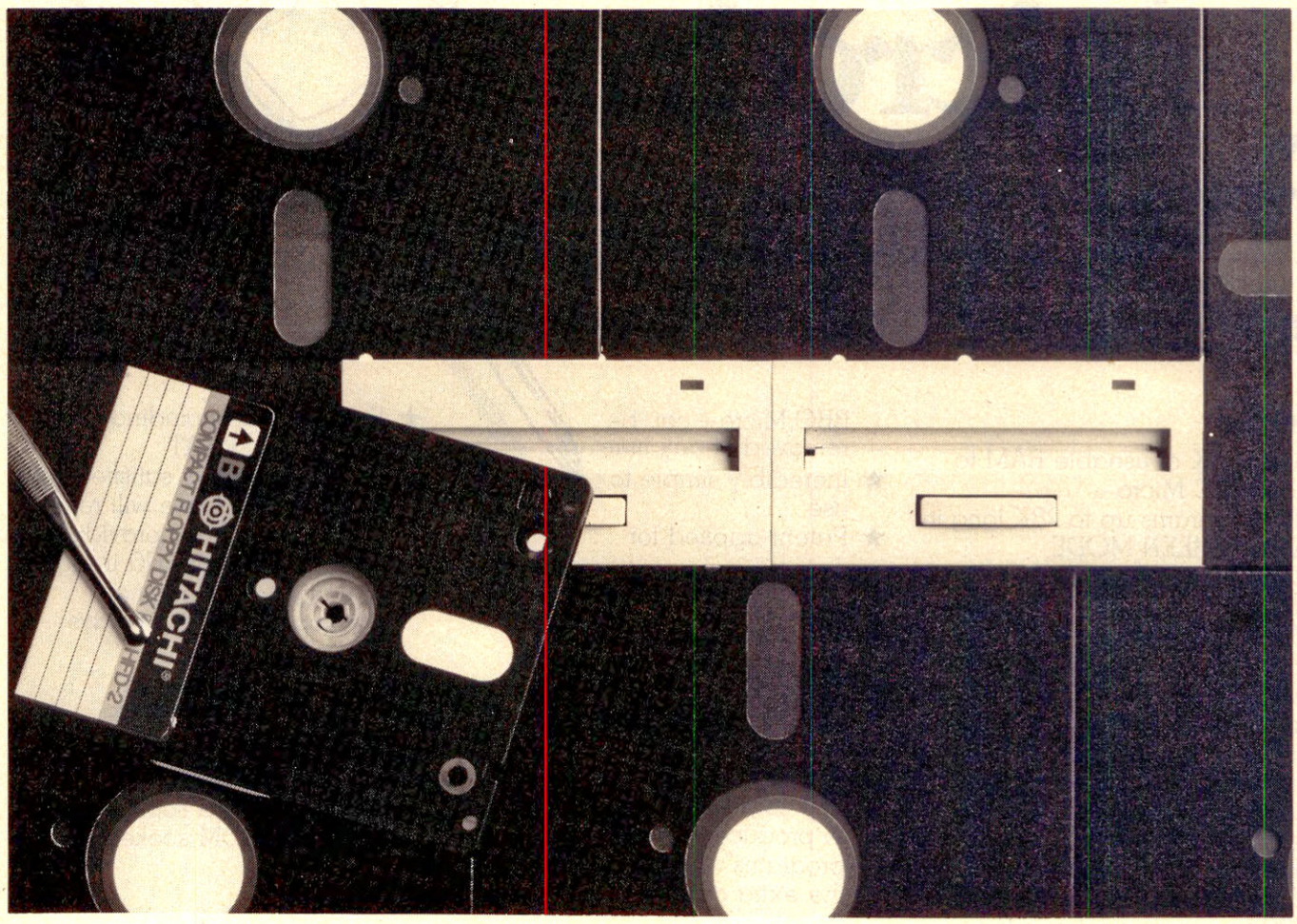
CHECKOUT

AMS 3in DRIVE

At one time, the 8in drive was the industry standard; then came the 5.25in and now the new style 'microfloppy' drives are making their debut. Surya examines a 3in drive from a company called AMS for use with the BBC Micro.



For many years, the 8in disk was the minimum size capable of offering a reasonable storage capacity. Disk drives simply weren't sufficiently reliable or accurate to allow data to be condensed into a smaller space. Today's 5.25in drives have a capacity ranging from 100kbytes to over 600kbytes, and for the first time a smaller disk is a practical proposition.

There is currently a lot of activity in the so-called 'microfloppy' market — under 4in drives — with several companies hoping to achieve the status of industry standard. Among the known contenders are Sony, Hitachi and Dysan. IBM is also rumoured to be working on its own microfloppy drive, but an IBM spokesperson would neither confirm nor deny the rumour. (As Newsprint readers will know: 'It is not IBM policy to speculate on possible future developments.')

The focus of the debate centres not on the format of the disk, but the size. Sony's drive is a 3.5in drive, Hitachi's is 3in. Personally, I am resigned to the debate continuing for at least as long as the old MS-DOS versus CP/M-86 saga, and doubt that either camp will emerge as a clear victor. But whichever drive you look at, microfloppy disks have two clear advantages.

Firstly, their size and low power requirement means that microdrives can be incorporated into truly portable machines. The Gavilan Mobile Computer (see Newsprint, *PCW*, July) is one machine to incorporate the 3in Hitachi drive.

Secondly, the microfloppy disks themselves are much more robust than conventional floppy disks. The term 'microfloppy' is misleading, since compact disks — as Hitachi prefers to call them — are enclosed in a rigid plastic shell, rather than the card casing used with 5.25in drives. Micro they may be, but floppy they aren't.

Both these factors are likely to make the compact disk — the term I will use in this feature — a strong contender for both business and home systems. I unplugged our 5.25in BBC drives to see how well the Advanced Memory Systems ('AMS') 3in compact disk system compared . . .

The AMS drive currently interfaces to the BBC Micro using the Acorn Disk Filing System ('DFS'). AMS hopes to be able to interface the drives to the Dragon, Spectrum and some of the new Japanese machines early in the new year.

The drives themselves are virtually identical in appearance to many 5.25in drives in all but size. The dual-drive unit measures a slim 19×18.5×4.5cm. The disk slots are covered by a plastic flap which is pushed aside when the disk is inserted into the drive. Each drive has an LED indicator and a disk-release button which you press to retrieve a disk from the drive.

The 3in measurement refers to the diameter of the disk itself. In its plastic casing, the disk measures 4×30×0.5cm, small enough to fit comfortably into a shirt pocket. The exposed surface of the disk is protected by a metal shutter which is automatically opened when the disk is inserted into the drive. The combination of rigid plastic casing and metal shutter means the disk is fairly well protected against dust, dirt and the odd knock.

Hitachi compact disks are described as being double-sided. This is true in the sense that a cassette is double-sided: the disk has to be removed from the drive and turned over to access side B. This gives a total formatted capacity of 200k (100k per side), but you can't store programs on one side and then access data files on the other without physically turning the disk over. The LED indicator on the front of each drive glows green when side A is being accessed and red for side B. This neat trick is achieved by the switch which opens the protective metal shutter on the disk.

As supplied, the disks are 'write-protected'. To enable a disk to be written to, you simply use a ball-point pen or similar to push a red plastic switch at the top of the disk so that it covers a small hole. Each side of the disk can be separately write-protected and the operation can be reversed as often as you like.

I had one disk in my possession for about a month. AMS gave it to me at the *PCW* Show, presumably in the hope that people would ask me about it as I wandered around (they did). Since I wasn't intending to use this disk, I didn't take any pains to look after it. In the course of four weeks, it was dropped, trodden on, spent a week sitting on a 50-watt loudspeaker, was stuffed into a jacket pocket together with keys, loose change and a couple of EPROMs, and then — the final indignation — had a glass of orange juice spilt on it. (What you might call a soak test.) Just out of curiosity, I decided to have a go at loading it. It booted first time. Try that with a conventional floppy! While the above treatment is probably not recommended by Hitachi, it does give an indication of the sort of hammering compact disks will take.

Both the strength and size of the disks are a big plus to anyone who has to carry disks around — perhaps between your office and your home. No special disk boxes are needed: you can literally carry them around with you in your pocket, stuff them into a briefcase or whatever. Being paranoid when it comes to disks (this goes back to an early traumatic experience with a 380Z), it took me a while before I relaxed and started casually slinging them around, but I've yet to have one crash on me. I only hope I don't start treating ordinary floppies in the same offhand manner!

Setting up

Supplied with the drive itself is a utility EPROM (Eraseable Programmable Read Only Memory), a user guide and a utility disk. The AMS system is available in both single and dual-drive forms. The connecting cables are wired into the dual drive and supplied with the single drive (plugging-in is a five second job). The system I reviewed was a dual-drive unit. In either case, the setting-up procedure is virtually identical to that required for conventional drives.

As with 5.25in drives, you need an operating system chip to run the drive. The compact drive is transparent to the BBC; that is to say the operating system neither knows nor cares whether you have standard 5.25in drives or the AMS 3in ones. You can, in fact, use one of each without experiencing any problems.

The official Acorn operating system is the Acorn DFS chip costing £98. Watford Electronics also produces its own DFS chip which retails at about the same price and includes some extra commands. Watford Electronics will, incidentally, swap the Acorn DFS for its own for the sum of £35.

Assuming your machine is an issue four or subsequent, fitting the DFS is simply a matter of unscrewing the casing, removing the top part of the case and pushing the chip into place in one of the 'sideways ROM' sockets. If you have an earlier machine, the job is best left to an Acorn dealer. Unlike 5.25in drives, the AMS drive comes with a utility ROM which is slotted into another sideways ROM socket. This provides the commands '*FORMAT' and '*VERIFY', used to prepare and check respectively a new disk. These commands are also supplied on the utility disk as with 5.25in systems. Having the commands in chip form is not essential, but is quite useful.

Once the DFS and utility EPROM are fitted, all that remains is to plug in the two connecting cables: the ribbon cable slots into the interface marked 'disk', and the other cable plugs into the power-supply socket alongside it. The system is now ready for use.

Inserting a utility disk into the drive and pressing SHIFTed BREAK (the DFS auto-boot routine) should load a program called MEMO. I tried it, and the Beeb promptly hung up. I pressed BREAK and tried again, with the same result. I tried '*CAT'. You guessed it, the Beeb hung up again. After phoning AMS, it appeared that the problem lay in the ribbon cable connecting the drive. Anyone familiar with the BBC will know that any cable plugged into the BBC does so with the cable hanging down, away from the machine. Not so the AMS review system. This had to be different and have the cable plugged in the other way up. On doing this, the system booted without any further problems. AMS tells me that a small number of drives had their cables fitted the wrong way up and that the review system was one of these.

The auto-boot program is, as I mentioned, called MEMO. I expected this to print something to the effect of 'Welcome to AMS — press the space bar for instructions' or some such greeting. What it actually did was to present a program which allows you to enter up to ten strings which are displayed on the screen, numbered 1 to 10 under a heading MEMO. These strings are then saved to disk and will be loaded next time MEMO is run. As a demonstration program it doesn't exactly keep you on the edge of your chair, but it is useful in that listing it gives you an example of simple disk-based file-handling.

Since the AMS is transparent to the operating system, all OS commands are used in an identical fashion to a 5.25in system.

Prices

	£
Single drive	225.00
Dual drive	399.00
3in Compact disks (each) (200k formatted)	4.95

All prices include VAT. Drive prices include cables, documentation, utility EPROM and 3in disk but do *not* include the DFS chip which must be purchased separately from an Acorn dealer.

Documentation

Documentation takes the form of an extremely comprehensive 80-page ring-bound User Guide. This describes the system, explains how to connect the cables and fit the EPROM and then makes a better job of explaining Acorn's DFS than Acorn does in its manual.

The User Guide is logically structured and neatly laid out. Diagrams are provided where necessary, and I found these easy to follow and unambiguous. The command summary is sensibly printed on the back cover of the booklet.

From getting started through the DFS commands to machine code handling and technical specifications, I found the manual hard to fault. The prose style is a little stilted and formal in places, but infinitely preferable to the 'hi there, kiddies' style adopted by so many manuals. This is documentation as she should be spoke!

Conclusions

AMS claims that around fifteen software houses have expressed an interest in supplying software on 3in disk. Transferring files between 5.25in and 3in disk is no more difficult than copying from one 5.25in to another, so there is no reason why software houses and/or dealers should not offer customers a choice of disks.

At £225 for a single drive and £400 for a dual-drive unit, the AMS system is marginally more expensive than an equivalent 5.25in drive, but not significantly so. I would think that a lot of people will consider the advantages of a 3in system worth the extra £30 or so. In terms of performance, the AMS drives turned out to be slightly slower than our 5.25in system running a simple file-handling program — but again, the difference was slight and would not be significant to the average user.

In the business end of the BBC market, any kind of disk drive is going to find it hard to compete with the recently launched Torch disk pack — at least, until Acorn gets around to releasing its long-promised second processor. With its Z80 processor, the Torch pack gives business users access to a virtually unlimited library of CP/M programs. I was surprised, too, to hear that AMS is intending to enter the Sinclair market: the price of the Sinclair Micro-Drive makes the AMS drives a very expensive alternative.

But for the home end of the BBC market, and both business and home users of other machines, the AMS drives are a very attractive proposition. END

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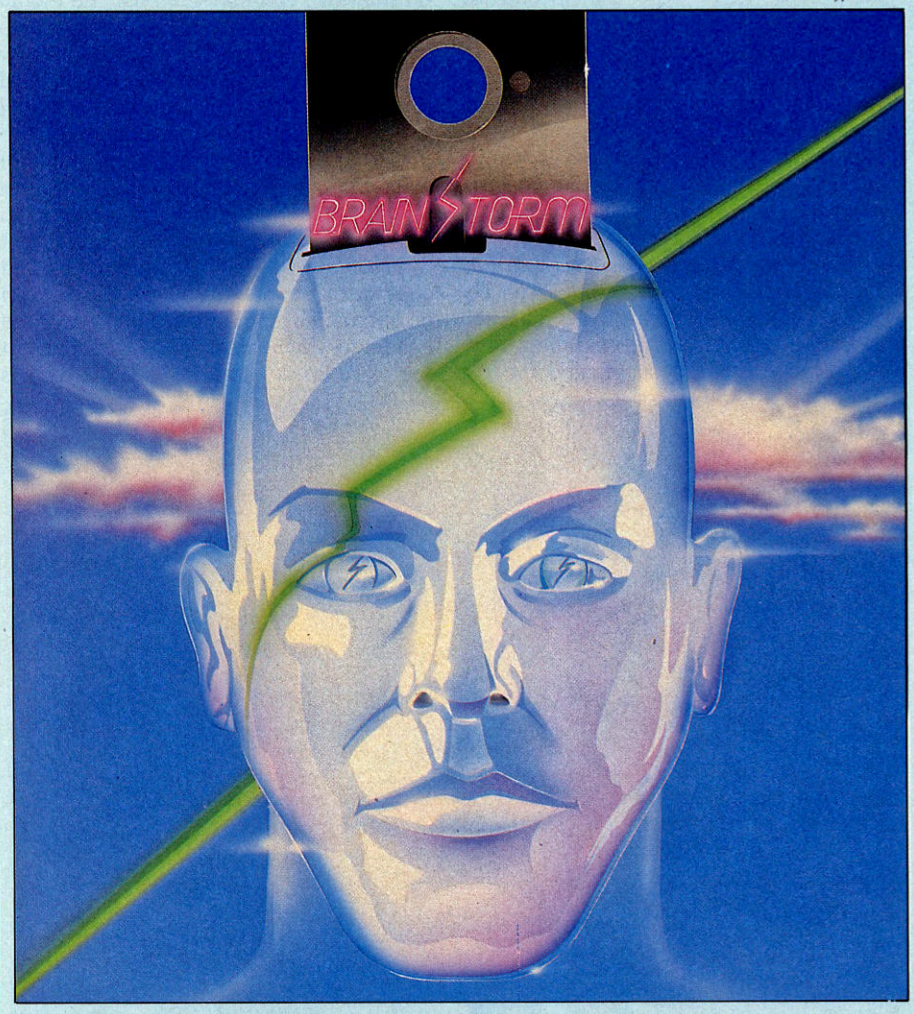


'The most effective aid to creative thought since the pencil and paper.' So says Caxton Software about its new product, Brainstorm.

One thing that boasts more for a product than any amount of advertising is whether the company who markets it uses it. Caxton's Director David Tebbutt — who first had the idea for Brainstorm — has been using it for three years, and since Caxton went into business two years ago Brainstorm has played a major role in the business of the company.

'We use it for everything: project planning, program design, document drafting — in fact, wherever there is a need to organise creative thoughts and turn them into practical propositions,' said Tebbutt, who is as proud of Caxton's software baby as he is of his own flesh and blood children. Brainstorm was co-written by Tebbutt and Mike Liardet of Brainstorm Software.

Brainstorm is being launched as an 'ideas processor'. The name is designed to benefit from the goodwill earned by data processors and word processors in the past. The way Brainstorm 'processes' ideas is to organise them, which is why I prefer to think of it as an ideas *organiser*. Whatever you call it, as a new kind of software product, it presents Caxton with a marketing barrier which word processors and spreadsheets don't need to worry about. 'We'll have to use our advertising not just to sell Brainstorm but to educate potential customers about a new application,' said Tebbutt.

And reviewers, he might have added. Out of the window went Benchmarks and experience of similar products. My first job was to find out what Brainstorm was supposed to do; my second to see if it did it.

What does it do?

Remember the Bisto ad? The thing about Bisto was that it did everything 'all in one go'. In this case, the gravy is your thoughts and the gravyboat is Brainstorm. Pour your thoughts into Brainstorm, and Brainstorm links and structures them all in one go. Take a look at this piece of Brainstorm output:

BRAINSTORM BENCHTEST

- Introduction
  - paragraphs
    1. Quote
    2. Background
    3. Launch
- Body
  - — Sub-headings
    - What does it do?
      - Para 1. Bisto Ad.
      - Para 2. Brainstorm structured printout
      - Para 3. Tell them what they've seen
      - Para 4. Notice 'paragraphs' duplication
      - Para 5. Explain promotion and namesake
      - Para 6. Explain worksheets
    - How does it do it?
      1. If I only knew!
      2. What appears to happen.
    - How do you use it?
    - Other sub-heads to be determined
      - Illustrations and diagrams.
- Conclusions
  - paragraphs
    1. Quote
    2. Background
    3. Launch
  1. Usefulness?
  2. Originality?
  3. Competition?
  4. Value for money?

The plan above was produced in two minutes, from inserting the Brainstorm disk into the Sirius to tearing the printout from the Epson. It is a first sketch of this Benchtest and shows you that this paragraph will tell you about what you've just seen. So now you've been told.

Notice that the word 'paragraphs' appears twice in the printout: once under 'Introduction' and again under 'Conclusions'. Notice also that the three lines under the first occurrence also appear under the second, before 'Usefulness?'. In fact, they were only typed once. Brainstorm noticed when I wrote 'paragraphs' the second time that it already existed as an entry. Whenever an entry in a Brainstorm file has a namesake (as such duplications are called), the program notices the fact. Depending on whether one or all of them have subordinate entries it then does its organising: more on that later.

Notice also that under 'Conclusions', 'paragraphs' has four other lines, 'Usefulness' being the first. You'll see that these four lines were not reproduced under the namesake. The reason is that they are not descendants of 'paragraphs', but exist on the same level. Descent, or subordination, is shown on the printout by indentation. All input to Brainstorm on the same screenful of data is considered to be equal

in rank. As befits an equitable environment, however, any entry in any screen can be promoted to header status and be the leader of its own screenful of entries.

A screenful of entries is in fact more than a mere screenful: it can be up to 988 lines of text (on my 128k Sirius), upon which the large middle split of the VDU acts as a 15-line window. The top split contains the name of the officer in charge — that is, the header to that group of subordinates. 'What does it do'?' is such a header. The bottom split contains prompts and acts as a command screen. It also displays status information (see screenshot).

How does it do it?

If I knew exactly how Brainstorm works I wouldn't be sitting here writing about it — so don't expect full details of the coding! What I can say is that it does its job extremely quickly, so quickly that the program doesn't intrude on your thoughts the way a word processor or a database might, by making you watch and wait while it carries out an instruction. Once loaded, Brainstorm resides in memory and requires no disk access except for SAVEs and LOADs of the model on which you are working.

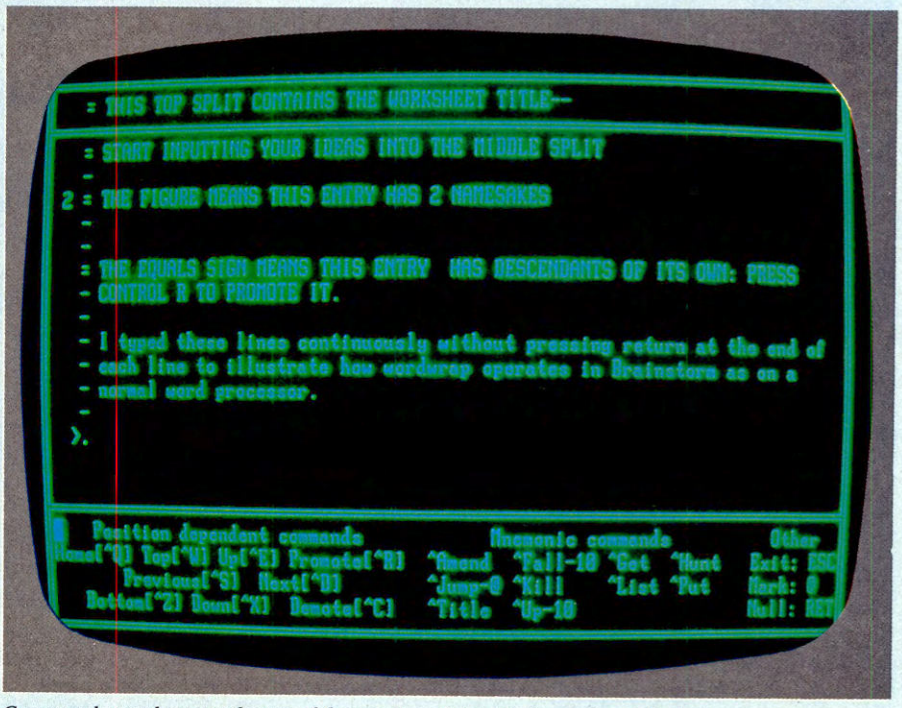
What appears to happen, however, is that every time you press the return key after writing a line of text, Brainstorm assigns pointers to indicate where it belongs in the model. Brainstorm also scans the entire model looking for namesakes of the line you just entered. If they exist, they all get flagged with a number indicating the total number of namesakes to date. The flagging and the pointer setting is totally transparent — that is, it happens swiftly without you being aware that something is going on. In fact, when you get more than 15 namesakes, you do see all the numbers incrementing down the left-hand side of the screen but this takes less than a second. The manual is slightly misleading about the number of namesakes permitted, for it says: 'It is possible to have hundreds of occurrences of the same namesake all connected in this fashion.' This is not strictly true as although you may have hundreds, only 99 of them ever get flagged — more than 99 and they're all still flagged '99'.

Namesakes

If none or only one of the namesakes has descendants, Brainstorm regards each one as an image of the others and, if descendants exist, gives them all the descendants of the one which had them.

If, however, you create a unique entry with descendants and then change it so that it is then the same as another entry with a different set of descendants, Brainstorm checks with you that you want the two sets of descendants to be merged. If you type anything other than 'Y', the line is not entered and you must change it to avoid the merge.

Namesake matching can be a headache: you saw how the subheading 'paragraphs' in Conclusions above acquired all the descendants of the first occurrence. Upper and lower case distinctions do not apply when Brainstorm searches for namesakes. However, leading and embedded spaces are significant, so a good dodge to distinguish between two entries of, say, 'paragraphs' is to type the second as ' paragraphs'. Trailing spaces are ignored. Another way of keeping same-meaning, non-matching entries apart is to choose a synonym for the new entry. You also need to be careful when you delete (or KILL) a header since all subordinate entries, if any, will also vanish. If what you want is to create namesakes easily, you can use an '*' wildcard (like the joker in Gin Rummy). The line '/I want to reproduce this line lots of times elsewhere in the model' can be copied wherever you want by typing '/*' and hitting return: the line beginning with the '/' is matched to the asterisked line.



Commands are shown at the top of the screen and status information at the bottom.

How do you use it?

Imagine you have just decided to do something — anything! You begin to think about how to go about it. Inevitably your thoughts encompass many aspects of the task, from your own input to the organisation of other resources. Similarly you find that some aspects of the job appear in your mind in detail while others are more sketchy. In this initial phase of thinking about a new task, Brainstorm can be used as you might use a tape recorder or dictaphone. Instead of speaking your thoughts, you type them in as they occur to you. There is no need to set up records or define fields as you would do if you were using a database. You can save the file (or model) when you run out of ideas, and load it again when you want to add to the model. The advantages of Brainstorm over a tape recording are: a) there is no need for transcription; b) further input can be 'placed' at any point in the existing model; c) Brainstorm will make namesake links between matching input lines; and d) immediate structured print output can be obtained at the press of a button.

Having used the program as a flexible, intelligent notebook for fixing your ideas on the task, you may then use the model you have constructed as a basis on which to build a more detailed, formal document. In this sense Brainstorm is a kind of word processor. You select the part of the model you wish to expand and carry on writing.

Certain word processing features are *not* available: you can't set Brainstorm to double space automatically your entries on the screen (although you can arrange for it to print that way). There is no block and copy facility as such. The same effect can be obtained by creating a namesake of the header to which the block is subordinate at the place in the model where the copy is required. Another way of achieving this effect is to use the 'mark', an 'at' sign placed in the margin (see below for details). Each time text is 'got' from a mark, the mark is reassigned to the next line of text. By 'getting' again, the next line is moved to the target area. There is no search and replace function, although there is a search option. Only if the target is a namesake, can you search and replace by changing it: this changes all namesakes instantly. To establish a point of comparison I ran the *PCW* Word Processor Benchmarks which could be used — saving and loading times — and the results are shown in Fig 1.

Good news, bad news

Two findings stood out while I was doing the Benchmarking. The good news is that with Brainstorm you can jump to any-

where in the text without waiting for tiresome screen scrolling to get you there. This is because the entire model is held in memory and no disk accessing is required. The bad news is when you spot a mistake in the line above the one you are typing — a very common event — you can't just move the cursor to the line above and correct. Brainstorm regards each 72 character line as a discrete character string or symbol expression and the cursor may only be moved backwards or forwards within it during input. Word-wrap does operate if you are typing continuous text but to amend a line above or below the one you are typing you have to hit RETURN to come out of the line, reposition the line pointer to the line you want to correct, and then press ^A to get into it.

Installation and tailoring

My test disk was supplied ready 'installed' for use on a Sirius with a Z80 card. About 25 machines running CP/M are catered for: should you not have one of them, an install program is supplied on the disk to enable you to get started. MS-DOS is the first 16-bit system for which Brainstorm will be available at launch: no decision has been taken at the time of writing about implementing Brainstorm under CP/M-86. A large section of the manual is devoted to explaining how to use the install programs. Even if you don't need them to get going, you may want to customise Brainstorm for your own use. You can change the graphics used for the menu borders and choose different control keys if you don't like the given ones. You can write your own prompt messages, change screen and buzzer control sequences and specify paper size and print area. You can also reset printer codes for double or triple line spacing, character sets and error checking sequences. Whatever new configuration you invent, you save it onto an alternative command file on a backup copy of Brainstorm which, as a registered user, you are permitted to make.

Screen display

The Brainstorm displays are uncluttered and simple, and there are only two of them (excluding the 'welcome' display), both using the same format of a triple split screen. The main menu contains available commands (Fig 2) in the top split and status information in the bottom. The larger middle split is used to display directory information when required. The second screen display is the worksheet. Here the top split is a single line holding the worksheet header. The large middle split is the 15 line window on the model. The lower split acts as a prompt display and command field.

File creation and structuring

To set up a Brainstorm file (or 'model!') type U (for use) from the main menu. No RETURN is needed for any of the command keys. The cursor goes straight into the bottom of the worksheet screen. A line pointer '>' indicates which line you will use next time you enter text. This pointer can be jumped backwards and forwards over nearly 1000 lines in about a second! If you aren't word-wrapping (which you won't be if you're using Brainstorm for ideas capture), hit RETURN after each idea and the cursor takes refuge in the bottom split, ready to jump straight into the next line when you type the first letter of your next thought.

The Mark

If you are wondering why you need both a cursor AND a line pointer (I did), the answer is that the line pointer acts as a marker when you are jumping around the model. You might want to mark a location (such as the Introduction header in my example) so that at any time during your flow of ideas you can jump straight back and add to it. You do this by typing an '@' sign. When you do jump, the '@' is automatically placed at the line you jumped from and the line pointer goes straight to where the '@' was. Next time you jump you go back to where you were. All this in a split second. However, only one '@' mark may be used; that is to say only one pair of lines can be linked in this way at any one time. This is no real problem because a wide range of other jump commands are included to get you swiftly from one part of the model to another.

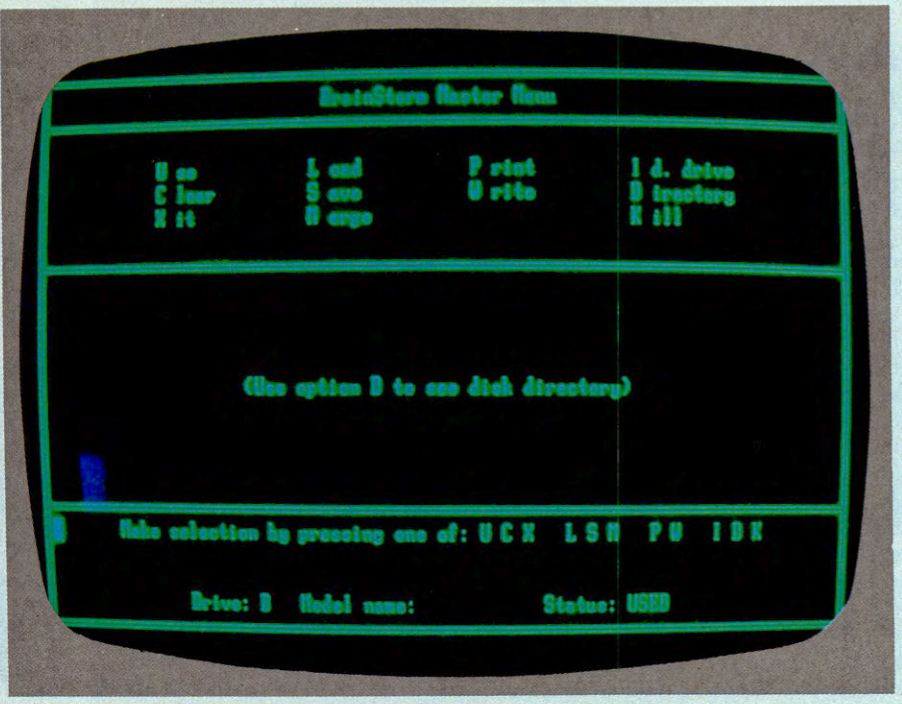
Brainstorm model

A Brainstorm file takes the form of a model, defined as the sum of all the entries made during a Use session. An entry is a 72 character line which may be the title of the model, a heading, sub-heading, sub-sub-heading (upon their backs to bite 'em), and / or a descendant. Each line is, of course, a descendant of the heading under which it is entered. It may at any time be promoted to header status, as I mentioned earlier. There is no limit except computer memory to the number of entries or subordinated levels in a model. I got just under 1000 lines into my 128k Sirius, or else you could have 1000 levels each of one line! The normal kind of model will be somewhere inbetween. During text input the bottom split displays an edit menu. In 'idle' mode (cursor in bottom split) the level of the current worksheet is displayed plus the line number of the current line, the number of lines in the worksheet and the amount of free memory. A control key menu can be displayed by typing'!'.

Control keys

I said before that you can jump from top to bottom of a 1000 line model in a second. Top and bottom jumps are done with ^W and ^Z keys respectively — their north/south position on the keyboard. Other jump keys are provided — see Fig 3 for details. Assuming you don't change them, the other control sequences are mainly mnemonic or positional.^H is used to enter search mode (H is for Hunt); ^J is for Jump, and so on. You can get text from an '@' mark or put text to one; both operations are useful when, having poured out your ideas, you start shaping them up.

WordStar users will find some of the control key sequences familiar; for example ^S and ^D which glide the cursor left and right without overtyping. Brainstorm's ^A and ^F, however, are equivalent to WordStar's ^G and DEL respectively. The manual is a bit naughty to refer to 'single keystroke commands' since they all require the ALT key to be depressed. It's very frustrating when you forget the ALT



Using Brainstorm for ideas capture, the cursor takes refuge in the bottom split.

because Brainstorm types a letter which you then have to delete (cursor inside an entry) or else creates a new line which you then have to kill (cursor in 'idle' mode). You also have to remember that the value of the control key changes depending on whether the cursor is editing or idling; for example, ^A gets you into a line for amendment, but inside the line it means delete character under cursor.

Hunt

Hunt operations may use the '*' wild card, commonly at either end of the target string to delimit it. Once again response time is negligible and no appreciable degradation with model size occurs. Upper and lower case distinctions are ignored during a search. Unlike databases, Brainstorm has no 'high-level' search function using logical operators, but this is not really necessary given the speed of response: many potential targets can be evaluated in real time. Further, use of Brainstorm involves you in permanent interactive contact with the entire model, unlike a database-type model in which the records lurk out of sight among the circuitry. This means you have a far greater degree of familiarity with the model, and your knowledge keeps pace with it as it increases in size. You may also invoke a selection option when you request print output, using a marker to indicate the end of the print required or using the Hunt command to specify required headings, etc.

Any entry in a model can become a title or header if you position the line pointer opposite and press control R (Raise?). The moment any entry acquires subordinates, it is flagged in the margin with an '='. Non-header entry's rank is denoted by '–'. Control K is used to kill an entry (and all its descendants if it has them!).

Multiple files

Brainstorm can hold several models simultaneously, memory permitting. The manual illustrates this well with a Diary and Address book example, where two files are maintained and used at the same time. In fact, Diary is simply a sub-heading on the same level as Address book, and both could be thought of as discrete sections of a larger model — at least, this is how Brainstorm will treat them. Files can be merged from disk into current models: when this is done, Brainstorm immediately cross-references any namesakes between the two files. This has an important implication for future Brainstorm-type programs: I can imagine this approach being very valuable for building up expert-system knowledge bases.

Having mentioned the MERGE option, this is an appropriate moment to consider the SAVE, WRITE and LOAD commands. These are the only ones that require disk access. SAVE automatically defaults to a .BRN-type file, in which your model is saved in Brainstorm format and can be loaded back in this format for further work. WRITE saves an ASCII version of your model which can be accessed by other programs such as word processors or by operating system commands like TYPE. Conversely, Brainstorm will load ASCII files produced by word processors. These load at a single level as blocks or paragraphs of text. They can then be structured manually using commands such as PUT, GET, and PROMOTE, before being saved or used as Brainstorm models. Brainstorm will, however, forge any namesake-type links which may exist between entries. A section of the manual explains how to structure external files to correspond to Brainstorm internal format so they may be loaded as BRN files. I haven't yet worked out why anyone would want to do this, but it gives you a sneak glimpse of what Brainstorm gets up to behind that inscrutable screen.

I missed an option to run another program from within Brainstorm: it would be neat to be able to go into a word processor and then call up a Brainstorm-produced file for a final edit.

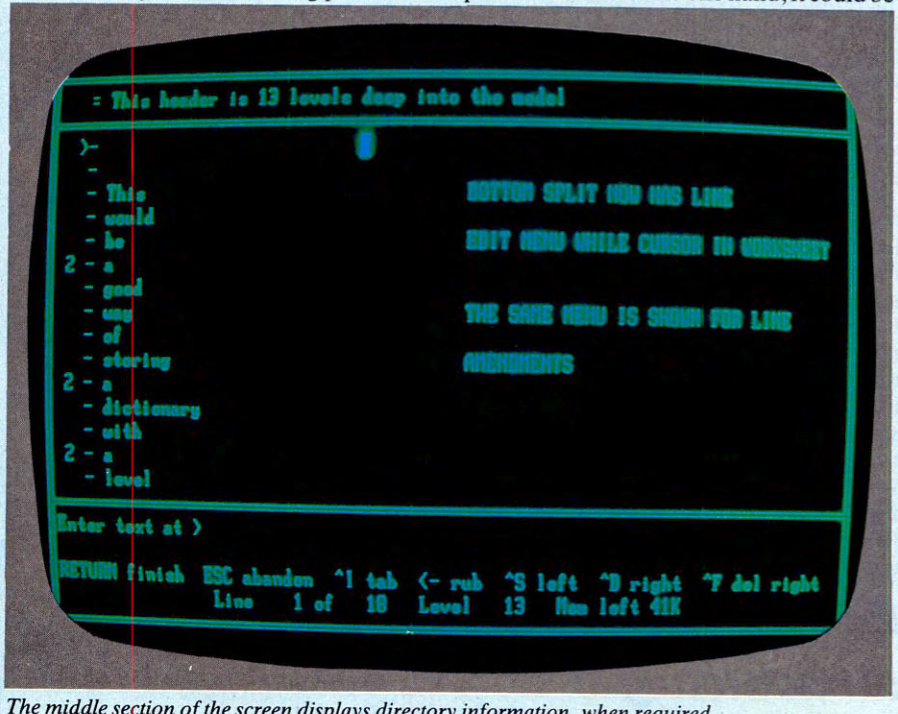
Output

There's an old saying in the computer world that if you put garbage into a computer you'll get garbage out. Brainstorm significantly modifies this adage: it's now a case of 'garbage in, *structured* garbage out'. The manual boasts no less than 2.5 million output formats based on the sawtooth indentation theme, as well as both continuous flow and word processor-type paragraphs without indentation. The manual accepts, however, that most people's requirements will be met from no more than 15 variations on the theme, and the most popular one is made the default output. This produces successive four-space indentations and 'outdentations' as you go into and come out of lower model levels. The system of entering parameters to vary output is strangely complicated, bearing in mind the simplicity of use which typifies the rest of Brainstorm: I couldn't get the hang of it before writing this review and used the default output every time. Even with this poor show (I mean, using one out of 2.5 million possibilities says very little for my imagination), the output produced is extremely handy. The Brainstorm manual itself was composed using the program, while in the *PCW* office I've used it to design the most exciting micro-users competition ever run in a micro magazine — details of which will be announced in next month's issue.

User image

Brainstorm is a program to help you think and to set you thinking. I found using it challenging because its quick reactions gave me a feeling that it knew exactly what it was doing, but I didn't really know what I was up to. With word processors and databases you spend a lot of your time telling the thing what to do. With Brainstorm it's more a question of knowing what *you* are going to do — or think — next. To my surprise I found that the cumulative effect of using the program was to improve the way I thought: I am becoming more and more capable of organised thought with every Brainstorm session. This happened because from the word 'go' I found myself rehearsing a little snippet of mental aerobics at every press of the keys. It goes something like this: 'Does this thought belong here? If yes, slap it into Brainstorm now. If no, flick through the model and see if there's a home for it somewhere else. No home? OK, promote this thought to header status and give it an Empire to rule over.' To begin with I was angered at being made to feel inadequate, but it soon dawned on me what a change this feeling was from my usual 'stupid blankety-blank machine!' experience.

Now structured thinking is not a natural phenomenon. On the one hand, it could be



The middle section of the screen displays directory information, when required.

said to exclude great creative leaps of the imagination but on the other, lack of structure has always been associated with second rate creativity. In the field of computer programming, the same principle is beginning to rule. There has to be a middle way between random, chaotic thought with its high creative content and ordered, structured thought which is high on communication power. Brainstorm is a good middle way.

Leaving the psychology of creativity for you to argue about among yourselves, I found that when I messed things up Brainstorm is well equipped to sort you/me out again. 19 textual error messages, including a friendly 'Sorry', and a novel 'Unsure' (not what I expected from a program with Brain in its name) are available on screen, with backup information in the manual. For those unexpected hardware and operating system crashes Brainstorm has its own 'salvage crew' aboard, a program (!) called Rebrain. I'll explain the screech mark in a moment. According to the manual, if you use Rebrain immediately after a crash it offers a 'high probability of recovering' the model you were working on. I looked forward to trying this out and engineered a spectacular power surge which shut everything down for a nanosecond or two. Unfortunately, when I tried to 'Rebrain' my way back to life, nothing happened: the Rebrain program was missing from the disk. When I called Caxton to complain I was told how to write my own Rebrain program: you simply create a file called, say, Rebrain (anything else will do). When you then call the program, it loads zero bytes and branches to 100H, where the first instruction of Brainstorm resides. The model should still be there. I used 'Pip' to create the file by typing 'PIP REBRAIN.COM=CON:'. This makes the console the input device. I answered the prompt with a control Z to give an empty file. I then tried to save a model with the drive door open: crash! The door closed again, I hit ^C to reset the offending drive and call the empty .COM file. This reset the pointers in the transient program area to the start of the last program to reside there; in this case Brainstorm itself. The model was intact, but I didn't get that 'Unsure' message promised by the manual. Most disappointing.

BRN format	
3000 words	
Load 12.8 secs	
Save 34.5 secs	
Full buffer (42k or 10,000 words)	
Saved 60 secs	
Load 34.1 secs	
Load degradation factor = 1	
Save degradation factor = 1.4	
DOC format	
3000 words	
Load 21.4 secs	
Save 35 secs	
Full buffer (42k or 10,000 words)	
Saved 60 secs	
Load 60 secs	
Load degradation factor = 1	
Save degradation factor = 0.7	

Fig 1 Brainstorm Benchmarks for Load and Save

Documentation

My manual was a pre-production version, but the retail version will come in a gold slip-case together with the disk. There were some 90 pages of manual, only 34 of which were used to teach me how to use all Brainstorm's facilities. I mastered them all in two half-hour sessions — all that is except for the print formatting codes which I'm still struggling with more as a point of honour than because I need 2.5 million options. So few instructions reflect Brainstorm's ease of use: I honestly didn't need any more help than what was offered. Of the other 56 pages, three or four contained error message and command key references. I'm told that the user will get a fold-out reference chart: I didn't. Since all the reminders you need can be had from the screen it didn't seem a vital section anyway. One page describes how to 'Rebrain'; 26 are devoted to the installation procedures, with five pages appearing twice, once in the section called 'Getting Started' and once in 'Installation'. The remainder are shared between a five page appendix on how to create Brainstorm format files externally, some diagrams of screens and an ASCII/Hex 7 bit converter chart. Last, but most interesting of all, no less than 18 pages of ideas for using Brainstorm: an excellent inclusion to help get this new product off the ground. This section includes a listing of the Diary/Address book program for you to type in and run.

Money matters

Having laid out a few thousand for your hardware and bought a word processor and/or a database for several hundred, you probably won't flinch at paying £295 for Brainstorm. I believe it could have been sold for less: Caxton would have loved to have sold it for more. In the end the price is Caxton's attempt to place its product into the market at an 'attractive' price.

Use	(Use a Brainstorm model or create a new one)
Clear	(the current model)
X	(Exit to system)
Load	(a file or model from disk)
Save	(to disk in Brainstorm format)
Merge	(current model with file/model from disk)
Print	
Write	(current model in ASCII format to disk)
Identity	(change ID of logged drive)
Directory	
Kill	(delete file from logged drive)

Fig 2 Main menu options — only the first letter needed

There's certainly no question, at the moment, of having to fight off the opposition: Brainstorm is the first, and so far the only product of its kind. I'm quite sure it won't be the last. As the founder of what is going to be an applications dynasty, Brainstorm will have to do all the work of winning a market share for this kind of program. For that reason, Caxton is not resting on what it hopes will be laurels. The next products based on the Brainstorm philosophy are already on the drawing board — or rather, in Brainstorm files!

Conclusions

This is a new kind of tool which every micro user could find a place for. Its usefulness is not in doubt. My main disappointment is the price, but I suspect that's just because I couldn't afford to buy it myself. If you can afford it, Brainstorm will do three things for you: increase your ability to communicate with your staff and colleagues on paper; increase your ability to control and exploit your own ideas; and gradually train you to think in a more structured fashion if and when you need to. More control over the innovative instant namesaking process could be introduced — in particular a menu which would allow the user, in a particular Brainstorm session, to ask the program to accept a namesake without giving it all the descendants of the others.

Amend entry	^A mend
Amend title	^T itle
Delete entry	^K ill
Cursor up	^E
Cursor down	^X
Cursor up 10 lines	^U p
Cursor down 10 lines	^F all
Cursor to top of list	^W
Cursor to end of list	^Z
Title screen	^Q
Promote an entry	^R
Demote an entry	^C
Previous namesake	^S
Next namesake	^D
The mark	@
Jump to mark	^J ump
Get from mark	^G et
Put to mark	^P ut
Search for an entry	^H unt
Print current list	^L ist
Edit Controls	
Cursor left	^S
Cursor right	^D
Delete left	^A
Delete right	^F
Tab	^I or TAB
Complete entry	<ret>
Abandon entry	<esc>

Fig 3 Standard edit commands

Bearing in mind that the program only occupies 14k of RAM and requires no disk access during use, Brainstorm is an ideal candidate for use with cassette I/O. This would bring thousands of home micro owners with memory expansions into contact with the kind of program usually reserved for business machines. So come on, Caxton, let's have a sub-£30 cassette version later this year.

END

CHECKOUT

VISUALL

The concept of on-screen window display is not new and has been adopted by companies such as Apple and Xerox with some degree of commercial success. Robin Webster examines a less conventional software offering from the three-man Trillian Computer Corporation, which is being marketed as a 'visual shell' between the operating system and the user.

The idea of allowing a computer user to display and work with more than one application by means of on-screen 'windows' is not new. The most significant work is traced back to Xerox, which started the whole thing with its early, experimental 'Alto' systems and the Smalltalk language. Xerox has continued to market the idea of a multi-window applications environment with some degree of success in the form of its commercially available 8010 workstation. Apple recently added its less powerful, but equally impressive, Lisa office system to the effort (see *PCW* August).

The software developers have been busy, too. By the time you read this, VisiCorp should have ironed out most of the problems it was encountering with the Visi On system for MS-DOS machines and Quarterdeck will have launched DesQ (reviewed last month), a windowing system that integrates off-the-shelf applications packages like dBase II, Multiplan and WordStar.

Despite all this feverish activity by such large companies, a small company called Trillian Computer Corporation (a staff of three, including the president, at the time of this review) is trying to make a niche for itself with a rather unconventional window system called VisuALL.

VisuALL is not a window-based system in the same sense as Visicorp's Visi On or Quarterdeck's DesQ. It is instead a package which sets up a so-called 'visual shell' between the operating system and the user — a kind of neat front-end to the MS-DOS command line interpreter. Instead of dealing with the A> prompt directly, the user has VisuALL to do the following:

"copy example, txt b:*.*"
at the DOS level or;
"Control-K, Control-E, from: **oldname, Enter,** to: **newname, Enter"**
to rename a file when using the WordStar word processor, thus minimising the user's keyboard tasks.

Installing VisuALL

Since VisuALL is not a replacement for the operating system, it must be installed like any other package. However, in contrast to the more complex windowing packages already mentioned, VisuALL can operate without large amounts of memory or a hard disk. The minimum requirements are an IBM Personal Computer, 64k memory, one single or double-sided disk drive, a standard 25 lines by 80 columns monitor and an IBM PC-DOS disk.

If you already have a mouse, a hard disk, an IBM XT or a colour monitor, VisuALL will function that much better.

After booting up the DOS disk, you place the Trillian distribution disk in drive A, a DOS working diskette in drive B and type the command 'INSTALL'. This copies the necessary VisuALL files to the DOS working diskette. If you only have one drive, disk swapping will be necessary.

This installation procedure supersedes the one contained in the VisuALL user manual which asks you to: '1. Have your system work diskette in drive A and the VisuALL diskette in drive B with the DOS A> prompt on the screen . . . 2. After the DOS prompt type: b: INSTALL2 and press Enter . . .'

I encountered two problems with the updated installation method. The first was that my system disk had too many files on it already and consequently it took a while to delete enough files so that everything went smoothly. The second problem was that VisuALL did not start up properly when I reset my computer after the installation.

Instead of auto-loading itself after the reset, VisuALL promptly went into some kind of loop and never finished loading.

The only way around this the first time was to depress the Ctrl-Alt-Del keys again, load the DOS disk, and 'manually' load VisuALL by typing the 'Visuall visuall.pro' command after the A> prompt appeared. This worked fine.

I was using a Compaq instead of an honest-to-goodness IBM PC and thought this may have contributed to the problem. According to Trillian president Peter Redford, though, VisuALL *did* work on the Compaq and he suggested I go through the installation routine again. I did and, this time, everything went smoothly.

While these problems were easily overcome, the potential user should be aware that the VisuALL system is in fact made up of two fairly hefty files, VISUALL.COM and VISUALL.PRO.

VISUALL.COM is the program that handles everything to do with drawing the pseudo-windows on the display, changing windows and making the necessary translations from window commands to MS-DOS reality. It is 45906 bytes in size. The second file, VISUALL.PRO (25732 bytes) is the window layout library for the VisuALL system. When you initially install VisuALL, a set of window definitions is supplied by Trillian. These include DOS COMMANDS, EDITOR COMMANDS (for the Edlin program), BASIC COMMANDS, WORDSTAR, LOTUS 1-2-3, and PERSONAL EDITOR COMMANDS.

Initialising 'visual shells'

Once VisuALL is loaded, the familiar A> prompt appears indicating that nothing extraordinary has happened so far.

VisuALL only becomes apparent when you press the mouse or function keys in a predefined way. On a three-button mouse you would press the 'select' and/or 'execute' buttons. On an IBM or IBM work-alike keyboard you would probably press function key 'F1' (depending on how each user customises, or initialises, VisuALL).

The specifications you must supply to initialise shells are as follows:

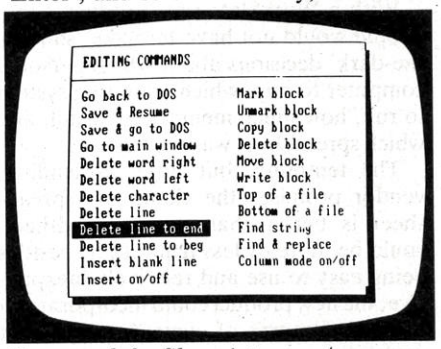
```
System
  Baud          =1200
  Comm          =2
  Mouse         =Speedster
Button
  Select        =Command
  Mark          =Ins
  Execute       =Enter
  User          ="This button has
                  not been defined"
Cursor
  right         =rightarrow
  left          =leftarrow
  up            =uparrow
  down          =downarrow
Keyboard
  Select        =s-F1   ;shift F1
  Mark          =s-F2
  Execute       =s-F3
  User          =s-F4
```

The first two lines of the System section

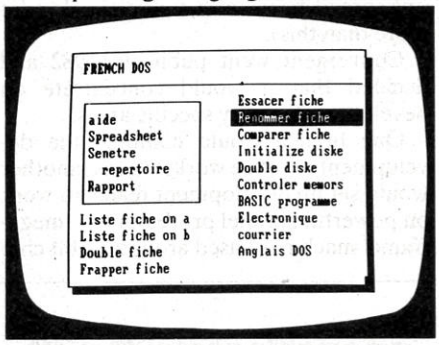
are used to tell VisuALL that the attached mouse can handle data at a rate of up to 1200 baud, and that it will be attached to the second installed serial communications board. 'Speedster' is the name which Trillian has assigned to a specific manufacturer's mouse. Three types are supported at present: the Mouse Systems optical mouse (Sportster), the Logitech mechanical mouse (Speedster), and the USI opto-mechanical mouse (Indian).

All initialisation statements for the Sportster and Indian models must contain a value for the communications port entry since they must be connected to a serial board of some sort. But the Logitech Speedster mouse does not require an entry since it connects to the same port as the keyboard. A 'T-connector' is used to attach both at the same time, although this mouse cannot currently be used with machines like the Compaq which do not feature snap-in cable connectors.

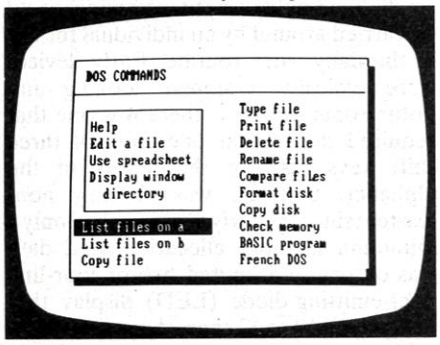
The Button section simply designates the effect of each mouse button: pressing the 'Select' button has the value 'Command', the 'Execute' button has the value 'Enter', and so on. Similarly, the Cursor and Keyboard sections link key depressions with a specific action. In the Keyboard section, though, you will notice that each function key name is preceded by a lower-case 's'. This signifies that the shift key must be pushed along with the function key so that there are no conflicts with application program assignments of function keys.



Commands for file maintenance/program loading



DOS foreign language visual shells



The window directory shows possible activities

If you want to redesign a current window, or create one from scratch, this is possible. In fact, you can create families or 'hierarchies' of windows (with a maximum of 48 separate windows within the bounds of one application) — each window getting more specific as you go deeper and deeper.

For example, you might want to develop one window for each class of operation in an application: with a word processor you would design windows for editing, file handling, text formatting and printing.

The design process is fairly simple, since all you are really doing is writing instructions in a kind of meta-language which can be understood by the VISUALL.COM program. Screenshot 1 shows how Trillian has used the meta-language structure for a WordStar environment.

In use

All operations were carried out by pressing the four function keys F1 to F4.

At the DOS level you display the DOS COMMANDS window by pressing the F1 (Select) key. The DOS COMMANDS window always appears in exactly the same location but, unlike the windows in Visi On and DesQ, VisuALL windows cannot be moved, re-sized, or set aside on the desk-top.

The distinction is that VisuALL windows are not application program windows — they are essentially pop-up (drop-down?) command menus that can be displayed at any time. These windows can be displayed without the user having to escape from the task at hand.

The DOS COMMANDS window contains all the commands you might need to carry out file maintenance or program loading (see screenshot 1). Positioning the cursor over a menu option causes the option to be backlit; it can then be activated by again pressing Shift-F1.

Some commands — such as Help, Edit a file, Use Spreadsheet, and Display window directory — will cause other sub-windows to appear listing a range of additional options. As you can put your own choice of text into a window, you can develop foreign language visual shells as evidenced by the 'French DOS' entry (screenshot 2).

If a filename, or a couple of filenames, are required by DOS, VisuALL displays a prompt (filename:, from:, to:) at the bottom left edge of the open window.

To get an overall idea of what windows are available, you must go to the window directory. This directory contains main headings for the range of possible activities, including Spreadsheet, Choose Editor (most people would prefer the Personal Editor to Edlin), Editing Commands, Basic Commands and Printer Commands (screenshot 3).

Earlier I mentioned that problems could be encountered when switching from one window type to another. An example is when you select the option to run Lotus 1-2-3. VisuALL presently has no way of knowing whether or not Lotus 1-2-3 is 'out there' somewhere on disk or in memory. It assumes you know what you are doing and have started a valid procedure.

Unfortunately, if Lotus 1-2-3 is not accessible, the operating system will respond to the 'load 1-2-3' command in its normal unfriendly manner and just wait for the next event.

Although it appears that nothing untoward has happened (error messages are displayed in some cases), VisuALL has in fact dumped the DOS COMMANDS window shell and made the Lotus 1-2-3 shell the current one.

The manual goes on to warn the user to be careful not to '. . . switch shells via the Window Directory . . .', since this will cause the VisuALL system to have a skewed idea of what is going on. Yet another mistake is trying to invoke a VisuALL window as information is being scrolled on the display. This can mess things up in its own right so that the whole VisuALL system has to be rebooted.

If VisuALL is being marketed as the friendly front-end system for personal computers running MS-DOS, my concern is that these acknowledged loopholes reduce its effectiveness.

You cannot tell PC users they will never have to worry about complex commands ever again, and then go on to expect them to keep track of the exact sequence in which VisuALL windows can and cannot be invoked. Maybe it's a small point, something which 98% of VisuALL customers will breeze through, but it is surely also a small matter to incorporate the right kind of code to keep such concerns out of immediate view — especially for $295.

Conclusions

The manual was generally very good at explaining how you use VisuALL and where you might encounter certain limits. I had no problem in understanding what the VisuALL profiles were doing, and how I could alter them at will.

Apart from the one minor installation problem, VisuALL performed pretty much as stated, and certainly smoothed out some of the rough spots in PC-DOS's user interface by hiding much complexity behind the windows.

I would view VisuALL as a good product for someone who really doesn't understand the kind of dialogue that is necessary between a user and the PC-DOS operating system before anything gets done. Because of this, it is likely that VisuALL will be of the greatest benefit for the first six months after purchase. By then, the user should have figured out what is going on and be ready to handle routine tasks without VisuALL's help. The danger is that a user may remain dependent on VisuALL to such a degree that, without it on another system, the A> prompt and a flashing cursor is all the user is left to work with.

END

BENCHTEST

WORKSLATE

After extensive research among end users who required their micros for spreadsheet tasks, the US company Convergent Technologies came up with the idea of a portable 'huggable not luggable' machine whose main purpose would be to handle spreadsheets. This idea has now become a reality. Robin Webster and Leslie Miner went along to the company's head office to find out how it all came about.

The last 18 months or so has seen a tremendous upsurge in the development of portable computers of the type that can fit in a briefcase or be easily lost under a pile of magazines.

It was once thought remarkable that a small, hand-held computer terminal could be carried around by an individual for use in the daily work routine. Early devices were typically 'cramped' looking and bothersome to use — there was one that required the regular operation of three shift keys just for the letters of the alphabet. Software was virtually non-existent since the early terminals had only a minimum memory allocation, and data was output to a limited two or four-line light-emitting-diode (LED) display that was maybe 10 or 12 characters wide.

Now, companies like Epson, NEC, Tandy, Sharp and Panasonic have all committed valuable time and effort to the notion of portable computing power. Each of these companies has its own idea of what a portable computer should look like and what it should be able to do for the professional user. As such machines are of greatest use in specific applications, they should not be looked upon as complete replacements for desktop personal computers.

Generally, current portables have the following in common: multi-line, liquid-crystal displays, 40 or more characters in width; full keyboards that are fairly reasonable versions of full-size 'qwerty' equipment; and microcassettes used as a data storage medium. In a few cases, internal modems for communications work and integral printers to record the results of data manipulations are included.

Available software remains generally not very impressive, but the latest company to seek a major share in all the action may have adopted a promising approach.

US West Coast-based Convergent Technologies (better known for its high-quality office workstations) has designed its WorkSlate portable computer around a single concept.

Software Arts, the developer of VisiCalc, took the green paper spreadsheet that cluttered every financial worker's desk and essentially turned it into a dynamic piece of software that would run on any number of general purpose computers. Convergent has now taken the spreadsheet software idea and turned it back into something tangible — a portable computer with the sole purpose of handling spreadsheets (although it can do a lot more than this).

Convergent went public in 1982 and decided that it would concentrate on development in very specific areas.

One branch would continue the development of office workstations; another would set up development teams to work on powerful parallel processors — 'mega-frame' machines based around 32-bit chip technology that can run many operating systems concurrently. A third group would work on the development of 'n-generation' products — future products based on Intel chips.

'a portable computer with the sole purpose of handling spreadsheets (although it can do a lot more than this).'

It was still another group, a company within the company, that developed the WorkSlate. It was the brainchild of Convergent's Matt Sanders; he simply walked around a lot of offices and asked people what they used their personal computers for. Invariably, the answer was they used the PC's for doing spreadsheet work.

The problem with all this, as far as Sanders could see, was that in nine out of ten cases a $4000 or $5000 machine was being used primarily for one application. Considering that this was probably the most expensive way to go about it, Sanders began to ponder the ways in which a dedicated, but inexpensive, 'VisiCalc machine' could be made.

If a large number of the business people in the US — the ten million small business proprietors, one million accountants, six million mid-level managers, and four to five million sales and service personnel — were not doing financial work on personal computers because of their complexity and price, then such a product would be extremely viable.

With a WorkSlate-type product, these people would not have to make 'shot-in-the-dark' decisions about which personal computer to buy, which operating system to run, how much memory to install, and which spreadsheet was the best.

The tempting, but often misleading, vendor promises the claim 'my spreadsheet is better than your spreadsheet' could be more or less ignored, if, besides being easy to use and relatively inexpensive, the new product could incorporate all the best features of current spreadsheet packages.

Having convinced himself, and the necessary Convergent Technologies executives, that a portable spreadsheet computer would find a ready market, Sanders was given a budget with no other specific directives. The project, in development for 14 months or so, was kept a secret from all but a few top people in the corporation. It was given the code name 'Ultra'.

Sanders found a base for the project in an old building in Santa Clara. It was dubbed 'The Vault' because the building had once housed a credit union, and the Ultra team had to handle one unexpected problem: people would leave cash on the receptionist's desk and walk out, thinking they could still make deposits to their credit union accounts.

The WorkSlate development team included people recruited from Motorola, Hewlett-Packard, Texas Instruments and Atari. The team obviously benefited from such diverse influences.

Karen Toland, marketing manager in the WorkSlate division, and one of its key designers, worked at Savin for about 10 years in the field of office automation and word processing. 'We knew from the beginning that the WorkSlate had to be portable; it could not be tied to an AC mains plug, and this required that we use CMOS technology. It also had to be a true portable, something that went into a



At first glance, the WorkSlate looks like some kind of grand calculator due to its LCD display

briefcase, but didn't take up all the space. Most of the so-called portable computers on the market are difficult to transport — I liked to point out that we were making a huggable machine, not a luggable machine.'

Hardware

The WorkSlate is indeed a very compact device measuring a mere 8½ × 11¼ × 1in, and weighing about three pounds. It can easily be mislaid among a pile of office documents, or in a desk drawer.

A wide range of features are packed in. There is a specially designed LCD display which can show 16 lines × 46 characters. The machine also featues a unique twin-head microcassette drive developed by Olympus for Convergent which can record data in digital form along one edge (track) of a standard microcassette and record verbal messages in analogue form along the other. Other features include a built-in 300 baud, auto-dial, auto-answer modem, 64k of ROM-based software and 16k of user RAM.

At first glance, the WorkSlate does look like some kind of grand calculator, because of its LCD display, its textured black plastic shell and small, circular keys. There is an immediate sense of portability about it. This contrasts with the 'hard' aluminium/stainless steel look of many other portables which appear to be designed heavily in keeping with the standard typewriter keyboard.

In fact the design and subtle colours are quite pleasing, and rather more handsome than is apparent in the photographs. The smooth grey sculpted keys are just ergonomic enough.

The display, after familiarisation, is just large enough to be useful. The key labels — white for alphanumeric, green for special functions and yellow for other functions — are just distinctive enough to be helpful.

Display

Since the WorkSlate was given a relatively large display, Convergent has been able to divide it into a number of distinct areas that keep the user informed of events.

Although the screen can show 16 lines by 46 columns at a time, the top line is used by the system as a 'status' line.

The first eight characters of the top line show the filename. You are allowed to use alphabetical, numeric and punctuation characters. If the box contains the word 'empty' then the worksheet has not yet been named (similar to the 'TEMP' default name given to all unnamed files in the Multiplan spreadsheet system).

The next 16 character space is used to show the contents of the active cell — the cell where the cursor is currently located. If the active cell contains the result of a formula, then the formula will be shown, rather than the formula product.

The area containing the number '79%' keeps track of the remaining amount of WorkSlate memory available to you (this is set to 100% at the beginning). It also occasionally displays a small square and cell counter which indicates that it is off searching or calculating and has 'X' number of cells to process.

The empty box next to this is used for showing further pictorial symbols; an example is the small picture of a telephone handset when you use the WorkSlate for communications work and the phone is ringing, on hold, or off the hook.

The next two sections are clearly there to show the current date and time, and these can be set and reset by the user through the various menu options.

Column labels (A, B, C, etc) are displayed white on black and stretch from A to Z to AA to DX, and the current column is marked by a small arrowhead shape set to the right of the pertinent label. Similarly, row labels, which go from 1 to 128, are highlighted and use the same arrowhead location marker.

Two lines at the bottom of the screen can display menus, the contents of which depend on whatever task the user is doing. Since they change frequently, from task to task, they are called Action keys.

LCD displays are often difficult to read in varying light conditions, but Convergent has found a satisfactory way around this. Along the left edge of the WorkSlate, there is a display intensity dial that you can adjust.

Keyboard

There are a total of 60 keys on the WorkSlate. Most allow the user to input more than one character or carry out more

than one action when used in conjunction with a 'shift' key. Each key is no more than fingertip size; the relevant symbols are pointed onto the black casing off to the left of each key.

Ordinary alphanumeric input is possible by pressing the circular grey keys alone (the white characters are input). Punctuation and other important symbols and/or actions (marked in green) are invoked by first depressing the green 'Special' key at the bottom left of the keyboard. Keys with yellow markings are often used keys like the space bar, shift and on/off.

By this means, the WorkSlate can be made to generate the full A-Z, 0-9 range, punctuation marks (! @ # , ? " ;), and symbols such as the Boolean '>' (greater than), or '#' (not equal to).

WorkSlate-specific keyboard functions include keys that will **Find**, **Print**, **Save**, **Get**, **Recalc**, **Switch**, and **Do It**.

'Do It' was the idea of Karen Toland who played a very important role in getting potential end users involved in the design process at a very early stage. She also battled with the programmers and engineers because she wanted the WorkSlate to have a 'Do It' key instead of the usual 'Enter', 'Return', 'Execute', or 'New Line' buttons.

'It was a radical idea to the engineers that users be involved in the design process,' said Toland, 'but I don't think they would have it any other way now.'

The oval **Worksheet** key to the left of the **Special** key is used in conjunction with the five oval buttons just below the display — marked **Calc**, **Finance**, **Memo**, **Phone**, and **Time** — to list the range of worksheets that are built into the WorkSlate.

Each of these worksheet keys brings up a particular set of Action keys on the bottom two rows of the display, as mentioned earlier.

Calc is an on-screen calculator feature, and its use with worksheets is explained later.

'Finance' produces a specially set-up financial analysis worksheet that guides the user through such tasks as net present value, and future value analyses.

'Memo' brings up a memo pad type of worksheet which can be used to store brief textual messages or, if you really need to, up to 3000 words or so of text — although it is not a word processing system (it has no word-wraparound, for example). The Action keys relating to Memo are concerned with voice recording (Stop, Play, Record, etc).

'Phone' is a phone-list worksheet which is set up to store a contact's name, telephone number and address, and the 'Action' keys allow the WorkSlate to function as a phone (Dial, Hang Up, Answer, Speaker Phone). What's rather neat is that the phone number listed in the worksheet can be automatically dialled by the WorkSlate if you wish.

'Time' brings up time-related action keys and also displays a personal calendar worksheet. This allows you to enter the details of a future meeting or task and then have the WorkSlate alert you about it nearer to the time by setting off an alarm and displaying a message.

The 'Options' key at the bottom-left corner of the WorkSlate is a very important addition since many more keys, or more complex set of commands, would be needed without it. Like the Worksheet key, it is also linked with the five buttons underneath the display so that at any point while working with a spreadsheet (built-in or otherwise) you can gain access to built-in commands.

Pressing Options once will reprogram the five buttons so they now offer the ability to: CHANGE, or edit, data already on the worksheet; CLEAR data that is no longer required (anything from a cell to the whole worksheet can be CLEARed); COPY the data in one cell or area to anywhere else on the spreadsheet (useful for certain kinds of headings or drawing boxes around data); DELETE data at all levels; and to change the DISPLAY defaults (do you want to have commas in your numbers, or do you want to display the formulas on the worksheet? — for example).

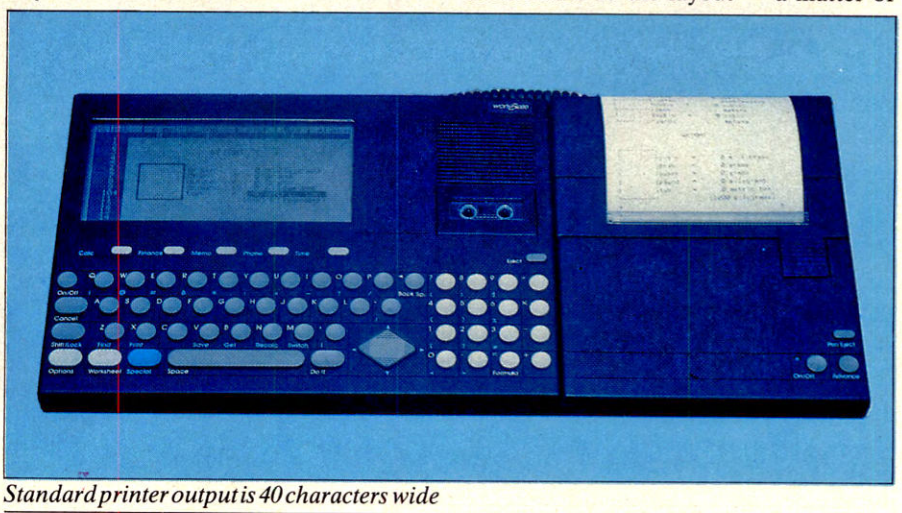
Pressing Options a second and third time lists the commands DRAW, FORMAT, INSERT, MOVE, NAME, and SET UP, SORT, WIDTH, and WINDOW. Suffice it to say that by selecting one of these options further sub-menus with more and more specific key assignments appear.

In between the main key section and the 16 key numeric/special symbol pad occupying the right-hand side of the unit, there is a four-way cursor controller which is rather fun to use. It is a combination of a joystick and the traditional arrow keys (press the top of the diamond shape and the cursor goes up, etc). Other machines would do well to use this design.

The On/Off button is located at the top left of the keyboard area, just above the CANCEL key, which cancels any operation in progress or eliminates menu displays.

Initially, it was difficult to use the keys accurately, mainly because they are a cross between the standard typewriter layout and a calculator keypad, and also because the complete WorkSlate is actually smaller than most PC keyboards. The characters are placed off to the left, and the Special key has to be used to enter commas, question marks and quotes. But once accustomed to the layout — a matter of minutes rather than hours — data entry became quite easy.

Probably the most difficult thing to come to grips with is the quick-thinking that has to be done when deciding which of the keys marked Options, Worksheet and Special you need for a task, and subsequently which Action key, or menu selection, you need to accomplish your goal.



Standard printer output is 40 characters wide

Microcassette drive

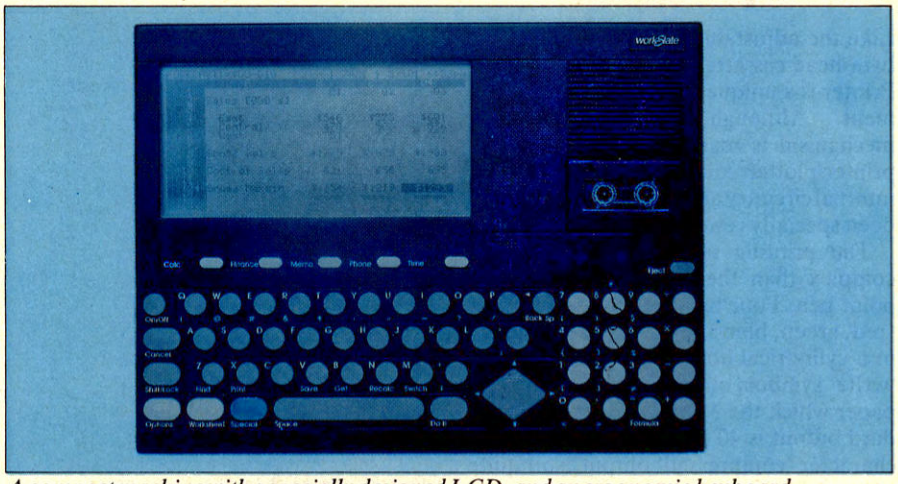
At the top right of the WorkSlate is the microcassette recorder/data storage unit. One microcassette can store up to 10 spreadsheets only (five to each side of the tape), or up to 30 minutes of audio information. A powerful use of the WorkSlate's ability to store data in both analogue and digital form is that the two may be used simultaneously — so creating, among other things, the concept of voice annotated spreadsheets. This kind of annotation will be of great importance to the target users since spreadsheets — even well formatted ones — tend to require further explanation when shown to those not involved in their original development. The voice feature could also probably be used to help to train people to do a particular job with the machine (Convergent itself supplies the narrated Teach Me Now and Teach Me Later microcassette-based learning packages with the WorkSlate).

When a user inserts a cassette, the system puts up the message 'checking for

'The WorkSlate comes with a selection of built-in functions and worksheets which Convergent believes will meet the immediate demands of the user.'

data' to indicate that it is looking at the tape's directory. This directory is located at the beginning of the tape, so the search takes just a few seconds. Once it has completed the search, the WorkSlate returns the user to wherever he left off in an application. Those people used to the rapid data access offered by floppy/hard/RAM disks might find the time it takes to save or load data from the microcassette a bit long, but it is not a big problem.

Loading a 61 row × 4 column spreadsheet from tape takes about 26 seconds. Rewinding a tape after turning it over (the directory is located at the left hub end of the tape) takes about 70 seconds. These times are acceptable although not impressive.



A compact machine with a specially designed LCD, and an ergonomic keyboard.

Just above the cassette drive, hidden by a plastic grille, is the speaker. When the WorkSlate needs to inform the user of some event it emits a beep. And, of course, when there is a verbal message, it will play it on demand. Because of its limited dimensions, the WorkSlate has all its I/O ports set into its sides, which are only one-inch deep. On the right side there is a dial that controls the speaker volume and two small jack-plug sockets — one for an earphone and another for a microphone. The microphone is not completely necessary since an internal IC mike is provided. Along the back edge, to the right, there are three telephone jack sockets and a DC power inlet. Two of the phone sockets are used to connect the WorkSlate 'in line' to a standard telephone to enable it to carry out auto-answer or auto-dial procedures. That is, it can act as a limited telephone answering machine (it will answer with a message, but is currently unable to record phone messages) and will automatically send worksheets over the telephone network to other WorkSlate's or host computers.

The remaining telephone jack is used to connect the WorkSlate up to all sorts of peripherals, including Convergent's own MicroPrinter — a companion product that measures 1¾ × 6½ × 8½in and which runs off batteries or an AC adaptor. It uses 4½in wide paper and can print between 40 to 80 characters per line.

For a portable computer to be reliably portable, it must be able to carry its own power source around with it. Convergent has tried to make completely sure that no WorkSlate user will have to see the frustrating sight of a completely 'dead' machine because he forgot to put in a new set of batteries.

You can use the machine off the mains, with the 6 volt AC to DC converter supplied, or you can use four AA size batteries which supply enough power for eight to ten hours. Or you can use the optional rechargeable NiCad battery pack which can be topped up every five hours or so by the 6 volt DC transformer.

If for some reason the power source should fail, there are still two button batteries (digital watch type) which will maintain all worksheets in memory for up to a week. If you get to that point, the WorkSlate displays a message advising that you replace them.

Access to the AA battery and button battery compartments is from underneath the machine. The retaining lids fit snugly, and the batteries are not allowed to rattle around. Also underneath the machine is a small foldaway rest which can be opened up when the WorkSlate is being used on hard surfaces. The flap inclines the machine towards the user, so making its operation and viewing of the display much more comfortable.

If you really get into a jam, or just want to clear the machine's memory, a tiny reset button is situated under the front edge of the WorkSlate. You will need something with a fairly fine point, maybe a ball-point pen, to operate it.

Using the WorkSlate

The WorkSlate comes with a selection of built-in functions and worksheets which Convergent believes will meet the immediate demands of the user. Those users who require more complex worksheets can, of course, create them as required. Let's take a look at some of the built-in features first.

The Calc function. This will be a real boon to those who use conventional spreadsheets and regularly find themselves having to add numbers up on paper (or in an unused cell somewhere off to the right of their work area) whenever a total figure must be input. Totalling company inventories, which tend to vary widely, might be such an occasion.

The WorkSlate offers a far simpler and nicer method of doing such additions. By pressing Special plus Calc, a small window-like area opens up along the bottom of the screen containing what is obviously a calculator display and function keys. All the standard calculator functions can be carried out, with the WorkSlate using its current worksheet as a data storage, or memory, area (shades of Lotus 1-2-3). The result of any calculation can be added to (M+) or subtracted (M–) from the currently active cell in a worksheet.

Values already entered into the worksheet — without the aid of the Calc function, and even if they are the result of a formula — can also be transferred onto the calculator display by selecting the Recall M option. Store M simply places the current calculator display value on the worksheet — it does not record the figure on the column of sub-totals and past calculations that appears at the top of the calculator display like a roll of paper tape. If the MicroPrinter is attached during calculator mode, a hard copy can be obtained with negative numbers automatically printed in red.

The Finance function/worksheet. If you have ever been faced with creating and recreating various spreadsheets to do loan amortisation, depreciation, and net present value (NPV) calculations, you'll be relieved to find these functions ready-to-go in the WorkSlate. It's worth taking a cursory glance at one of the depreciation procedures to see how the WorkSlate keeps you on track.

First, you press Special and Finance to obtain a menu listing the functions **Deprec, Loan** and **NPV** and the WorkSlate prompts 'Select an action key'. Selecting Deprec lists another menu which offers the choices of **Decline, Straight** and **SumYears** depreciation and the prompt 'Select a method of depreciation'. Pressing Decline (which handles declining balance calculations) leads to a really specific menu — **%Rate, Book, Salvage, Period #** — that will be used, in conjunction with the correct responses to WorkSlate prompts, to finish the task. This kind of hand-holding is great, and reduces sensible, but rather tedious, calculations to an easy routine.

The Memo Worksheet. The memo key allows you to dictate and record messages onto a microcassette. The WorkSlate protects careless users from recording over already stored data by first checking the beginning of each tape for a voice or data tape identifier. If it is a new tape, or a voice tape, the WorkSlate displays the message 'Tape has no data'. If data is encountered, the prompt would be 'Data tape: Record will erase'.

To control the microcassette drive, the five action keys are assigned the values of the piano-like keys found on standard cassette equipment: **Record, Play, Stop, Rewind, Forward**. These operate explicitly, but there are some things you don't have to worry about — for example, you don't have to press the Stop key to switch from fast forward to rewind.

The Phone function/worksheet. After

attaching your WorkSlate to a telephone, or even just a telephone socket, it is possible to use the machine for many communications purposes.

It will allow you to answer phone calls using the built-in speaker phone. It will dial numbers listed in your PhoneList worksheet (accessed by pressing Worksheet and Phone) automatically, or allow you to enter other numbers via the numeric keypad. It will automatically make calls to or receive calls from host computers (such as *Dow Jones* and *The Source)* and other WorkSlates, or send worksheets to and receive worksheets from another WorkSlate (see the section on Data communications).

If you are too busy, the Phone function also allows the WorkSlate to act as a one-way answer-phone machine — playing a recorded message to all callers.

The Time Function/Calendar worksheet. Naturally, through the time options you can set the system time and date. Pressing Special and Time gives the menu: **Alarm, Date, Set Time, Timer** and **Reset**.

Selecting Alarm displays the prompt 'Type date, time for alarm, then press Do It'. The present time and date is displayed for you to change and then the WorkSlate prompts 'Type message, then Press Do it'. At the pre-set date and time, the WorkSlate turns itself on, sets off an alarm beep seven times, and then indicates which worksheet contains the message to be read.

When Timer is selected, the WorkSlate displays a clock icon and counter instead of the current date and time. This feature is pretty much like running a stopwatch to mark elapsed time. The Reset option is used to reset the timer.

But you can do much more in the Time function mode. It gives you a two-week calendar period to work with, based on the worksheet principle. By giving the calendar start date, the system updates the following days according to an embedded formula. Messages can be typed in and alarms set for any day within the two weeks.

Setting up worksheets

Setting up a spreadsheet on the WorkSlate follows more or less the same route as might be taken with VisiCalc-type software since the end goal is in essence the same. First, you figure out the application. Then you design a usable format. Then you start entering text and formulas.

With the WorkSlate, formulas are entered into a cell by pressing the button marked **Formula** located on the numeric keypad. This displays the prompt 'Select Action key or Type Formula, then Do It' and, on the next line, 'Cell xxx ='. It then waits for you to type in the formulas.

You can do this the hard way, by manually typing in the row and column labels in the format: A10 = (A1+A2+A3)/(A4+A5+A6) *0.25. Or you can make use of the options: **Average, Maximum, Minimum, Total,** and **Copy Cell**.

Copy Cell is used to copy formulas from cell to cell.

Microprinter

Like the adjustable LCD display and the twin-head cassette drive, the $249 MicroPrinter is a unique technological development. Although the main printing mechanism is manufactured by a micro printer/plotter company called Alps, the internal circuitry and the method of use has been specially reworked by Convergent.

The printing technology is no more complex than the technology in a ball-point pen. Four ball-point-like cartridges (red, green, blue and black), are arranged in a cylindrical holder; they more or less 'write' symbols onto the 4½in wide plain paper which the MicroPrinter uses. Standard output is 40 characters wide, but 80 character 'compressed' output, still quite readable, can also be obtained.

'Like the adjustable LCD display and the twin-head cassette drive, the $249 MicroPrinter is a unique technological development.'

Some personal computer users with Epson or Okidata dot-matrix printers have resorted to buying a special software package that prints spreadsheets out sideways to cope with worksheets that are more wide then they are long (that is, the rows come out at right angles to the paper edges). This is immediately possible with the WorkSlate/MicroPrinter combination; no extra software is required.

In use, the MicroPrinter makes little noise — it just clicks a lot. Power is supplied by a mains adaptor or AA batteries.

Data communications facilities

The WorkSlate can be turned into a communications terminal by means of the SET-UP command. You can, for example, make the machine communicate in half duplex, instead of full-duplex mode. The end-of-line can be set as a line feed instead of a carriage return, and so on.

If you are a regular user of online computer services, then it would probably be worth your while to create an automatic sign-on sequence rather than type in ID, password and service type commands each time.

Sign on sequences are typed directly into a worksheet and take the form of the following example in the WorkSlate user manual:

A1 = "XYZSYSTEM" + Dial ("792–1234", data) + (GoTo(A2)
A2 = Delay(2) + WaitFor ("ENTER ID:") + GoTo(A3)
A3 = Send("JOE$^{c}_{r}$") + GoTo(A4)
A4 = WaitFor ("ENTER PASSWORD:") + GoTo(A5)
A5 = Send("793AZY702$^{c}_{r}$") +

```
      A          B          C
 1  EXAMPLES OF MATH/LOGIC FUNC
 2  ------------------┐
 3                    10.00
 4                    20.00
 5                    30.00
 6                    40.00
 7                    50.00
 8
 9   AVERAGE =        30.00
10   MAX     =        50.00
11   MIN     =        10.00
12  ------------------┤
13                    10.10
14                    21.26
15                    22.22
16
17   TOTAL   =        53.58
18   INTEGER =        53.00
19   ROUNDED =        54.00
20  ------------------┴---------┐
21  Raise 9 to the sixth power.
22
23       9.00  to power 6
24     equals 531441.00
25            ---------
26
27  ----------------------------┤
28  Truth checking with IF/AND.
29
30              22000.00
31              11000.00
32
33  IF cell A30 > 20000 AND cell
34  A31 < 15000 display "error"
35  else display "OK".
36              ----------
37             error
38              ----------
39
40  ----------------------------
41  Truth checking with IF VALUE,
42  VALUE1, ELSE VALUE2.
43
44                   81.50
45                  125.00
46
47
48  IF cell A44 > cell A45 THEN d
49  "re-enter data" ELSE display
50
51              ----------
52             great!
53              ----------
54
55  ----------------------------
56  Date and Time arithmetic usin
57  US format of month/day/year.
58
59  Problem: Find the difference
60            8/14/46 and 9/12/84
61
62                9/12/84
63       minus
64                8/14/46
65              ----------
66       equals     13909 days
67              ----------
-
-
    D         E
ONS.
```

Examples of maths/logic functions

```
      GoTo(A6)
A6  = WaitFor("!") + GoTo(A7)
A7  = Send("STOCK QUOTE^r") +
      GoTo(A8)
A8  = Keep(B1...C1,1,1,20) +
      GoTo(A9)
A9  = HangUp(0)
```

The left-hand column (A1,A2, etc) are worksheet cell labels. Note that the WorkSlate's sign-on language requires a GoTo (next worksheet cell) statement at the end of each statement.

The fictional sign-on sequence would connect a WorkSlate to a system that required information in the form:

System Query	WorkSlate Response
Enter ID:	JOE
Enter Password:	793AZY702
!	STOCK QUOTE

Documentation

Convergent has obviously expended a lot of effort in developing its WorkSlate instruction materials. The operation and reference manual is well written, and only gets a little sticky when complicated tasks are encountered.

There is a full index of the contents, and high-quality photographs and illustrations are used to great effect.

The narrated Teach Me Now tape, which is included in the retail price, puts you quickly through the paces of using the cursor to jump around the full size of the worksheet — 128 rows × 128 columns; using the worksheet as a memo pad, recorder, timer, phone and calendar.

Then, in a more complete fashion, it introduces spreadsheet functions, formula creation and explains the knack of using the calculator in conjunction with a spreadsheet. The WorkSlate is in fact capable of a two window display.

Very brief reference is made to 'GET-ting' worksheets from and 'SAVEing' worksheets to the cassette. This has been made quite simple for the user.

Another tape, called Teach Me Later, will be supplied by Convergent to cover the more advanced WorkSlate operations, but this was not available at the time of review.

Of course in the manual, there are the usual warranty disclaimers. One to watch for is that Convergent says it will not accept charges for mis-dialled calls . . .

Configuration commands

ACTION KEY	FUNCTION
Terminal	Enables access to configuration options.
Display	Enables access to display control keys Control, EchoPlex, HalfDplx, # Lines.
Control	Displays control character being received from remote computer system.
EchoPlex	Tells WorkSlate to echo back characters received from another WorkSlate or remote computer.
HalfDplx	Tells WorkSlate to transmit characters entered at the keyboard to remote system.
# Lines	Defines the number of lines of the WorkSlate display to be given over to showing incoming and outgoing communications data.
Line End	Allows you to choose the end-of-line character.
^R	Specifies eol as a carriage return.
^F	Specifies eol as a line feed.
^R^F	Specifies eol as combination of the above.
Modem	Accesses the modem configuration keys: parity, Xon/Xoff, parity, and standard.
Parity	Specifies Zero, Ones, Even, Odd or None.
Xon/Xoff	Enables 'handshaking' between remote systems (Workslates and otherwise) and your machine.
Security	Enables you to establish security protection.
Incoming	Sets WorkSlate to receive incoming worksheets.
Outgoing	Sets WorkSlate to transmit worksheets.
Password	Allows you to set up communications password.

Technical specifications

CPU	Hitachi 6303 8-bit microprocessor.
ROM	64k of ROM containing diagnostics, and the Phone List, Finance, and Time/Calendar worksheets.
RAM	16k user memory.
Display	16 line x 46 character liquid-crystal display with intensity control set in the left-hand edge of the case.
Keyboard	60 keys, including numeric keypad. Multiple functions available through almost every key.
Storage	Standard microcassettes obtainable from office supply companies. Each cassette can store up to 30 minutes of voice messages or up to 10 worksheets. Worksheets can be voice annotated. The cassette drive mechanism was specially designed by Olympus for Convergent.
I/O ports	The WorkSlate has two ports along the back edge to connect it inline with a telephone. A third port at the rear is used to connect the MicroPrinter or other peripheral devices. An internal IC microphone is supplied, but there is a socket for a bigger external one. For privacy, an earphone socket is supplied.
Communications	Internal 300 baud auto-dial, auto-answer modem.
Power Source	An AC to DC 6 volts converter is included in the purchase price. Removable power comes in the form of four standard AA batteries, or a rechargeable nickel-cadmium pack. Whenever these options fail, two digital watch-type batteries maintain memory contents for up to a week.

Prices

WorkSlate, complete with AC to DC adaptor, Teach-Me instruction tapes, blank cassette, owner/reference manual, soft carrying case, and a toll-free assistance number: $895

MicroPrinter, with roll of paper, a set of four coloured pens, carrying case and owner's manual: $249

Range of optional Taskware tapes, including Personal Tax, Sales Reporter, Loan Analyser, Estate Planning, and Financial Statements: $29.95 to $49.95

Conclusions

Other WorkSlate products are planned for release later this year. Probably the next one to appear will be a portable word processor with a larger screen and a keyboard more suited to writers. But for now there is only the one, designed around the daily work tools used by office managers.

The longer you use the WorkSlate, the more useful it seems to become. It handles many routine chores in an effortless way. Although it is portable, it has sufficient power and flexibility to be more than just briefcase ballast.

It can act as a telephone and telephone answering machine. When you need it, it can even send worksheets over the telephone network to a colleague in unattended mode (not such an unusual idea — we recently had to arrange such a configuration).

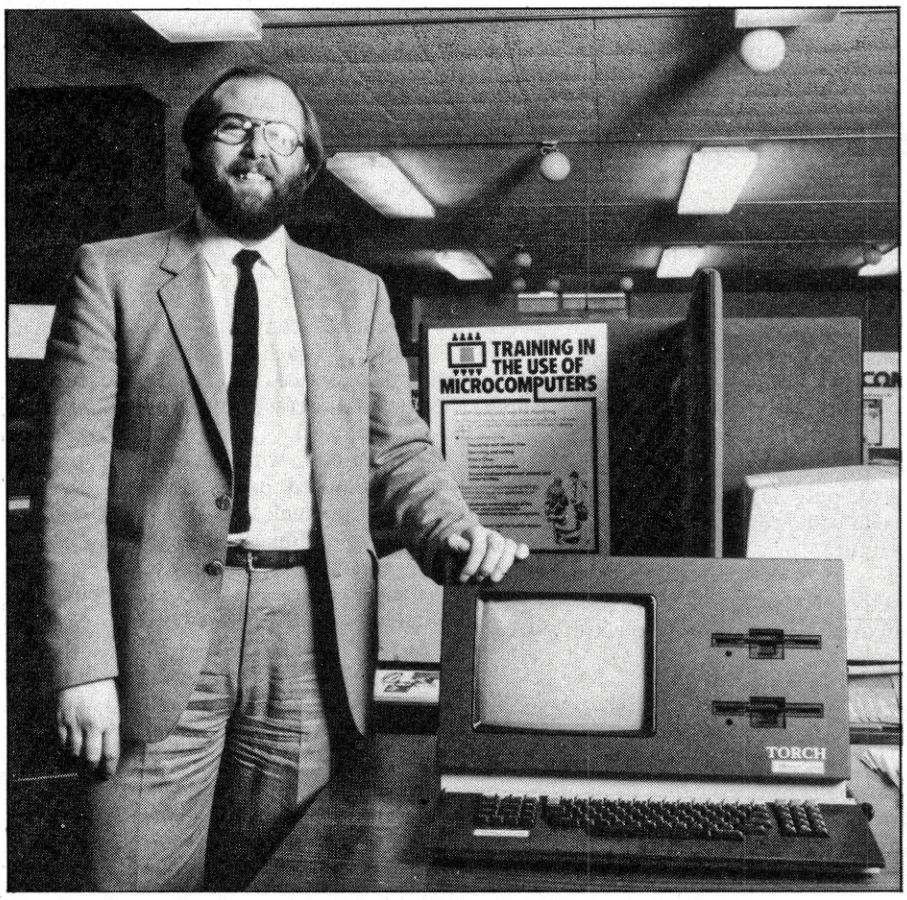
It acts as a recorder, a typewriter, and of course, as a very sophisticated calculator.

It will be interesting to see if the extensive market research, which Convergent carried out prior to manufacture of the WorkSlate, was accurate. This research dictated every detail of the product: user group feedback indicated that managers don't want to type, resulting in a keyboard that is more like a calculator than a typewriter.

Well, anyway, it was the star item in this year's American Express Christmas catalogue. END

STEPPING IN THE RIGHT DIRECTION

Attempting to computerise your business? Where can you turn for impartial advice and help in order to implement a suitable system? Jerry Sanders tracked down the National Computing Centre's London office and, by posing as an astute businessman, decided to try out the Centre's usefulness.



Eric Bagshaw offers impartial advice at the London Microsystems Centre

'The business computer user needs educating into a mood of cheerful cynicism.' This advice comes from a pamphlet (one of today's true commercial bargains at 20p) by Philip Virgo of the London Microsystems Centre.

Eric Bagshaw, Senior Consultant at the Centre, aims to help business users 'hack out a clearing in the market-place jungle'. As Winston Churchill almost said, never in the field of human commerce has so much been sold by so many to so few educated consumers. To find out what I could learn in an hour with a professional I made an appointment with Mr Bagshaw at the London Centre.

The brief of the Federation of Microsystems Centres is: 'To make knowledge on the use, application and potential of micros available to smaller businesses and the public at large.' There are currently 17 Centres, set up by the National Computing Centre under contract to the Department of Trade and Industry, whose ex-Minister recently educated a number of us into a mood of cheerful cynicism. The Centres receive financial support for two years, after which they should have achieved self-sufficiency. To discharge their responsibilities and generate income the Centres publish and sell books, run training courses, make micros available (free of charge) for public use and run a consultancy service. All of them subscribe to a code of practice which does not permit any commercial interest in sales of hardware or software.

This ensures impartiality in the consultants but denies the Centres a substantial source of income from commission. Consultancy fees are thus higher once a Centre comes out of sponsorship. In Leeds, where the Microsystems Centre has been open for about a year, the going rate is about £30 per hour. The London Centre is self-supporting and charges £65.

A popular money-spinner at £25 per issue is the *Software Directory*. It has 61 pages and 2500 entries collated from sources all over the UK. The database holding the information is updated daily and the entire directory is re-issued 10 times a year. All 10 issues are available by subscription for £180. Programs are listed in applications alphabetical order. Be you antique dealer, tachograph analyser or undertaker, you'll find an off-the-peg application to suit your requirements.

Some Centres are researching particular software fields to acquire expertise which will be pooled and made available to all the Centres' customers. The Centres and applications studied are, in alphabetical order: Avon — modelling systems, statistical packages and operations research; Edinburgh — stock control; Hertfordshire — payroll and personnel systems; Leeds — word processing; Milton Keynes — vertical market information; Sheffield — accounting systems and Ulster — databases.

1. Process and print translations from keyboard input using English and foreign character sets. Four typing positions to be available.
2. Receive direct telex transmissions of clients' material for swift turn-round, translation and onward transmission.
3. Permit building and interrogation of specialist dictionaries during on-screen translation work.
4. Improve cash flow by automating invoicing and provide information for profile analysis of the business to aid improvement in market position.
5. As a long-term aim, permit installation of terminals in homes of employees to use to the full the skills of female linguists with family commitments.

Fig 1. The requirement for computerising my business

Appointment

I telephoned the London Centre and gave Mr Bagshaw advance notice of my requirement (see Fig 1 above). On the day appointed I arrived in New Fetter Lane on schedule but wasted 10 minutes looking for number 11. City block designers must think each creation is unmistakable but that's no use if you've never seen the building you want to find. For the record it's on the corner of New Fetter Lane and Bartlett Court.

Inside the lobby, having learned the 'rain of dark oaths' spell, I found the Centre's name sandwiched between those of Suem, Grabbit and Run (Commissioners for dark oaths) and Reedmore Books.

Things eased up on the first floor where two sticky labels on the swing doors give the game away. Pass, friend and be rewarded by a legend affixed with drawing pins to another door. No, it doesn't say EATME. With tongue in cardboard cheek it tells you to 'Please read the literature on the receptionist's desk. You may find the answer to your question without paying for it.' Another notice warns 'We do not hold information on home or hobby computers.' This, when run through a cheery cynicism filter (not supplied — yet), explains the presence of Spectrum books on the Centre's shelves.

The hidey-hole location is quite deliberate according to Mr Bagshaw (call me Eric). 'If we had a High Street site our workshop area, where the public could get free hands-on experience of machines recommended by us, would get swamped with children in the school holidays.'

If you use the workshop facility you may elicit free advice from secondees. These are people with mainframe experience, sent by their employers to learn about micro evaluation. In return for free time on the Centre's micros they act as unpaid helpers to the Centre's clients.

The workshop micros are laid out in a large open-plan hall between shoulder-high partitions. I noted Apple, Sirius, TRS, Morrow, IBM, Xerox, Tashkl (sic), Commodore, Rair, ICL, BBC, CAL and DOT — but only three micros were being used. At 2pm on a Monday I would have expected to see more use being made of the workshop — London consumers have only themselves to blame if they buy a micro without trying it out first.

Eric nodded approvingly as I set up a tape recorder for our interview. 'It makes sense at £65 an hour,' he said. 'I'm surprised more people don't bring a recorder or a dictaphone along to their sessions.'

Requirements

We began by talking about the work of the Centre in general. 'If your main reason for getting a computer into your business is to save time and money you should consider two things,' said Eric. 'I've talked to small businessmen who work all the hours that God sends and include their own time in their calculations. What they don't realise is that they pay themselves nothing at all or at most a few pence an hour. In such cases a computer will save time, but that's not going to mean a saving of money.'

'Secondly, you may think a computer will reduce your work load and your wages bill. But any business which has a large amount of data on paper will have to make extra funds available to get the material into electronic form. Moreover, work expands to fill the space available. You will probably acquire a computer with scope for future expansion and that future will become the present quickly once you have the computer up and running.'

We then started to go through my specification. Eric's first question concerned the 4-keyboard requirement. This could be met either by four stand-alone computers or a single multi-user one. Eric asked me to state a preference but I had no idea and asked him to decide for me and explain his choice. He nodded and went on to enquire about character sets. I specified French and German; this, said Eric, eliminated a number of machines from the reckoning. I wasn't clear whether this meant Eric had decided already to choose stand-alones, but I didn't interrupt. In retrospect this was a mistake on my part because while I wondered, he went on and I missed what he said next. Hence the usefulness of the tape recorder. Having lost the thread I picked it up by asking if character sets were machine-specific, that is, if you couldn't make any machine use any character set. Eric answered that they were 'fairly specific'. He didn't elaborate, instead he named the Sirius computer as a good bet.

I was surprised that, so early in the proceedings, Eric seemed to have decided on a machine. When I challenged him he corrected to 'the Sirius type of machine'. This showed me that my consultant did have a preconception about a good type of machine — a useful pointer.

'The brief of the Federation of Microsystems Centres is: "To make knowledge on the use, application and potential of micros available to smaller businesses and the public at large."'

Moving on to software (program) requirements Eric asked if my linguists would need prompts and menus — the writing on the screen that tells the user what to do — in foreign languages.

The next question concerned print loads. I estimated that each of the secretaries produced 20 letters per day (including an allowance for expansion). The linguists' output, on the same basis, I put at 8000 words every two days. Eric's verdict was that I needed both a daisywheel and a dot-matrix printer. 'The secretaries will tie up the letter quality daisywheel. If the linguists need hard copy for revision and proofreading (which is very unpleasant to do on the screen) they'll get bottle-necked. Another important feature is that matrix printers can be switched electronically between character sets, whereas a daisywheel must be removed and replaced, spares stored, and so on. Now with the Sirius machines you can buy an extra program to get onscreen alternative character sets . . .'

I asked why he had again mentioned the Sirius. Since there was no commission involved, did this mean it was by far the best machine for the job? 'It's really a convenient image,' he said. 'I could just as easily have used the IBM PC. It's a way of giving you an idea of something concrete that you may well have seen advertised. In fact both have customisable character sets. Now if you were using a dedicated word processor you wouldn't have any problems matching character sets.'

This was becoming confusing as Eric hadn't mentioned dedicated word-processors before. I dropped, for a moment, my hypothetical computer illiteracy and asked Eric about the trend towards running standard operating systems on the latest dedicated word-processors, thus turning them into micros. Eric didn't want to get involved in discussing the pros and cons and turned the conversation round to the software aspect of my problem. He made a point of saying that although most consultants try to attack the software angle first, he believes in dedicating a certain amount of time to what it's going to run on. 'It's more a question of going back and forward between the two in order to get at the most useful combination. What about your accounting system: does it have any peculiarities like multiple currencies or customised invoices? Will you want to link it into your customer database?'

'Will it enable me to analyse client data and get a profile of my market?' I asked. Eric replied that I needed a package that would allow me to tag transactions in different ways and report on business done by certain clients, or on work done in different languages. 'This kind of reporting is more sophisticated,' he said, 'than is available from the middle-of-the-road accounting system.' He recommended a package called DBFLEX from a company called Dataflow. 'It's quite a new package by an established company. Now what about the dictionary building aspect?'

'I don't want a spelling checker,' I explained. 'I need some sort of window on the screen where my linguists can look up words and input new entries to the dictionary they are building for a particular language.'

'True windowing, as you describe it, is unlikely to be possible,' said Eric, 'but Cardbox with Concurrent CP/M would provide the kind of thing you want. You would be able to swap between screenfuls of data. On one "screen" you would be accessing the dictionary as held on Cardbox files — Cardbox is a program which holds index-card-like images which can be interrogated for keywords. On another "screen" the linguist would be typing his translation. Both "screens" are projected onto the computer's VDU as requested by the user, who can swap from one to the other by pressing a single key.'

As the last minutes of our session ticked away Eric produced a printed list containing details of five computers. It turned out that of the 500 listed on the Centre's database, only five could handle the telex part of my requirement: Sirius (surprise, surprise), Torch, Future, Orion and CAL. The IBM PC was also a candidate but for reasons Eric did not explain it wasn't on the list produced by his database. This was as far as I was going, but Eric explained that the next stage would be to put me in touch with suppliers of the five machines,

STEPPING IN THE RIGHT DIRECTION

preferably selecting those who had some experience with telex use. It would be up to me to do the legwork and perhaps return to the Centre's workshop at a later date to get some hands-on practice before making the final decision. The same applied to the software he had recommended. If I was really desperate (and flush with cash) the Centre was able to see the whole project through from first consultation to final, up and running installation.

Choice

As I made my way out one question in particular troubled me. Eric's database search, done before I had arrived for the consultation, had come up with only five micros suitable for my application. Why hadn't he said so at the start of the interview? I could only ascribe this to a bit of professional wizardry. Eric scored full marks for his skill at eliciting relevant information from me, but the question of the Sirius niggled me. I felt a bit as if I had asked the AA to recommend a good buy, paid a £65 fee and been told that the Maestro was a suitable car. The Sirius was, after all, one of the best sellers in the market.

Summing up

The first flaw in the consultation was that Eric never asked me how much money I wanted to spend on my computerisation plans: this may have been because he knew the exercise was a paper one only. For the record, Eric's recommendations are given in Fig 2 below.

The second (and major) flaw showed up a couple of weeks after my visit when I was chatting to an ACT representative. I mentioned that Concurrent CP/M had been recommended for use on the Sirius, and he told me it wasn't available. So I checked for all the machines Eric had recommended and only got a definite 'yes' for the IBM PC: not even ACT could tell me for which machines it was available!

1. Four stand-alones of either Sirius, Torch, IBM, Future, Orion or CAL make.
   One each daisywheel and matrix printers.
   WordStar or Wordcraft word processing program.
2. All models chosen are telex-compatible.
3. Cardbox under Concurrent CP/M.
4. DBFLEX.
5. Any of the four micros from the office may be used independently at home.

Fig 2 The solution from the London Microsystems Centre.

Most of the dealers had no idea about whether their machine could run it or not, but one dealer (Trigon Computer Systems) not only knew that the Torch couldn't, he offered to provide me with an alternative solution to my specification. It makes an interesting comparison with Eric's ideas and is shown in Fig 3 below.

A wise man once remarked to me that the best doctor was the one who, whether he cured you or not, made you feel less anxious after a consultation than you were when you first entered the waiting room. That's a good yardstick to apply to a computer consultant. Like their medical namesakes they hold a position of trust, dealing in concepts not understood by many of their clients. They prescribe not hard and soft drugs but hard and soft technology, and there is no NHS for those in need of computer clinics. What the government has helped to provide, in the Federation of Microsystems Centres, is impartial advice with a 'stamp of official approval' — but at a price. It remains for us to look forward to the day when every medical prescription contains a government warning: 'Take the contents of this prescription in a spirit of cheerful cynicism . . .'

Are you about to computerise your business? Have you thought about it and then dropped the idea, or are you about to implement the recommendations of a consultant? If so, we want to hear from you. Similarly, we seek consultants as volunteers to participate in a new feature series. The idea is that we will choose a number of requirements from the proposals sent in by small businesses and ask one of our volunteer consultants to comment and advise on it. Each month we will publish a proposal and the solution supplied by the consultant in question, whose work will be acknowledged in full in the text of the article. The identity of the 'client' must be supplied to PCW but will be withheld if desired. Please send your proposal or offer to act as a volunteer consultant to 'Consultation Feature', PCW, 62 Oxford Street, London W1A 2HG. The closing date is 1 March, 1984.

END

Stage One:
Equipment
1 CH520 20MB Hard disk Torch
4 Torch 301 workstations and monitors
Torchnet Hardware
1 letter quality dot-matrix printer (for example, Toshiba TH-2100H)
Software
All included with machines

The first stage of this exercise is the most critical, involving the bulk of the hardware and software. The hard disk Torch would act as a controller for the network providing the disk space and printer interface for the workstations.

Since the Torch has a soft character font any characters (for example, German umlaut) can be set within the machine. Keyboards could be engraved to provide the relevant keys, and are removable so each translator could have a particular language keyboard which could be used in any workstation.

The software provided with the computer includes the Perfect suite of packages. Perfect Writer is well suited to this type of application as it has a window facility that gives a split screen, allowing the document you are translating from to appear on the top half of the screen, while you type your translation on the bottom half of the screen — this being a separate file. In fact Perfect Writer can hold up to seven documents in its buffer at once, so users can 'flip' between them with one keystroke.

Stage Two:
Equipment
Either a Hasler Telex interface or a Telexbox interface
1 Small high speed printer (for example, Epson FX80)
Software
TorTelex Software

The Telex interface is attached to the hard disk Torch via its RS423 socket. The small printer is attached to the Telebox to act as a line monitor. Telexes received are converted in ASCII and stored on disk; these can then be accessed by the operators at the workstations, translated and returned to the hard disk torch for transmission.

The reason for the choice of two telex interface modems is simply that the relevant software to drive the Hasler is available at the moment, whereas the Telebox software is still under development, but promises to be more advanced.

Stage Three:
Software
All included with Torch

In fact Stage three could begin with Stage one as the relevant software is included, this is Perfect Filer, the database for Perfect Writer.

Stage Four:
Software
Either, dBase II or Compsoft Delta and Torch Mars (included in the price)

Some kind of transactional database is required to provide automatic invoicing of the type required here. Standard invoice packages would probably not do as they are too restricting in their form.

The database will also interface with Torch Mars (a derivation of the standard Mars) to allow advanced modelling and analysis reports to be produced easily. Torch Mars also has graphic facilities built in that allow graphs and piecharts to be produced from results.

Stage Five:
Equipment
1 CF500 computer for each home worker

The home worker can access the hard disk Torch via a standard BT line. The computers all come complete with Mail Plus which allows 'head office' to send the worker files automatically, or for the worker to access the hard disk Torch automatically.

The complete system, covering all stages and one home worker, would cost in the region of £15,800.

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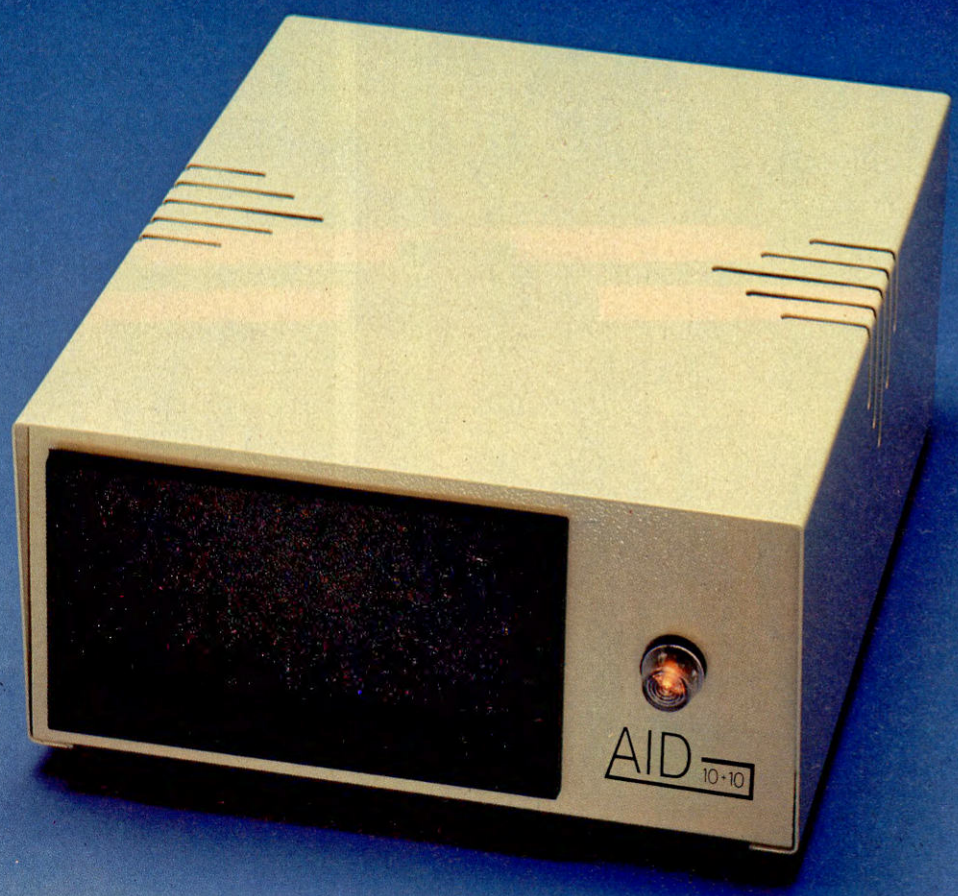

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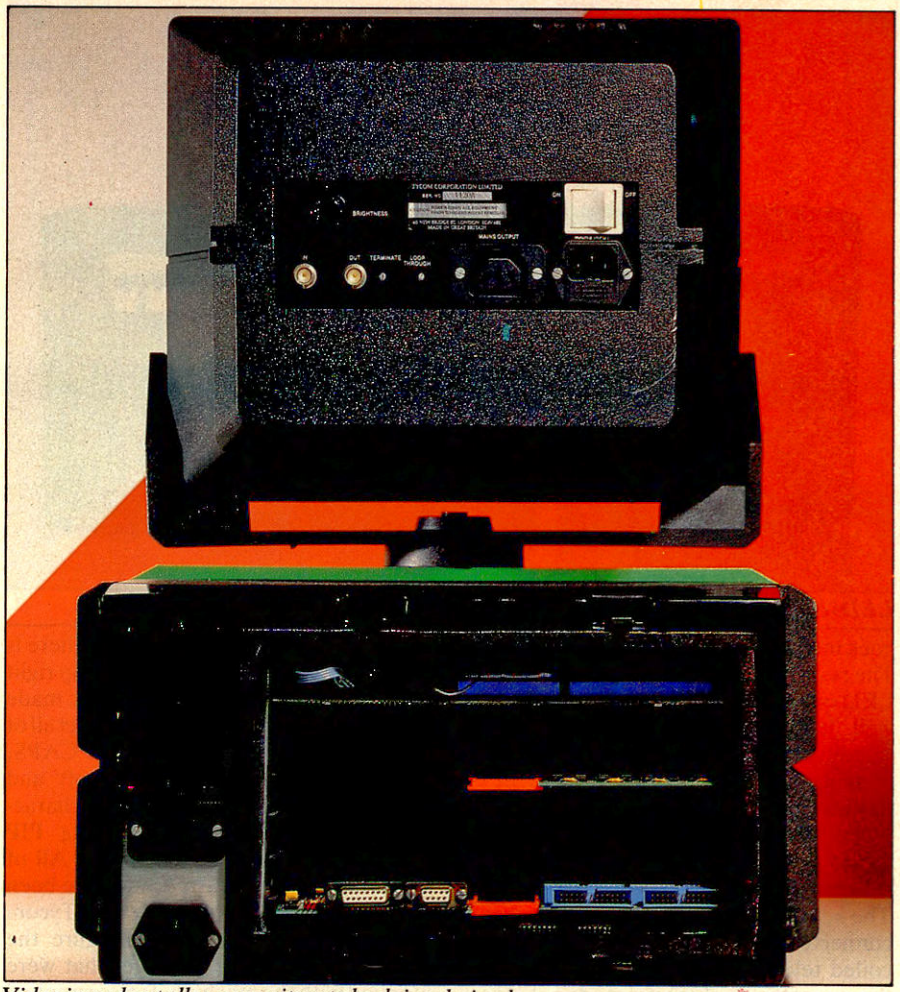
TYCOM MICROFRAME

The concept of a future proof computer has been greeted enthusiastically. Does the Tycom Microframe fit the bill? Peter Bright casts a critical eye.



Video in and out allows monitors to be daisy chained.

To try to be all things to all men can be a dangerous ambition. Yet this is what Tycom is trying to do with its Microframe computer.

Tycom is a relatively new name in the micro manufacturing world. It started out as Guestel selling Apple computers at a discount. It then went into the hotel market providing computing systems based on modified Apples, and progressed to designing and building a fully fledged micro.

With an entry level price of £2900, the Microframe is pitched squarely at the mid to top end of the business micro market. The fact that it is capable of being used in multi-user mode also means that Tycom is trying to take some business from the bottom end of the mini market.

The Microframe's main claim to fame is that unlike conventional micros, it is able to support a wide range of operating systems, applications packages and processors by the use of plug in cards. Tycom has coined the phrase 'Future Proof' to describe this structure.

The idea of using plug in cards is not new, many different micros use the popular S100 bus architecture which allows a degree of compatibility between different cards. But it is not possible to be perfectly sure that any S100 bus card will work with any other. It was for this reason that Tycom decided not to use the S100 system in the Microframe. Instead it decided to use a more sophisticated structure in order to guarantee that all of the different cards would work together. This was achieved by using an intelligent bus controlled by an Intel 8088 running real time executive software held in ROM. This means that all of the software can work on a logical rather than a physical level. For example, on a logical level it is possible to say 'output data to the mass storage device' without having to know if it is a hard disk or a floppy disk or even a laser disk.

The Microframe has come in for a good deal of criticism since it was launched. Much of the controversy has centred around the 'future proof' advertising which characterised the Microframe's launch. When I received the machine for review I wanted to find out how much of the criticism was valid and how much was a gut reaction to the advertising.

The idea of a future proof computer has a lot going for it. It is a great deal easier to design and build just one card rather than a whole computer. It is interesting to see that Tycom is actively looking for markets where the interfacing capabilities of the Microframe allow it to be used to control other machinery. One area where it has had some success is in call logging in the new computerised telephone exchanges.

Hardware

After a first look at the Tycom the lasting impression is one of solidity. If this were a car it would be made by Saab or Volvo. This impression comes from the casings which are made out of cast aluminium rather than the more normal pre-formed plastic. Tycom says that this helps to cut down the RF emissions which our cousins in the USA are so strict about. This is certainly true, it is also true that for small volume production, aluminium is cheaper. Tycom says that it will go over to plastic eventually but that many of its customers prefer the metal casings.

Describing all of the various options on the Tycom could prove to be complicated so I will start at the front of the machine and work backwards mentioning the options as I go along.

The basic single user Tycom is a normal three box design: keyboard, screen and main processor box. The latter could hardly be described as low profile measuring as it does 373mm × 483mm × 203mm. In fact the whole unit stands 508mm (20 inches) high (even higher with the 22 slot machine).

On the front of the main processor unit are the two main disk drives and the Tycom badge under which hides the reset button, the diagnostics LED and a dial which tells the system which slot to boot from. The disk drives come in a variety of configurations. The entry level system has two 720k byte floppy disks. However, I think most of Tycom's customers would go for one of the hard disk options. These are either five, 10 or 20Mbyte Rodime hard disks plus one floppy for backup. The review machine came with one floppy and one10Mbyte hard disk which was split up into two partitions, 5Mbyte for CP/M and 5Mbyte for MS-DOS.

Going to the back of the machine we come to the more interesting bits. The main unit is basically an intelligent motherboard with either 6, 12 or 22 slots into which various Tycom eurocards (standardised circuit boards) can be plugged. Tycom calls this architecture CAN (Centralised Area Network). What this amounts to is a network in a box.

The review machine was a Tycom Microframe 12. The 12 means that it was a 12 slot machine. Slots 1 and 2 are taken up by the main processor PCB. This card takes the form of a double eurocard and houses an Intel 8088 microprocessor running at 8Mhz, 128k of RAM (expandable up to 576k on board), 8k ROM and disk controllers for 5¼in and 8in floppies and the hard disk controller. Putting all of these features onto one card has meant that the chip density on the board is very high. In fact the disk controller is piggybacked on top of the main card, so things tend to get quite hot in there. Incidentally the Tycom comes with a powerful but noisy fan to keep the heat under control.

The other cards on the review machine were a Z80 card, a serial/parallel printer card and a VDU/keyboard controller card. These cards can be plugged into any of the available slots with the one proviso that the VDU/keyboard driver card must go into the lowest available slot. When I tried to use the office Epson MX80 with the printer card I found that it was necessary to disconnect pin 14 because the Epson was doing two line feeds for every new line. On powering up, the Multi-Tasking Executive (see 'Systems software') looks at each slot to see if it is occupied and if so, by what type

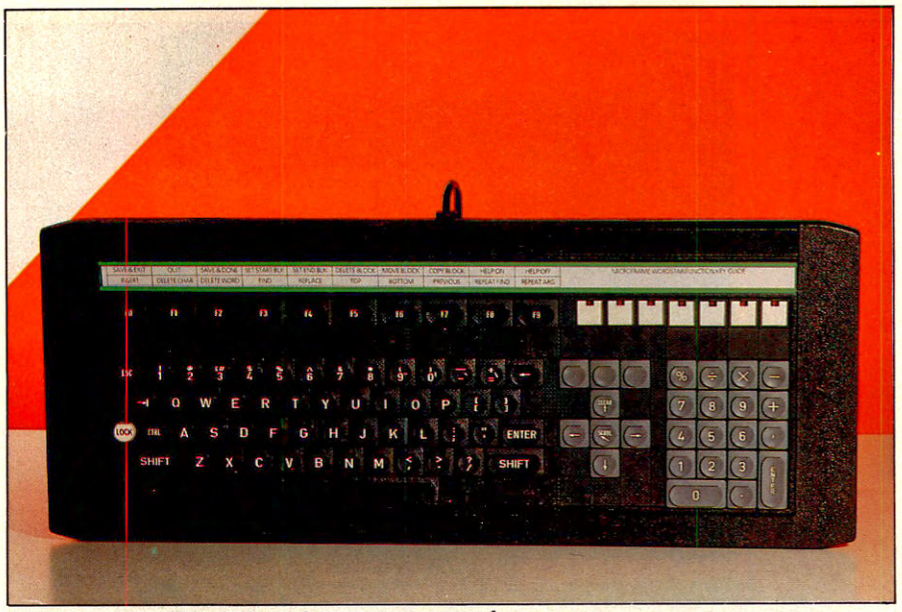
of card. It then knows where to direct the relevant messages. In order to test this I took out all of the cards, gave them a quick shuffle and replaced them. Everything worked fine.

All the PCBs that I could get at (there were some that I couldn't take out) seemed to have been produced to a very high standard with very few obvious signs of last minute alterations.

On the test machine the 8088 acted as the main processor just as it would in a normal single processor computer. However, when other processor cards are plugged in, the 8088 is only used by the Multi-Tasking Executive to control disk operations and to monitor I/O on the Bus. The new processor card actually executes the user program. So, for example, when I was using the Z80 card for CP/M-80 programs, the 8088 was only operating in the background handling the I/O.

If the machine is going to have more than one user, the only hardware modifications needed are the addition of some more VDU/keyboard controllers. As always the software could present more of a problem. At present it can prove difficult to upgrade the Microframe to more than one operating system. (See 'GLUE' in 'Future products').

Actually booting up the system was very easy. It was simply a question of selecting which operating system to use and loading the appropriate floppy disk into the drive. The Tycom start up procedure is to load the disk and then switch the power on. Although this worked fine, I never like to have disks in drives when I switch the power on just in case something goes wrong. After switching on, the machine goes into a self-test routine and boots up. The result of the self-test is shown by a red LED on the front of the main unit. If all is well it flashes once and then shines steadily. If something is wrong it will flash a certain number of times. The number of flashes indicates what it wrong.



LEDs can be made to light under program control.

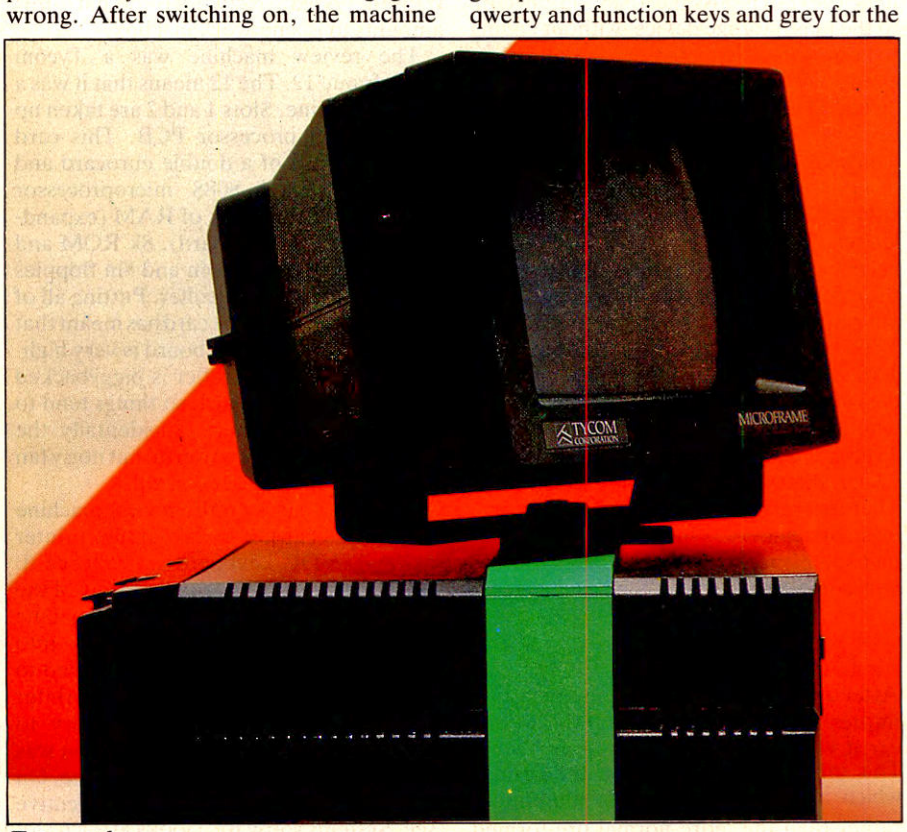
Keyboard

The keyboard forms a separate unit that is connected to the main processor box via a coiled telephone style cable. Along with the rest of the machine it is made out of cast aluminium which makes it quite heavy. It also means that the keyboard is very stable when used on a table, but it can be uncomfortable when you use it on your lap.

The keys are arranged in four functional groups and are coloured black for the qwerty and function keys and grey for the cursor control and numeric keys. There is also a block of seven LEDs in the top right corner of the keyboard which can be made to light under program control. In fact all of the keys with the exception of the CAPS, LOCK, CTRL and SHIFT are 'soft' and can be programmed to return any character or string of characters using PIP (CPM-86) or EDLIN (MS-DOS). All of the keys auto-repeat after they have been held down for about half a second. Tycom has taken the trouble to configure the function keys for the packages that were supplied with the machine. It also supplied a set of properly typeset prompting strips which slide into a channel above the function keys.

The main qwerty section is laid out in a fairly standard manner but it has a very 'bouncy' feel to it. The whole keyboard has a lot of give in it and doesn't feel very sturdy. The CAPS LOCK key has a built-in LED so that you can tell at a glance if it is set.

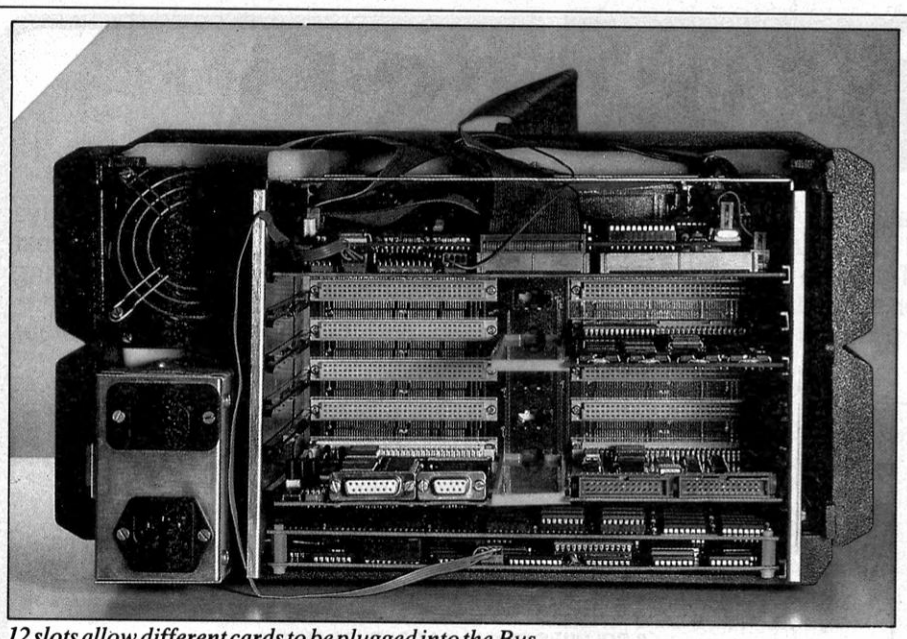
Cursor control is achieved by the use of the usual left, right, up, down and home keys. Above these keys is a group of three blank keys. The first two are user-definable and can be used in the same way as the rest of the function keys, the third is used to enable or disenable the numeric keypad. When the keypad is disenabled LED No 7 lights up as a warning.



Tycom at bay.

Screen

The screen is weird. If you ever want to find out what it is like to be cross-eyed just try looking at a Tycom screen when you are scrolling through a WordStar file. I challenge anyone to read what is actually on the screen. I am not quite sure what the reason for this is. It may be that it is caused by the long persistence phosphor that has been used in the display, or it may be because of some strange screen addressing system. Either way I don't like it. The screen is nominally 80 characters by 24 lines. However, it is possible to turn it into a 40 character screen by entering '40' in MS-DOS or 'TYPE 40' in CP/M-86. It is also possible to make characters flash, or



12 slots allow different cards to be plugged into the Bus.

underline them, by calling screen attribute files held on the system disks. For example, if you were in CP/M-86 and wanted the characters on the screen to be underlined you would type 'TYPE ULINE'. This strikes me as an odd way of doing things but there you are.

A look at the back of the monitor reveals a number of unusual looking connections on the backplate. These are video in and out, power in and out and a switch marked Terminate/Loop through. The most interesting of these is the Terminate/Loop switch. When this is used in conjunction with the video out connection it is possible to daisy chain a number of monitors together. When this is used all of the switches are set to 'Loop' except for the final monitor in the chain which is set to 'Terminate'. This means that one computer can be used to drive a large number of displays. This could be useful, for example, in teaching, where each student could have a monitor displaying the information rather than everyone having to huddle around one display. The power in/out sockets also allow the power lines to be run in and out of the monitors thus making wiring up easier.

The only other points to be made about the monitor are that it is possible to tilt it in both vertical and lateral planes; and that the only adjustment for the display is one for brightness. I would have liked one for contrast as well.

Systems software

The idea with systems software on the Microframe seems to be 'If you want it, you can have it.'

At present the Microframe supports six different operating systems. These are CP/M-80 and CP/M-86 from Digital Research, MS-DOS version 2 from Microsoft, BOS/5 and MBOS/5 from MPSL and the UCSD p-System from Asolv. In the very near future Xenix version 3 from Microsoft will be running on the Motorola 68000 card (see 'Future products'); also Concurrent CP/M and MP/M from Digital Research will be offered.

The review machine came with CP/M-80, CP/M-86 and MS-DOS version 2. These were fairly standard implementations although there were one or two features that you don't always find implemented on some other micros. For example, on CP/M-86 the HELP facility has been implemented. Although this is a Digital Research facility, it is not always used which is a pity. On typing 'HELP' CP/M-86 displays a list of commands for which a help file exists. For example, typing HELP PIP produces a half page potted description of how PIP works and the command structures that it requires. In certain circumstances sub-topics can also be called. To continue the PIP example, typing HELP PIP OPTIONS produces a list of the PIP command switches that can be set. The amount of information provided by the help is not exhaustive, but it does mean it is not always necessary to go back to the user manual to find out how to use a function.

Tycom is proud of the fact that it took only six weeks to put MS-DOS version 2 onto the Microframe. This was the first time that I had used version 2. I have used version 1 and found it nice enough, but nothing to write home about. Version 2 supports hierarchical file directories, pipes and filters, print spooling and a host of other helpful features. At first I found the hierarchical directories a pain — I knew that I had a file on the disk somewhere but I could not remember which directory it was on. I eventually got used to it but I still doubt its validity on a single user system. The main point to remember about MS-DOS version 2, however, is that it is upwards compatible with Xenix which is Microsoft's implementation of the Unix multi-user operating system. It is here that the hierarchical directories will come into their own.

Due to its unusual design the Microframe also has a great deal of system software that is specific to this one machine. Top of the list is the real time executive which is known as VRTX. This started life in the USA in process control in oil fields. Tycom took it up and adapted it for use in the Microframe where it now controls resource allocation for multi-user operations. It is very compact: VRTX and the bus controller together take up only 8k of ROM.

As the Microframe can support a number of different operating systems at the same time, it is necessary to be able to store data from different operating systems on one disk. On most micros this is not possible and you have to choose one operating system and stick with it. However, the Microframe has a utility called PARTMAN which can partition either floppy or hard disks, allowing one disk to contain files from all the operating systems supported by the Microframe. As far as I know the only other micro that allows you to do this is the IBM XT but even this only allows four different partitions whereas the Tycom allows an infinite number of partitions.

When PARTMAN is selected, it asks which disk you want to work on and goes on to ask whether you want to format a disk, split an existing partition, examine the partitions or exit. You can only create a new partition by splitting an existing partition. If you do this, PARTMAN asks for the partition number you wish to split and then tells you which operating system is allocated to that partition along with its size. It then asks you to confirm that this is correct. After you have confirmed that it is correct PARTMAN asks how much of the old partition you wish to preserve. The final stage is to allocate operating systems to the new and old partitions.

Another utility on the CP/M system disk was called RDPC. The user manual says that this will read IBM PC format CP/M-86 disks. As CP/M-86 disks for the PC are quite rare, I was not able to test this out.

Future products

Most of the hardware features of the Microframe are contained in plug in boards, so it is relatively easy for Tycom to design and build new boards to allow new features to be integrated into the basic machine. As I write this article (late September), Tycom is working on two new boards. They should be available by the time you read this.

The first enhancement is a Motorola MC68000 card. This card will contain the MC68000 processor, a memory management unit for multi-user memory allocation and all the circuitry needed to interface the card to the rest of the Microframe unit. In addition to the processor card at least one RAM card is needed because the 68000 won't be able to access the RAM used by the 8088 I/O controller. The extra RAM cards currently use 64 kilobit chips to give a total of 512k per card. However, Tycom plans to use 256 kilobit chips in the future to give a total of two megabytes of RAM per card as soon as the chips become more widely available.

When the MC68000 card is released Tycom will also release Xenix to run on the

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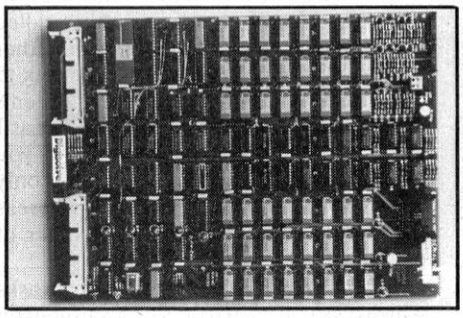

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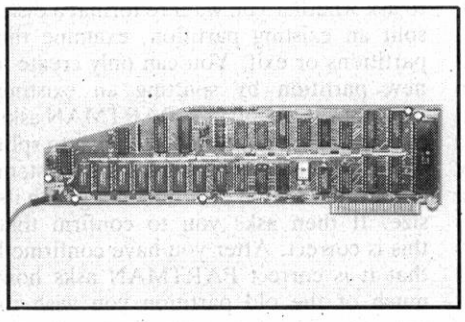

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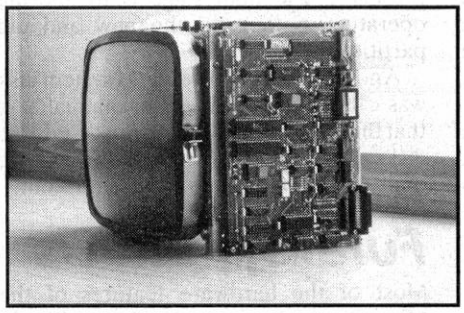

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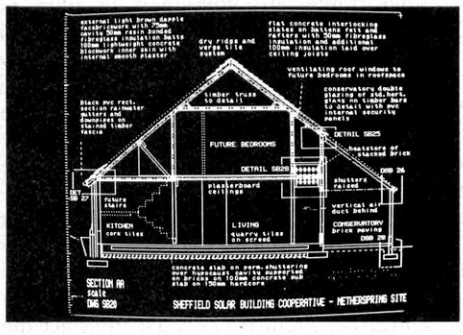

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TYCOM

Microframe using the 68000 processor. Xenix is Microsoft's implementation of the popular Unix multi-user operating system. Tycom says that its implementation of Xenix should provide up to 10 users with 'adequate' computing power. I wonder what adequate means. In the first quarter of 1984 Tycom also plans to launch a system which will allow multiple Microframe Xenix systems to be connected together using packet switching techniques.

The second new card that Tycom is developing is a high resolution graphics card. This card will plug into the Microframe and take the place of the normal VDU/keyboard driver card. The high resolution card will have two modes of operation: ANSI and TEKTRONIX 4010.

In ANSI mode the terminal will print normal ANSI characters. The display size will be either 112 columns × 24 rows (Hi-Res) or 56 columns × 24 rows (Low-Res). All characters will be formed on a 9 × 14 matrix.

In TEKTRONIX mode the display emulates the Tektronix 4010 display. Here mixed text and graphics can be displayed. The resolution is 1024 pixels × 336 pixels (Hi-Res) or 512 pixels × 336 pixels (Low-Res). Several different sizes of characters can be displayed and a cross hair cursor is supported. When the Tektronix display is being used it is possible to zoom in on any part of the screen. This is done by positioning the cross hairs over the desired point and hitting the zoom button. Zoom factors of ×2, ×4, ×8 and ×16 are possible. When you have zoomed into a window on the screen it is also possible to pan across the screen or up and down the screen. One point to remember with the zoom function is that although the area is magnified, the amount of detail remains unchanged. I saw a pre-production version of this card and was very impressed by the high resolution graphics.

Tycom is also working on a new software tool which is known at present as 'GLUE'. This will be used to integrate different operating systems. At present the whole machine needs to be reconfigured if you wish to add another operating system. For example, at the moment Tycom has some pre-configured packages of combinations of operating systems (MS-DOS and CP/M-86) but this is not very flexible; GLUE will sit on top of the various operating systems and will allow many different combinations of O/S.

Expansion

A major selling point of the Microframe is that it can be expanded into multi-user operation. At the moment the only multi-user operating system available on the Microframe is MPSL's MBOS/5 although Xenix should follow shortly. The use of MBOS does somewhat limit the applications software that can be used as there are nowhere near as many applications running under this O/S as, say, Unix or CP/M. Tycom says that the Microframe can support up to five or six users. I would have thought that this was a little on the high side for one little 8088 and two or three would be nearer the mark. Unfortunately because of lack of time I was not able to try the multi-user variant.

Applications Software

Usually listing the applications software available for a machine is a fairly straightforward job. Not so on the Microframe. As the Microframe can run virtually any micro operating system you care to mention, it can also run virtually any applications package you care to name. Suffice it to say that the price list contains six versions of Basic and various versions of Cobol, Fortran, PL/1, Pascal and C. Business applications packages come from Paxton, Omicron, MPSL, Wasp, Sorcim, Micropro, Microsoft, Comshare, etc.

The review machine came with MBasic and a Pascal compiler from Microsoft, Fastplan financial planning from Comshare, WordStar, Mailmerge and Spellstar from Micropro and the Omicron business accounts package. These all have been well documented in the past and worked well on the Microframe.

Documentation

The Microframe came with a total of sixteen different manuals: five for the Omicron accounts packages, two for WordStar, two for the Pascal compiler, two for CP/M, one for MS-DOS, one for Mbasic, one for Fastplan and two for the Microframe itself.

The two Microframe manuals comprised an assembly and start up manual and a user manual. The installation manual was a six page photocopied leaflet. It contained all the necessary details on how to unpack and set up the machine. One very good point was that a helpline telephone number was printed on the front and rear pages where it could easily be seen. The user manual was easy enough to read but half of it was taken up explaining CP/M-86 commands. This was fine when I was running CP/M-86 but when I wanted to use MS-DOS I had to use the unfriendly Microsoft manual. It seems strange that the user manual should only document one operating system. The rest of the manuals were standard issue from the manufacturers of the different packages.

Prices

The entry level system consisting of two 720k floppies will set you back £2900. This is not competitive with other single user 16 bit systems. However, the Tycom comes into its own when more than one user is hooked up — a workstation costs £1195 which brings the cost per user down to nearer £2000. As more users are added the cost per user decreases.

Conclusions

I like the idea of a future proof computer. The idea of being able to upgrade hardware and software without having to sell the existing system and start again definitely appeals. The only question is whether the Microframe actually does provide these features. The answer is a qualified 'yes'. So long as Tycom continues to provide a range of additional upgrade boards, there is no problem. The only possible query is that by going its own way rather than by using established techniques, Tycom has become the only source of add-ons for the Microframe. Tycom says other manufacturers have shown an interest in producing products based on the Microframe bus structure, but this is all in the future.

The Microframe itself worked well but there were one or two points that I was not so keen on. The first was the keyboard: on a machine costing as much as the Microframe I would have expected better quality, even an IBM rip-off would have been an improvement. The LEDs were a good idea though. The screen can also be criticised because of the long persistence phosphor. These criticisms are minor though when they are set against the benefits of being able to run virtually any software you like and the ability to upgrade with the minimum of hassle. END

Technical specifications

CPU	Intel 8088 running at 8MHz as a base processor. Optional Z80 and MC68000 cards.
RAM	128k expandable to 576k on board (MC68000 needs extra RAM cards).
ROM	8k.
Display	25 lines × 80 chars.
Disks	Twin 720k floppies or one 720k plus 5/10/20MByte hard disk.
Systems Software	CP/M-80, CP/M-86, MS-DOS V.2, BOS, Xenix.
Applications Software	You name it.

Benchmarks

BM1	1·5
BM2	4·1
BM3	8·1
BM4	8·4
BM5	9·7
BM6	18·0
BM7	27·6
BM8	21·5
Average	12·36

All timings in seconds. For an explanation of the Benchmark programs see the December '83 issue.



DATABASE BENCHTEST

BUSIFILE

Kathy Lang takes a first look at a new British data management system for Apple Lisa.

Although the Lisa has been around for a year now (though not, until recently, in large quantities), there is surprisingly little software available beyond that provided by Apple itself. The subject of this month's data management review is therefore of considerable interest, as one of the first packages available for the Lisa from an outside company, and, I'm told, the first from a British software supplier.

For the review, Apple lent a complete Lisa system including two hard disk Profiles. One hard disk contained the Lisa Office System, while the other had BusiFile and the Lisa programmer's workshop system. So, with the second Profile connected, when the system was first powered up, the display showed these two options, plus Power On and Power Off, as being the available Environments. By moving the mouse (which is either a feature of the Lisa or a gimmick, depending on your attitude) to get an indicator in the relevant box, and pressing the mouse button, you load BusiFile. This is rather a lengthy process — a problem which I understand is common to much Lisa software, and so is presumably due to the system itself. Once loaded, the BusiFile main menu is displayed, showing the options available. These can be selected by moving the mouse either into the line of words describing the option, or into the corresponding box along the bottom of the screen, identified with an abbreviated version of the menu option.

Options are available to carry out the usual range of data management functions, including file creation and indexing, data input and amendment, viewing on the screen and reporting on all the records or just a selection, sorting and manipulating groups of files. BusiFile, in fact, bears a strong family resemblance to Beta, a package for UCSD-p systems which I reviewed in August 1983, a resemblance which owes much to the fact that the same designer was in the main responsible for both systems. However, BusiFile is a much more powerful system, and its interest here lies both in that increased functionality and also in its implementation on Lisa. BusiFile is the product of a British company, European Information Systems, and is marketed by Business Systems International Ltd, of Southport, Merseyside.

Constraints

BusiFile stores its information in records of fixed size and structure; the maximum number of records a file may contain is also fixed when the file is set up. To change any of these parameters, the file must be dumped and reloaded. The major constraints on records and processing are shown in Fig 1. The limitation most likely to cause problems in some applications is the maximum size of field, rather on the low side at 64 characters. On the other hand, BusiFile has a wide range of data types, including a 'Table' facility which gives the ability to look up abbreviations and substitute extended names when displaying or reporting, which should save space. There are also three types of date available, to help both UK users and our cousins across the pond, with the third option being a 'forecast date' type which allows you to record an action date for reference when extracting records for process, either as a constant or as a variable derived from other date fields. Calculated fields may be based upon combinations of constants and field values which precede the computed field in the record, and the usual arithmetic operations are provided.

File creation and indexing

To create a file, you must first define its structure, set up a menu by which it may be accessed, and create one or more screen layouts for record display. The first of these three stages involves describing the structure of each record, and defining the file indexing and size. Structure is described by giving a name, type and length for each item in the record. For calculated items, BusiFile will ask what calculation is to be performed.

The next part of this stage is to define the indexing methods to be available when direct access — as distinct from access via a sequential search through all the records — is needed. Each data file may have one primary index; the field chosen must contain unique values. You may also use one or two secondary indexes, on fields which may contain duplicated values. Only four data types are eligible for index fields — integer, character, table, and numeric without arithmetic capabilities. So you can't have a field containing a number with a decimal point if you also want to be able to, say, total that field. In normal circumstances, therefore, you can't have a direct access via either a date field or a field which may contain a decimal point. You aren't obliged to use indexing — instead of, or in addition to, indexed fields, you can process records by record number if you say at file creation time that you need this facility.

Sizes of index fields are not restricted directly, except they are based on a single field so cannot exceed 64 characters, but the larger the primary index is, the more often you will have to carry out an auditing run to clear the 'overflow area' used by the program when new records are entered. This overflow area can hold up to 1024 characters, and each new record uses (primary index feld size+2) characters. So if you use an 8-character field as your primary index, you have to carry out the operation to clear the overflow area after every 102 new record entries. This process is quite fast, but you would need to make a practice of clearing the overflow area regularly to avoid having to interrupt a data entry session because the area was full.

The last part of this first stage is to tell BusiFile how many records the data file will contain. BusiFile then reserves enough space on the disk for the file. If you find later that you need to increase this reservation, then you must copy the file out to another BusiFile format file with a larger size allocation.

Once the structure of the file is defined, you must then describe its screen layout and the menu through which functions for processing the file are to be accessed. If you wish, you can ask BusiFile to create a standard layout (one field per line) and a standard menu through which this will be accessed. This option is available from the 'Amend data base definition' menu, and is very quick. However, you will usually want to set up at least one screen layout of your own — more of this under 'Screen Display' — and your own menus will be necessary if

you set up more than one screen layout, or want to set the system up to make it easy for inexperienced people to use. BusiFile gives you the ability to set up a maximum of seven screen layouts and ten menu displays for any data file.

The combination of default settings with the option to create your own is very valuable, but it has to be used with care. When you ask BusiFile to create the default layout and menu, it does them both at once, and overwrites the current screen layout. Since the menu provided assumes screen layout 1, if you want to create your own screen layout but use the menu provided, you must use the default option first and then create your desired screen layout. Otherwise, you have (if you realise in time) to copy the screen layout you've created, set up the defaults, and then copy back your screen layout so that the menu gets the correct layout. It would have been better to separate the default menu and screen layout creation to allow the user the choice of either one or the other, or both.

Data input and updating

To specify which record is to be added, you must specify the primary key if there is such a field. If you specify a key which does not already exist, BusiFile assumes you want to add a record. When updating, you can retrieve a record by record number, primary or secondary key, or by any other fields searched through the selection mechanism. Once the record is displayed, you can move around the record with the Return and Cursor keys. I couldn't find a way to accept the amended record immediately adjustments had finished, without getting the cursor into the last field.

Screen display

BusiFile gives you the option either of using its standard, one-field-per-line format, or of creating one or more screen formats of your own. These are set up using a combination of form-filling and 'paint-a-screen'. Screen formats don't need to include every data item in a file, so you can use them to present a subset of a record to preserve confidentiality where public and sensitive information is mixed within a record.

Printed reports

Three types of printed reports are provided. A simple standard reporting facility allows you to get printed information about records without setting up complicated layouts. A full reporting facility is also provided, using column and row specification (with the use of defaults if needed, which may subsequently be amended), plus totals, sub-totals and page breaks on a maximum of two fields upon which the file has previously been sorted. (Sorting here means the generation of a sequence file, like an index but for reporting only, not a full sort—see below.)

The third facility is for 'template' letters set up with BusiFile's own editor or a word processor, which can incorporate items from a BusiFile data file. This is quite a simple-minded feature, with no 'word-wrap' provided, but would be sufficient for many purposes.

Selection and sorting

To select records from BusiFile, you must construct a 'search screen'. This is then used, right away, to identify those records which you need to view, to print, to copy to another data file or text file, or to update in a batch. Selection allows up to eight criteria to be specified, using the usual range of comparison operators, including 'wild codes' for matching any characters in parts of strings. Any criteria may be either mandatory or optional; for a record to pass the selection test, it must satisfy all mandatory requirements and at least one optional criterion. Selection can operate either over a whole file, or within a range of records specified by record number.

Reports can be printed in order up to four fields, in ascending or descending order. Records may also be sorted physically, but this facility is not likely to be of much practical use, as it is restricted to the number of records which the program can read into memory, and quite a small area at that — 16,000 characters. So on my Benchtest file, trying to sort 1000 records of 152 characters each would not have been allowed — I could only sort a maximum of 167 records.

For data input and amendment, BusiFile has quite powerful facilities. These include the ability to calculate fields at input, and to add to, rather than replace, fields when amending. The facility for carrying out calculations on every record in a file are less powerful — they only allow you to copy a data value from one field to another, or do arithmetic using one operand and one operation at a time, so Benchtest 8, which does 'Price2=Price3+1' for every record, had to be carried out in two steps. The facility is very fast on the Lisa, though, so this wouldn't be a real problem. Within reports, you can ask for totals and sub-totals, but no other calculations, and you couldn't get these on the screen without setting up at least a simple report format.

By the time you read this, the multiple file version of BusiFile, allowing access to up to nine files at a time, should be available, but I wasn't able to test it on my review copy.

BusiFile has reasonable facilities for providing your own menus, to give access to the facilities tailored to your application. Or you can use the standard options provided by BusiFile — a good compromise.

It is possible to say that a field may not be updated, or that the current version of a field should be displayed while the new one is entered; both these features would provide some security against keyboard errors.

All file functions are available from the BusiFile utility menu, including, if the operating system makes this possible, the system-specific disk formatting program.

Max file size	Files span disks	Max rec size	Max no fields	Max char fld size	Max precn digits	Max len prime key	Special disk format	Filesize fixed
16384 records	N	1024	100	64	10	NS	N	Y

Data types	Fixed record size?	Fixed record struc?	Amend record stored?	Link data struc?	No. data files	No. sort fields	No. keys	Max len key fields
N,C,D,R,L,-M,	Y	Y	CO	Y	9	1/4	3	NS

Link to ASCII data file? Y

Fig 1 Constraints

BM1	Time to add 1 new record	3secs
BM2	Time to select record by primary key	Inst
BM3	Time to select record by secondary key	Inst
BM4	Time to access 20 records from 1000 sequentially on 3-character field (same field as in BM2 key)	Inst/3secs/rec
BM5	Time to access record using wild code	2secs/2secs
BM6	Time to index 1000 records on 3-character field	50secs
BM7	Time to sort 1000 records on 5-character field	NP max 167 recs
BM8	Time to calculate on 1 field per record and store result in record	4mins 20secs
BM9	Time to total 3 fields over 1000 records	NT
BM10	Time to add 1 new field to each of 1000 records	F
Time to import a file of 1000 records:		5mins 15secs

Notes: NT=Not tested NP=Not Possible F=Failed during test

Fig 2 Benchmarks



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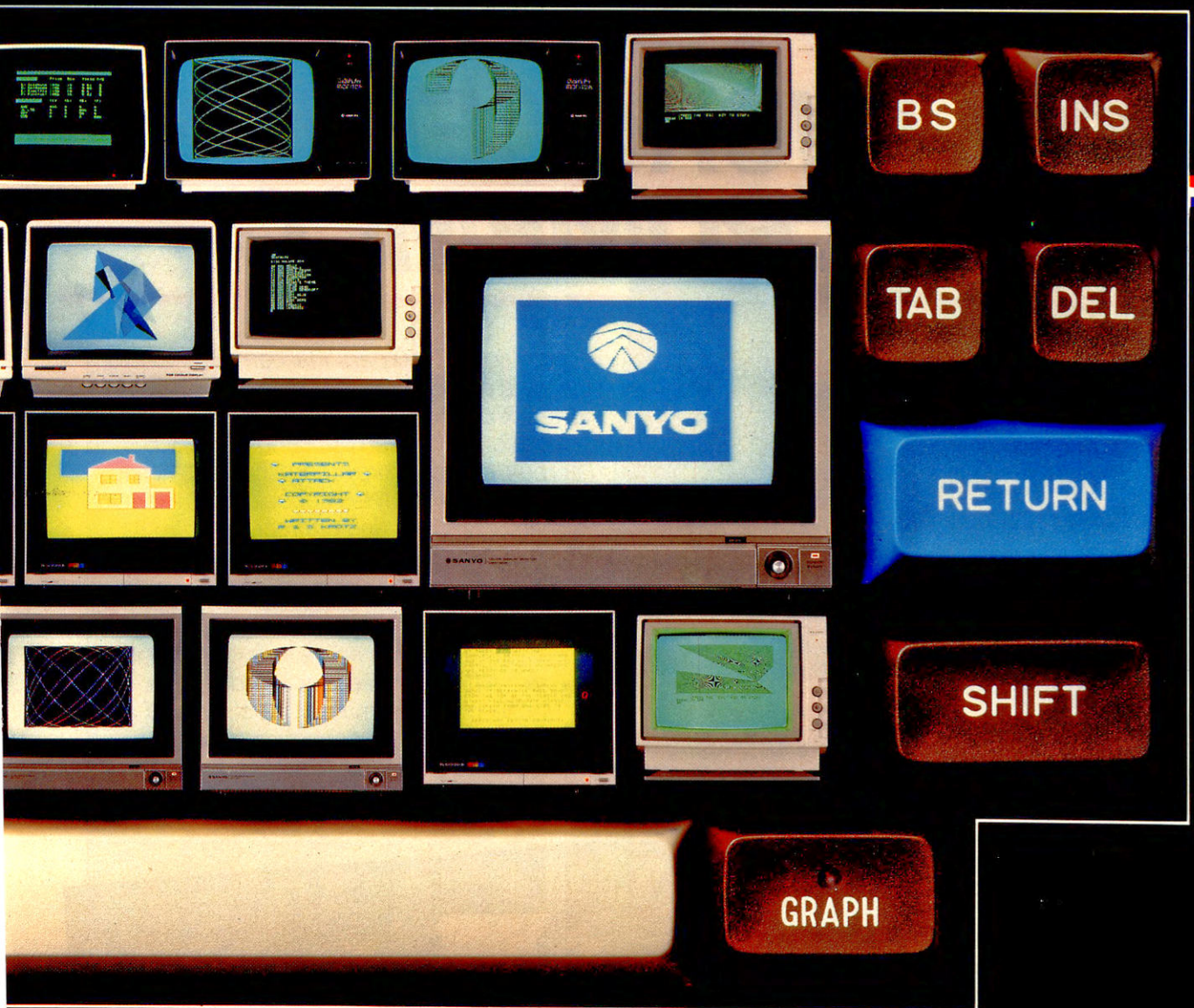

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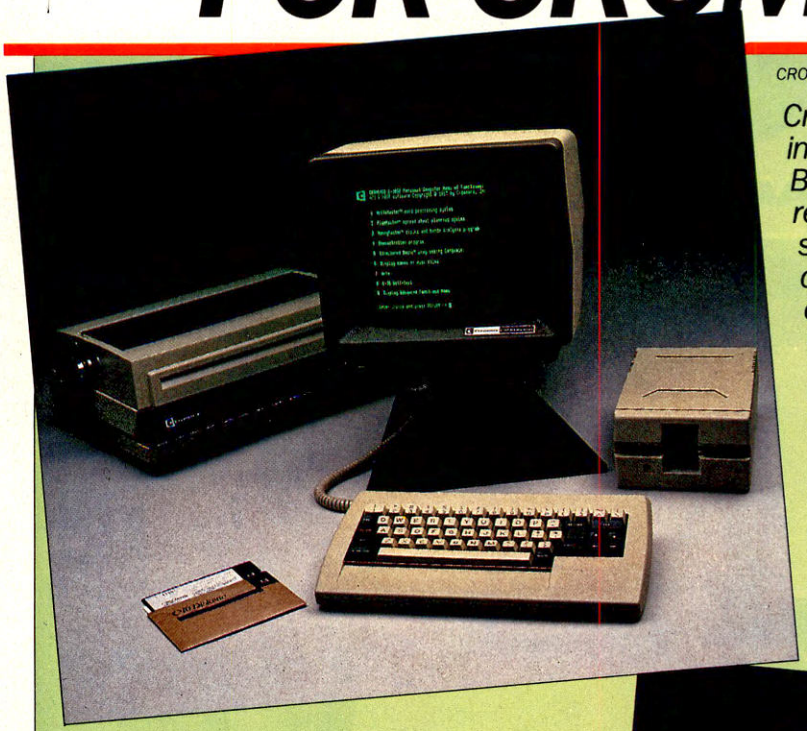

CROMEMCO C-10MP

Cromemco's C-10 personal computer includes a Z-80A microprocessor with 64K Bytes RAM, 24K Bytes ROM, high resolution 12" green phosphor 25 x 80 screen, detached keyboard, 5" floppy disk drive with 390K Bytes capacity, communications and printer ports, terminal emulation, graphical characters, CDOS operating system and 32K Structured Basic.

In the C-10MP we add a software "Super Pak": a full screen editor, WordStar, MailMerge, Writemaster, CalcStar and PlanMaster spreadsheet programs, Chess game, MoneyMaster financial analysis and InfoStar data base management system.

The System One Hard Disk computer, with an integral 21 Megabyte Winchester hard disk, includes Cromemco's dual 68000/Z-80A DPU processor (featured below), with 256K Bytes of RAM and 390K Bytes of floppy disk storage.

The S-100 bus has eight card slots, sufficient for expansion utilising Cromemco's range of interface cards for high resolution colour graphics, process control, analogue-digital data conversion and telecommunications.

A choice of operating systems includes CDOS, CP/M and CROMIX.



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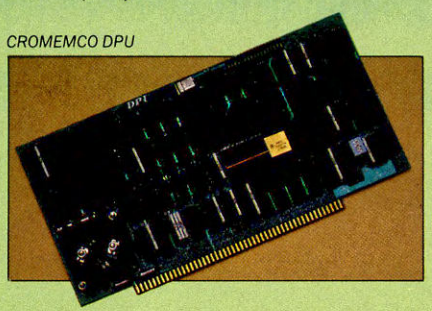
CROMEMCO DPU



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BUSIFILE

This means that an inexperienced user can work totally within BusiFile.

Links with outside

BusiFile can read and write ASCII text files, with delimited fields (the default delimiter is a comma) and records terminated with Carriage return. I had no difficulty in importing the Benchtest file using this facility, and it was very quick. Setting up the data file using Lisa Pascal was a different matter — Apple seems to have gone out of its way not to implement many of the nice features of UCSD-p Pascal. For instance, the string functions don't take substrings as arguments, so assignment to substrings is tedious in the extreme. You must retype the edit and compile file names each time you go through the edit/compile sequence — and, when linking, you have to give the name of the Pascal library explicitly, although the manual says it must be present for the object code to be linkable!

Data validation	Screen formatting	Unique keys	Report formatting	Store calculation	Aggregations
A	P,D	1M	C,D,L	IN,BA	T+ST

Store seln Criteria	Combine criteria	Several tests/fld	Wild codes	Browsing
N	My + 1Dp'l	Y	SW	AF

Fig 3. Functions (for codes, see Dec '83 PCW)

User image

The general approach to providing BusiFile functions is to display menus and sub-menus, with further choices available through question-and-answer. The screen displays are quite well designed, although I would like fewer upper-case words on the menus screens — especially as I'm not a great fan of the Lisa character set. Beyond that, to some extent, your reaction to the BusiFile user image depends on whether you like mice and on the way they have implemented that feature. I'm a mouse fan only in certain limited circumstances — I can't really see that it's much help for requesting menu options, for instance. (Using my finger to point at the option on the screen, now that might be different.) However, my main quarrel with BusiFile in this area is the lack of consistency. In some circumstances, you may respond to queries or request menu options either by pointing the mouse at the option or query itself, in which case you depress the mouse button and *let it go* to activate the option, or by pointing the mouse at a row of boxes along the bottom of the screen, in which case *pressing* the mouse button *down* is what activates the option. I can see the logic behind it, but I didn't find it very easy to use.

But much worse is the method of use, alone or as an alternative to the mouse, of the keyboard and cursor characters. For instance, when requesting a file name, BusiFile will display those available, and then ask you to type in the name required! If ever there is a time when a pointing device is useful, it is to avoid having to type in file names which are already displayed on the screen. On other occasions, on one screen you have the option of accepting a default either by pressing Return or by using the mouse on the bottom of the screen, while on the very next screen only the mouse would be available. I believe that inconsistency is one of the hardest faults for users to cope with in a user image, and this badly needs tidying up in BusiFile. And, as with Lisa in general, very little use is made of function keys other than the mouse — character deletion is by backspace or by control character, for instance. This is partly a feature of the keyboard, but it would help not to disable the cursor keys so frequently, even if they are very slow — some of us have just got used to them . . .

User image types	Reference manual	Tutorial Guide	Reference Card	On-Line Help	'Hot Line'
M,LT	***	***	Soon	**	NS

Fig 4. Support (for codes, see Dec '83, PCW)

Documentation

The manual for BusiFile has a tutorial section and a reference manual in one A5 binder, with the fashionable fold to enable you to stand it on a desk. The manual is quite readable, and small enough to be quite easy to find your way around. A glossary is provided. I understand that an index plus several reference cards for summary material are on the way, and should be available by the time you read this. The manual isn't typeset, but the typeface and page layout are quite acceptable.

Conclusions

These have two aspects. Is BusiFile a good package, and should you buy it for the Lisa? The answer to the first question is, basically, yes, although I have reservations about the lack of sorting for display purposes, and the limited aggregation features for numeric fields. The package runs extremely quickly on the Lisa — much quicker than the Office System, of which more anon — but how it would perform on a less powerful processor than the 68000 I cannot, of course, predict. Benchmark times are shown in Fig 2: these of course are Lisa times, and **should not be compared with my usual Sirius figures.** Summaries of BusiFile's functions are shown in Fig 3, and support assessments in Fig 4.

Should you buy BusiFile for the Lisa, when you lucky Lisa owners already have simple record processing on the system? Well, for any serious work involving numbers LisaList would be most unlikely to be adequate, since it appears to lack any proper arithmetic or the ability to analyse figures. I also found it extremely slow, like everything else on Lisa itself when screen handling is involved. In this respect Lisa is that strange beast (for a micro), a system which handles batch work very fast because of its powerful processor, while screen interaction is painfully slow, presumably at least partly because the system has so much work to do. BusiFile's designers have made a reasonable job of overcoming these problems and taking advantage of processor speed, bearing in mind my caveat about the inconsistency of the user image. As to function, BusiFile is a reasonable, middle of-the-road package which should be compared with rivals such as Friday!, Pearl and Rescue at the lower end of this market (if you don't need full multi-file facilities) and with the likes of Delta, Tomorrow's Office and Condor at the upper end.

END

Summary

Package Type	Fixed length, fixed format records, menu-driven (N,F roundup categories)
Availability	Lisa, most UCSD-p systems inc. IBM, DEC, Sirius
Version Reviewed	1.0
Facilities	Record creation, display and reporting using direct retrieval on up to three indexes, sequential access on any field combinations. Adequate reporting and calculation features, good updating facilities. Multiple files.
Drawbacks	Sorting inadequate. No interactive calculations.
Ease of use	Occasionally good, often adequate but inconsistent.
Error Messages	Not very helpful.
Documentation	Quite good — will be better when reference summary available.
Costs (ex VAT)	£350.
Supplier	Business Systems International, Stockport. Tel: (0704) 44511.



WHICH SPREADSHEET?

SORD'S FALC

Mike Liardet takes the lid off a sophisticated spreadsheet system, with an extensive range of facilities, for the Sord M5 home computer.

Sord is a Japanese company that has previously confined itself to manufacturing business computers. Although virtually a household name in Japan, it has not yet made a great impact in the UK. Recently it launched its first home computer, the M5, which has a superficial resemblance to the Sinclair ZX Spectrum, and is obviously intended to grab a fair slice of this booming area of the computer market.

Background

Following an initially underwhelming response back in Japan, Sord appointed an independent distributor for the M5, in order to avoid the confusing mix-up between this alien beast and its existing range of business machines. Having found that this was a more successful way to market the product, Sord has repeated the formula in the UK and appointed Computer Games Ltd (CGL) as distributors of the M5. Although the M5 is CGL's first venture into the computer market, it has a great deal of experience marketing other home electronics products such as chess machines and space invader games.

For a relatively new product, the M5 has already amassed a fairly impressive list of available software, mainly games as you would expect, but also a package rather cryptically named FALC. FALC is a sophisticated spreadsheet system with a surprisingly large breadth of facilities. Sord obviously hopes that everyone will be FALCing about in the near future — the manual's preface claims that it is for 'the working mother, mother at home, working father, father at home, or their children'.

FALC's sophisticated design can be directly attributed to another cryptically named Sord product called PIPS ('Pan Information Processing System'). PIPS is a spreadsheet cum database system, first launched way back in 1980, for the Sord M20/23 and M200 range of business machines. Sord must have missed a great opportunity with PIPS, since at the time of its first release the world had yet to wake up to VisiCalc, and if things had been handled differently we might have had PIPS in the record books and a range of PIPS-clones instead.

Anyway, when Sord decided to try its hand at the home computer market and include a spreadsheet option for the machine, it looked to PIPS for the design ideas. Accordingly FALC was born.

My review system for FALC simply comprised a standard M5 computer with the FALC package itself. The M5 (reviewed in *PCW*, August 83) occupies an area slightly smaller than this magazine, with a qwerty keyboard (rubber keys) and special slot for ROM cartridges. Included with the M5 are all the necessary leads for connecting to a TV and cassette recorder, plus a substantial power supply pack, Basic ROM cartridge and manuals.

It is fairly easy to fit all this lot together, with the manual giving clear instructions on what to do. The M5 has video outlets for both monitors and domestic TVs, a nice feature, but it's easy to get them mixed up. There is no damage done if you do, you just spend a long time fruitlessly tuning your TV with no image appearing.

There are lots of dire warnings in the manual and on the M5 itself that you must switch off before you insert a ROM cartridge. The M5's power-on light is not very bright, so I only felt safe doing this with the mains-lead unplugged altogether. It's a pity that Sord did not arrange a combined on/off switch with cartridge-lock, then the user would not have this worry, and Sord would not have to deal with all those blown ROM cartridges.

The ROM cartridges are about the size of a cassette-tape box, with a well-protected edge connector at one side. You just press it firmly into the socket on top of the M5. If you insert the Basic ROM cartridge, supplied as part of the M5 system, and switch on, then you are free to start Basic programming immediately. There are in fact other optional cartridges available, including more sophisticated Basics. The FALC software is a further cartridge option (£34.95 inc VAT). Press the FALC cartridge in, switch on, and you instantly enter the world of FALC.

FALC is a refreshingly different spreadsheet system. It has quite a number of features in common with VisiCalc but has evolved from a completely different branch of the world's software tree. Its immediate ancestor, PIPS, was developed independently, and presumably without knowledge of VisiCalc. Accordingly, while still being a spreadsheet system, FALC works in a different way from most of the other spreadsheet packages.

Initially these differences are not too apparent. Following switch-on, there is a very brief pause for initialisation, and then a fairly standard type of spreadsheet display appears on screen. Like most inexpensive home computers the M5 does not provide an 80 character by 24 line display, the standard for more expensive machines. Instead we are treated to 24 lines, but a width of only 32 characters. Initially each cell of the spreadsheet is allocated seven characters display space, thus allowing for four columns of cells to be displayed. The very bottom of the screen is reserved as a 'scratch-display', so actually only 20 of the 24 lines are available for the spreadsheet itself.

Of course, at first all the cells are empty, so most of the screen is just blank space. The top row and left hand side of the screen contain the column and row identifiers and at the bottom is the command-line prompt. Both rows and columns are identified by numbers.

Like the Spectrum, which also has a rubber keyboard, the M5 keys are all marked with several symbols, and this can be a little confusing. On the right of the keyboard are four keys which, among other things, are marked with arrows pointing left, right, up and down. These are laid out in the obvious way, like four points of the compass. But it can't be that obvious or more manufacturers would actually manage to do it this way. Anyway, these keys, if pushed in conjunction with the CTRL key can be used to explore the spreadsheet. Unfortunately you need two hands for the keystrokes, since the CTRL and arrow keys are about as far apart as it is possible to be on this keyboard. But before doing this it is necessary to use the WRITE command. WRITE is one of nine commands available, each selected by pushing its initial letter.

WRITE mode

When in WRITE mode, FALC comes closest to being an orthodox spreadsheet system. WRITE changes the screen colour and a cursor (actually two little arrow symbols at each end of a cell) is displayed.

This cursor can be moved from cell to cell using the arrow keys, with attempts to move off-screen causing a rapid redraw so that the destination cell can be displayed at the expense of a row or column lost at the other side. Unfortunately on my black and white TV the arrow characters, denoting the cursor, were very indistinct and I had to peer quite hard to see them. My guess is that no one in the 'land of the rising sun' has to put up with a monochrome set so Sord was not too concerned with this.

As with most spreadsheet systems, it is possible to enter text or numbers at the current cursor position, simply by typing whatever is required. FALC does not, however, accept formulae in this mode, and neither does it differentiate between text and numbers, so the numbers are left just as typed, and not formatted in any way. The amount of information in each cell is strictly limited to the cell width, but different widths for each column of cells can be specified when using the system initialisation command.

A single keystroke terminates WRITE mode and FALC returns to the command menu. You can use the WRITE command in conjunction with a cell's coordinates, and then the first cursor cell jumped to is the one indicated by the coordinates. This resembles the GOTO command, available on most spreadsheets, and enables you to quickly flick between distant parts of the spreadsheet.

Initialisation

Unlike some spreadsheet systems, you must specify information about the dimensions of the spreadsheet before you enter any data. For convenience, FALC does an automatic initialisation at switch-on, giving you eight 7-character columns of cells by 60 rows.

To perform an initialisation the NEW command must be used. FALC needs to know the number of columns and the width of each individual column. It can then allocate as many rows as possible — and the wider the spreadsheet the fewer the rows that it can make available.

Since a cell can only contain as many characters as are allocated to it at initialisation, this exercise may require careful planning. It is rather like designing a record structure for a database system. In fact with highly useful sort and search commands, FALC can be used for very small database-type operations. It shares this distinction with only a few spreadsheet packages like Multiplan and 1-2-3. Unlike them it is severely limited by the M5's low memory capacity — but its hardware is a twentieth of the price!

Implicit in the initialisation process is the ability to allow for some column expansion space, so that there is sufficient room to add new columns of cells later.

Initialisation also permits an area at the top of the spreadsheet to be set aside for headings. The only significance of this is that this area is ignored by calculations, and sorts, etc.

Not all of the initialisation process is irreversible. It is possible to come back later and alter the information on the title area, and also vary the column widths, but the latter does not necessarily work the way you would like: if you enlarge one column at the expense of its neighbour then it simply 'steals' the characters which were in the column next door.

Calculations

When in command-mode, you can perform calculations on the numbers in the spreadsheet, by entering formulae directly. For example

C2 + C6 = C8

would add the numbers in column 2 to those in column 6, and store the result in column 8. Notice that, unlike most programming languages which are less logical in this respect, the calculation is on the left and the destination of the '=' assignment (C8) is on the right. If column 8 does not happen to be on screen at the time this formula is entered, then the answers can be seen by moving to it with the WRITE command.

It is possible to mix constants in with the formulae, so

C2 − 1 = C5

stores column 2, decremented by 1, in column 5. Other tricks of the trade include the use of '/'

R3 + R13 = / R14

The '/' causes all rows from 3 to 13 to be summed and entered in row 14. Without it there, just rows 3 and 13 would be summed. We can also specify the display format of the answer:

C2 / 7 = C9.0.3

would divide by 7 each number in column 2 and store the result in column 9. The '3' in '.0.3' specifies that the answer is to be displayed with two digits after the decimal place (and the decimal point itself consumes one character position: 1+2 = 3). The '0' determines how the number should be 'rounded', if the real answer needs more decimal places than are provided for, and the last digit is five. For example, to two decimal places 12.345 can be rounded down to 12.34 or rounded up to 12.35. Moreover, a number like 12.349 could be 'truncated' to 12.34. FALC allows you to specify which of the three options you want.

FALC also provides 'block operators' like average, maximum, and minimum. For example,

AVE R5,10 = R11

takes the average of the six numbers in column 1 (rows 5 to 10 inclusive) and stores the result in column 1, row 11; then repeats the same operation for all the remaining columns. For completeness, FALC also provides similar block operators for the four main arithmetic operations, but these can also be dealt with by the '/' facility already mentioned. Thus,

ADD C2,6 = C8

is equivalent to

C2 + C6 = / C8

So far we have seen that FALC has the facilities of a sort of all-powerful calculator. Instead of a single register display a whole array of numbers can be dealt with, and whole rows and columns can be manipulated at will. However, to be really useful, FALC must store the calculation commands as well. This is the basic facility needed for 'what-if' analysis. It becomes tedious recalculating a matrix, following a minor change, if a long sequence of calculations has to be re-entered every time. Sord has obviously recognised this fact, and has done something about it, but not as much as I would like to see, and this is my major criticism of an otherwise very good home computer package.

Essentially it is possible to access an alternative screen where 'programmed functions' can be permanently set up, and subsequently selectively re-executed with a couple of keystrokes. These functions, by the way, need not be confined just to calculations on the spreadsheet, but can also include almost any sequence of commands: cassette reading, searches, etc. Actually when they are invoked they flash up momentarily in the area where you normally see your own typing — just as if you were typing them yourself, only at Superman speed!

The major limitation to this facility is that only one screenful of text can be set up in this way, that is, about 600 characters maximum. This is probably not a great disadvantage for command sequences, but would be fairly easy to exceed the limit with a complicated calculation sequence for a model.

Memory and expansion

In fact memory is very tight on the basic M5, so it is not possible to build up large spreadsheet applications anyway. The situation could be improved by purchasing the 32k RAM expansion pack, which should be available by the time you read this.

However, when the extra RAM does arrive, FALC will not be making the best possible use of it. As the system stands, there is a basic area of just over 4k reserved for the spreadsheet data and programmed functions. This can be instantly transferred, using the PUT command, into one of two buffer areas numbered 1 or 2. The existing spreadsheet can then be freely modified and the original can be restored at any time using the GET command. Now with an extra 32k of RAM, the number of buffer areas will be increased to 9, but the spreadsheet itself will remain at the same size.

Doubtless Sord has organised things this way because it anticipates that the home user is likely to have lots of small applications, rather than one big one. Certainly, this arrangement will be particularly convenient if this is the case, since it circumvents much of the cassette reading and writing that would otherwise be necessary. All applications can be read in from cassette, in one go at the start of a FALC session, and only need be written out once at the end. (Reading and writing to cassette is achieved by PUTting and GETting with names — filenames, rather than numbers — the buffer identifiers.) In

SORD'S FALC

the middle of a session, applications can instantly be changed by PUTting and GETting to buffers.

Since it does not appear to be possible for different buffers to communicate results with one another, memory expansion will just facilitate more different applications to be run, but be of no help to anyone wanting to do larger problems. It is a pity that the user cannot control the number of buffers and size of spreadsheet, then he could have the best of both worlds!

SORT and SEARCH

So far we have covered four of the nine commands available: WRITE, NEW, PUT and GET. Two other commands are SORT and SEARCH.

SORT always sorts rows of the spreadsheet. It can sort using any specified column, or multiple columns, into alphabetical or numerical ascending or descending order. For example, if the spreadsheet contains a list of names, telephone numbers and area codes, by specifying a single sort on the area code column, then on the name column, the list would be rearranged, sorted first into areas, then in alphabetical order for names within an area.

SEARCH provides quite a powerful search facility. Like SORT it must be given a column to work on, then searches down it for the 'target' of the pattern specified. The pattern can include joker characters, identical as it happens to those used by the CP/M operating system for ambiguous filenames. Thus the search pattern "*A?C*E" would match only with a cell whose last character was 'E' and containing the sequence "A"+any character+"C" elsewhere. This would, for example, match "ABCDE", "QQQAXCQQQE" but not "ABBCDE".

Other commands

There is a LIST command provided to give printouts of the spreadsheet. I could not test this as I did not have a printer connected. The M5 provides a Centronics interface through a 16-pin flat-cable connector.

The MOVE command allows a rectangular area to be specified as the 'source' of the move, and a possibly different shaped rectangular area for the 'destination'. Single columns or rows are just a limiting case and can be moved with equal facility. The source of a move is not affected, but of course the destination is completely overwritten.

The final command provided by FALC is GRAPH — to plot graphs on the screen. Sord rather underplays this command, which is quite a rarity even on disk-based spreadsheet systems. Anyway the M5 has a character graphics facility, which can be used to make boxes, and so on. The GRAPH command uses these characters, with its colour display facility to build up an attractive bar graph display. The graph is plotted horizontally, not vertically, with each bar corresponding to a row of the spreadsheet. As there are up to 20 rows on display at any one moment, 20 bars can be accommodated. Several columns can be graphed simultaneously, with a bar broken into different colours, to represent the 'contribution' from each column. It is also possible to print this graph, but Sord does not record what printer will do this.

Conclusions

The FALC package has a feeling of quality about it. As a software package for a home computer it is very good. Perhaps the £34.95 price tag will deter some potential users, more accustomed to £5-£10 for a games cassette, but it comes supplied as a ROM cartridge with software instantly available at switch-on, and no cassette loading delays. It is also very nicely packaged and clearly documented, taking 100 pages to explain its extensive breadth of facilities. These facilities include sorting, searching and graphics — a rarity even with disk-based software.

Previously in this series, I singled out Vu-calc on a Sinclair Spectrum as a reasonable spreadsheet system for a home cassette-based computer. I prefer the Sord+FALC to the Spectrum+Vu-calc. Clearly Sord has put its experience at the more expensive end of the micro market to good use and come up with something that is a cut above the usual for the home computer market. This applies equally to the M5 computer itself. Maybe it costs rather more than the Spectrum, but put the two side by side and you will see why.

Spreadsheet evaluation

This month I am introducing a new feature to the 'Which Spreadsheet?' series: a 'star' rating for various fundamental aspects of the packages. Actually I shall not be using stars, which could only be positive, but '!'s and '?'s instead. This follows the chess notation where '!' denotes a good move, and '?' a bad one. Each month I will evaluate the spreadsheet under review, in four different categories and anything from three '!'s to two '?'s will be awarded:

!!! = Excellent
!! = Good
! = Passable
? = Poor
?? = Bad

To avoid introducing a long checklist of facilities, I will rate the systems on fairly abstract (and therefore subjective) considerations, which manage to cover just about everything between them:

1. Ease of learning. If the manual has good tutorial material, aimed at a newcomer who knows nothing about computers, and the software is tolerant of a beginner's mistakes and designed so that the user can quickly build up a model of what is happening 'under the bonnet', then it will be deemed 'easy to learn'.

2. Ease of use. This is not the same thing as above. In particular, it is quite difficult to score well on both counts, since easy to use software should work in a fast and concise way, which is generally at odds with being easy to learn. Here the reference documentation is more in question. It should be well indexed, and easy to access information on even the most obscure corners of the system.

3. Reliability and error handling. Obviously a system which crashes regularly or corrupts files and loses data must score badly in this department. Rare programming oversights in distant outposts of the system will not be taken so seriously — after all there is not a software package anywhere in the world that does not somewhere have a bug of this nature. To score well the system must be 'positively robust', and by good design prevent the user from making mistakes, and with well thought out explanations when s/he does.

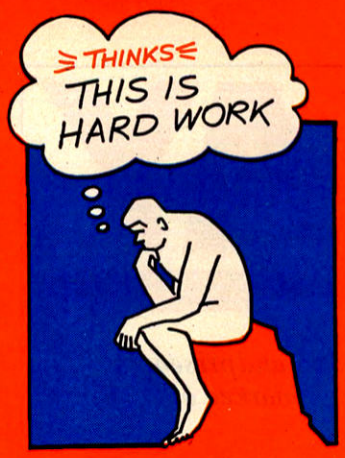
4. Facilities. This category will give some limited measure of the facilities available in the system, but if you want to know more, then read the article! Obviously, I will be more generous in my marking when looking at home computer software. You cannot reasonably compare facilities between packages differing in price by a factor of ten or more.

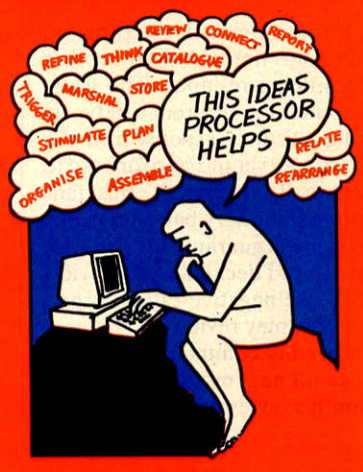
FALC scorecard

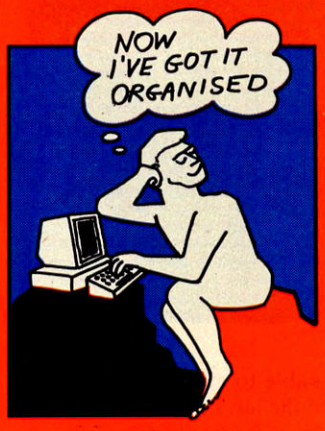
Easy to learn:	**! (passable)**
Easy to use:	**!! (good)**
Reliability/error handling:	**! (passable)**
Facilities:	**!!! (excellent)**

Checklist

Documentation:	100-page manual. Nicely presented and occasionally illustrated. Well indexed. A few minor misprints.
Facilities:	Only simple arithmetic: +−*/, average and mean, but extensive facilities elsewhere: graphing, sorting and searching.
Spreadsheet size:	3600 characters available. Can be configured with up to 100 columns, or up to 100 rows. Defaults to eight columns ×60, each column seven characters wide. Room for two spreadsheets with standard M5, nine with addition of 32k expansion RAM.
Max column width:	30 characters.
Benchmarks:	(see *PCW* Feb 83) 1. (a) (b) (c) could not be tested. (d) 6 rows per second. (e) 4 columns per second. 2. Max rows of text accommodated: 34. 3. Max rows of numbers: 30.
Price:	£34.95 inc VAT. (Sord M5 £149.95).
Available from:	Computer Games Ltd, CGL House, Goldings Hill, Loughton, Essex IG10 2RR.







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SCREENPLAY

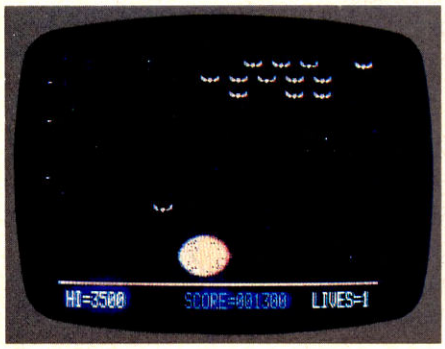
Tony Hetherington gives his verdict on games for the BBC, Dragon and Commodore and presents a contribution from Steve Mann on games for the Spectrum and Oric. (All ratings are marked out of 8).

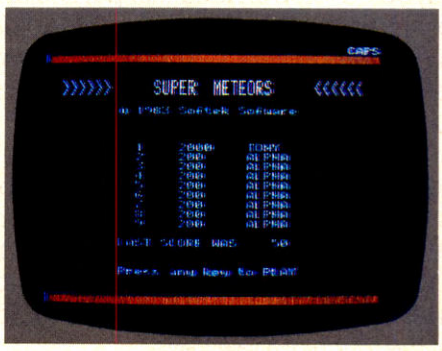
Have you ever wondered how games are selected for inclusion in this section? If so, you'll probably be surprised to discover that it's not entirely a random process. The first task is to weed out the unoriginal, bad and boring games. This leaves a selection of games which are then extensively tested until six are chosen as those most likely to be of interest. Couple with that a desire to present a balanced selection, a fair amount of hair-pulling, and that's about it. This selection 'process' has the effect that only the better software is reviewed with the real turkeys being pushed aside.

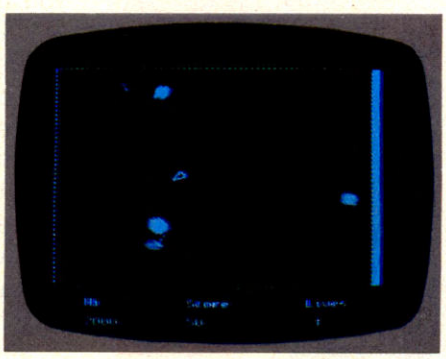
Unfortunately there is no way of telling the quality of a game by its appearance in a shop and so I feel it's time to highlight the really bad ones; and so I'm introducing Screenplay awards. The high spot of these awards will be the presentation of the 'turkey of the year award'. This will be awarded to the year's worst game. The first Screenplay awards will be presented in late 1984 so this is advance warning to allow you to send me any that you feel are suitable for this great honour.

To emphasise the point, take, for example, 'Owzat by Virgin Games which also produced the excellent Falcon Patrol reviewed below. 'Owzat is supposed to be a cricket game simulation, but each running of the program only covers one innings. Therefore, for a test match, the program must be run four times with the other innings scores being re-input. The game also claims to cater for different ball types, each requiring a distinct response from the batsman (a batsman should step forward to meet a short ball). However, this fails dismally since a stationary batsman with a straight bat is almost guaranteed a century. I'll stop there since I decided not to review it — only because negative ratings aren't possible in Screenplay reviews.

With that parting comment I'll put my soapbox away till next month and let you read this month's reviews.







SUPER METEORS/ GALAXIANS

Computer: 48k Oric
Supplier: Softek
Price: £6

More in Softek's range of arcade games for the micro . . . I've lumped these two together because they are both written by the same person — Gordon Russell — and they both run on a micro that has up until now been poorly served by software suppliers.

Regular readers will know that I have done my fair share of wailing and teeth-gnashing over the state of Oric games software. The Oric has been around for nearly a year now, and at a comparable stage in its career the Spectrum was starting to receive the support it deserved from software manufacturers — but, with very few exceptions, Oric games still struggle to become even mediocre. Softek has had the opportunity to improve the machine's tarnished image with a couple of old favourites, and I'd like to state here and now that it has done a fine job. I'd like to — but I'd be lying through my teeth if I did.

Just what is it about this much-maligned machine that encourages such slipshod programming? Okay, the serial attributes make it a bit harder to produce high quality, multi-coloured displays, and the Oric ROM is hardly bug-free, but the mistakes in these programs are down to a lack of thought and an absence of error-checking.

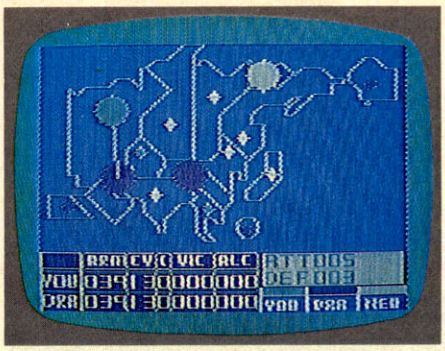
Both programs are a mixture of Basic and machine code and in both cases the controls do not do what they are supposed to do. Super Meteors is better known as Asteroids, and would be a nice implementation if it worked properly. I found that the control keys were wrongly labelled on the cassette insert, the key to rotate the user's craft in an anti-clockwise manner did not work, and the Fire, Thrust and Shield controls would work only when key 'L' was held down in conjunction with the keys that would normally be used. Despite all this, the game was at least playable — which is more than can be said for Galaxians.

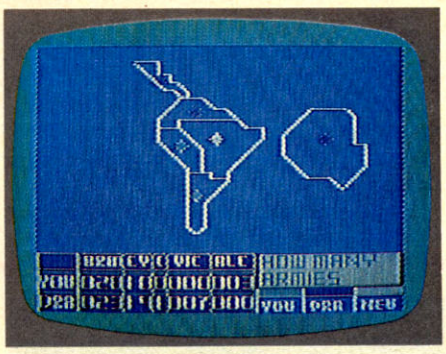
Galaxians has three controls only — to move left, to move right and to fire. Left and fire worked okay — but I found it totally impossible to move right; so if the user moves to the left side of the screen he won't be able to move back again until a life has been lost. Not surprisingly, this renders the game totally unplayable.

I find it inconceivable that these games were not checked before they were released. I've been very impressed with some of Softek's software, particularly its Spectrum toolkit and utility programs. I've tried two versions of Galaxians, and both have the same fault, no matter which loading speed is chosen. A definite black mark for Softek here — I just hope the company withdraws all offending cassettes as quickly as possible. Super Meteors receives a higher rating because I found it quite enjoyable despite the cock-ups; Galaxians receives a zero score because it was completely unplayable.

Super Meteors
Presentation: 3/8
Use of graphics: 5/8
Addictive quality: 2/8
Value for money: 1/8
Galaxians
No marks awarded







EMPIRE

Computer: Dragon 32
Supplier: Shards Software
Price: £7.95

Based largely on the popular board game 'RISK', Empire is a game of global conflict but with a subtle difference. In this game your aim is not world domination but that of preventing the evil Dragon Empire's expansion.

The world is divided into six continents: North America, South America, Europe, Africa, Asia and Australasia. Each of these is subdivided into a total of 39 states with your object being to prevent the Dragon Empire taking over the world. Should you fail then the computer tells you that the Dragon Empire will rule forever.

At the beginning of the game both you and the Empire have 13 states each, the remaining states being allocated to a neutral country. This neutral power will not attack anyone but will defend violently if provoked. You then must place your 26 extra armies — this is arguably the most important step in the game because the Empire attacks first and if you've spread your forces too thinly you may not have many left.

The game is played in turns with the Empire moving first. Before you attack you have a number of additional armies to allocate; the exact number of these being determined by the number of states you have and a bonus five armies for each complete continent. This highlights an important strategic aspect of the game since all continents are worth this bonus. However, Asia has 12 states but South America has only four. Consequently in the early part of the game, when forces are limited, these small continents are vital.

Once these armies are allocated the battles commence. Armies in a state can attack any enemy in an adjacent state. A blow by blow account of the battles as armies are lost follows. If victory is yours you can move in your armies and continue your attacks. If you come a poor second then you lose the state from which you were waging your attack and forfeit your turn.

The graphics of the game are adequate but not over impressive with the options of a view of the whole world (shaded accordingly) or a close up of each of the continents. On the continent maps, little coloured blobs represent single armies with the blobs growing according to the number of armies they represent.

A flashing cursor alternates between the states displayed on the screen — by pressing the space bar you can select a state for attack or army allocation. This can be a little slow especially if you've got about 50 armies to allocate since you can only place nine at one time.

There are eight different levels of play with the first level being too easy whereas level eight is almost impossible. The level chosen seems to determine the bias towards the Empire for in one game at level eight the Empire beat a force of 12 armies with only two of its own.

One final word of warning. Don't spend too long thinking about your next move because unless you touch the keyboard within 20 seconds, your turn is lost — which is disastrous.

Presentation: 4/8
Use of graphics: 4/8
Addictive qualities: 6/8
Value for money: 6/8







PINBALL ARCADE

Computer: BBC Micro
Supplier: Kansas City Systems
Price: £9.95

A long, long time ago before the first Space Invader bleeped, the arcades were full of bumpers bumping and flippers flipping because pinball ruled supreme. But soc n the joystick and the fire button signalled 'game over' for these ball-bouncing tables and aliens were abound. However, now arcade games have become faster, more complex and generally more difficult, the number of people who can play them has decreased and pinball is making a comeback. It's only natural that there should be a version of pinball for home computers and here is one for the BBC Micro.

This is by no means the first video pinball but it differs from the others in the respect that you can design your own table.

The screen is divided into two sections, the table itself and the menu options used to build up the table.

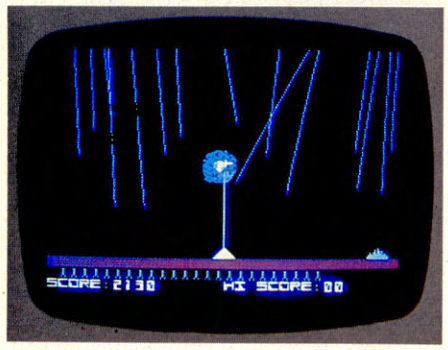
The table is built up using a cursor which is controlled by the cursor keys and the space bar. The 'action' of the cursor is very smooth and moves fast enough, but without being too fast to control. To construct a table you simply select a shape from those displayed and position it where you want it, and so on, until the table is complete. There are six pages of possible shapes with one being displayed on the screen at any one time with the PAGE menu option being used to change the page displayed. Shapes available for selection include bumpers, wires, slings and targets. The fine tuning can be done by setting the SCORE and BOUNCE for the slings, bumpers and targets and the strength of the FLIPpers and the TILT or speed of the table.

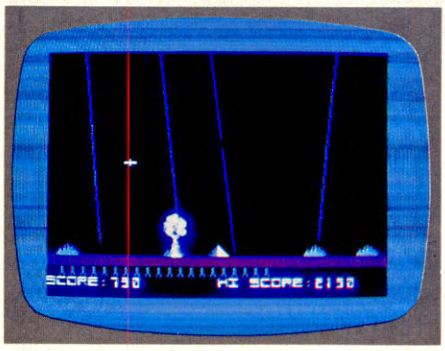
To play the game, select the PLAY option and away you go. To enter the ball you hold down the space bar then release it; the longer you hold it down the faster the ball will be. The nicely placed Z and / keys operate the flippers and you get five balls per game.

Should the game be going badly you can halt the game and move, for example, a bumper over the gap where the first three balls fell through and off you go again.

Any tables you make can be saved to be loaded in again when required. The game will probably be at its best when played between two or more players with each one setting up the table for the next. Incidentally my best score was well into the thousands (once those nasty gaps were covered up) and I'm still going strong. How does that song go . . . 'He's a pinball wizard . . .'

Presentation 5/8
Use of graphics 8/8
Addictive quality 5/8
Value for money 7/8







REPULSAR

Computer: 16/48k Spectrum
Supplier: Softek
Price: £6

Repulsar is simply Missile Command with a new title, and is the only implementation of this classic arcade game I have so far seen on the Spectrum.

I'm sure that everyone is familiar with the arcade version — just in case they're not, let me briefly outline the story behind the game. Once more, we find ourselves in a 'save the Earth from the alien menace' situation: the player has the awesome responsibility of single-handedly defending the last six cities on Earth from the hordes from space, whose missiles rain down in ever-increasing numbers at ever-increasing speeds. The bombs are, in fact, beams of light that head citywards from the top of the screen; these are wiped out by positioning a cross-hair sight at the lowest point of the beam and then firing. As an added complication, alien craft move horizontally above the cities, dropping further bombs.

Repulsar comes in two versions — for Kempston joystick and for normal keyboard operation — one on each side of the cassette tape. Attacks come in waves, and you are limited to 30 missiles per wave, so care must be taken to conserve ammunition. At the centre of the line of cities is a missile store — this must be protected at all costs. 50 points are scored for each bomb destroyed, and at the end of each attack wave a bonus is awarded, based on the number of cities left and the number of missiles remaining. Alien attacks start fairly sedately, but the speed increases with each wave and the action becomes pretty frantic by the seventh or eighth screen.

This is certainly a fair representation of the arcade game, although, understandably, there are some limitations. In the arcade version it is possible to track the sight quickly across the screen, laying down a barrage of missiles — on the Spectrum this is not possible. Repulsar does not appear to feature bonus cities — the arcade game allows an extra city every 10,000 points, which makes for a longer and more enjoyable game. But minor quibbles aside, I must admit that I found this reasonably addictive.

Presentation: 6/8
Use of graphics: 6/8
Addictive quality: 5/8
Value for money: 6/8







LUNAR JETMAN

Computer: 48k Spectrum
Supplier: Ultimate Play The Game
Price: £5.50

With comparatively few releases under its belt, Ultimate Play The Game (from here onwards referred to simply as 'Ultimate') has gained a reputation for high-quality, addictive games with excellent graphics. Lunar Jetman will do nothing to diminish that reputation.

There seems to be something of a trend at the moment for developing a character or concept that subsequently reappears in other games — witness Horace (of Skiing and Spiders fame), Mad Martha, and Cuthbert, who appear in a set of Dragon escapades. Lunar Jetman appears to be a sequel to the chart-topping Jet Pac: the cassette insert tells us that Jetman's poorly assembled multi-stage rocket (Jet Pac concerned Jetman's attempts to put the rocket together while plundering alien planets of their valuables) has started to disintegrate, forcing a crash-landing on a strange, undiscovered world. Understandably somewhat miffed at the asset-stripping activities of Jetman and out for revenge, the planet's inhabitants are keen to wipe out Jetman before turning their attention to the nearby Earth. To stop

them, Jetman has to destroy single-handedly all the alien attack mechanisms and save Earth from a terrible fate. Equipped only with a Hyperglide Moon Rover, Quad Photon Laser Phaser and his Hydrovac Jet Pac, Jetman roams the planet surface, making use of any equipment he can find lying about — but, as the cassette tells us, it's a pity he can't find the relevant operating manuals.

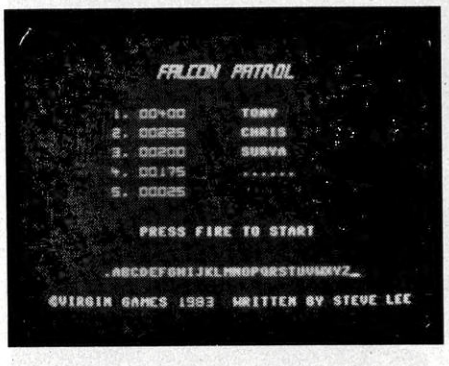
As we've come to expect from Ultimate, the graphics are truly stunning — and very fast-moving. The game is for one or two players, and has provision for Kempston or cursor-controlled joysticks. But joysticks may be more trouble than they're worth in this game — the controls are so complex that sticks have to be used in conjunction with the keyboard, and it isn't that easy to switch from one to the other. The controls move Jetman left and right, up and down; there is a key to power our eponymous hero's Jet Pac, and one to allow him to hover; he may pick up or drop any useful-looking object; another key allows him to enter or leave a suitable piece of equipment (ie, his Moon Rover or a teleportation booth); and, finally, the whole game may be paused by hitting the 'O' key.

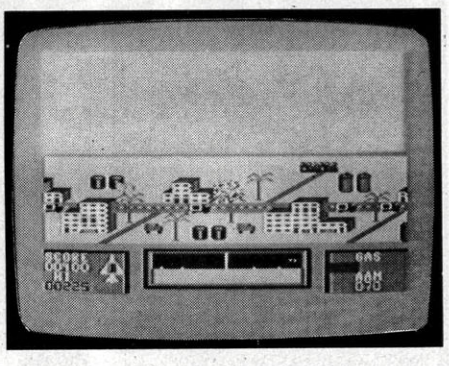
There's much too much going on in this game to allow easy summarisation — in fact I doubt very much whether I've discovered all the possible hazards yet. But as a brief rundown, let me tell you that Jetman has the option of walking, flying through the air under Jet Pac power, or travelling in comfort and relative safety aboard the Moon Rover. Meteors and missiles fly about at a great rate of knots, knocking large chunks out of the planet surface — these impede progress of the Moon Rover and force Jetman to leave the vehicle if he wants to continue. However, there are various bridging units which can be used to cross these obstacles and a teleport system which will move him to a new location. There is a constant onscreen display that gives details of how much time and fuel is left — when the time reaches zero a newsflash appears to warn of a missile approaching the Moon Rover: eight hits will disable this missile but failure results in the Rover's destruction and the end of the game. There is also a bomb with a burning fuse that appears next to the Moon Rover, but I have not lasted long enough to discover what happens when this goes off.

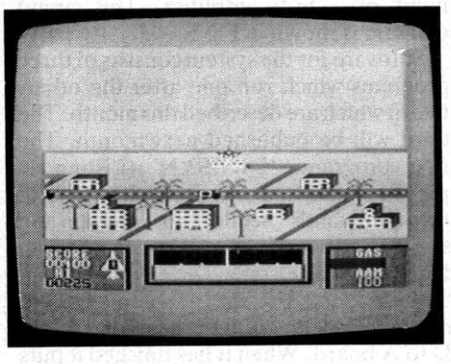
Ultimate has a strange idea that 'armament' is spelt 'armourment' and also insists that the attacking missiles are 'linoleum-shelled', which is reminiscent of the *Not The Nine O'Clock News* sketch in which Rowan Atkinson instructs his troops on what to do when the enemy attacks with 'fierce tables' . . .

All in all, though, this is a more than worthy successor to Ultimate's earlier Spectrum releases. It certainly takes a while to get used to all the controls and it's not the sort of game that can be mastered in an afternoon — which is all to the good, as it means that Lunar Jetman is likely to provide weeks and weeks of entertainment. This one ranks with Manic Miner, Zzoom, Pimania and The Hobbit as classic Spectrum games.

Presentation: 7/8
Use of graphics: 8/8
Addictive quality: 7/8
Value for money: 7/8







FALCON PATROL

Computer: Commodore 64 & Joystick
Supplier: Virgin Games
Price: £5.95

Falling squarely into the 'I'll just have one more go' group of games is Falcon Patrol. It's a defender style game in which you control a VTOL (Vertical Take Off and Landing) jet with the job of defending a city from attack by enemy planes.

Your defending plane is blue and the attacking aircraft are red, and they turn and bank quite realistically through an intelligent use of graphics. In fact the graphics in this game are of a high quality, literally streets ahead of the other programs from the Virgin stable. No longer are you confronted with the usual, meaningless lunar landscape but that of a city complete with roads. I tried landing on one of these roads with unfortunately predictable results so it's just as well that proper landing sites are spaced throughout the city. These sites aren't just a convenient place to park your plane between attack waves but are useful for refuelling and rearming whenever you get the chance to do so. However, be warned though, because the enemy is unsporting enough to shoot you even while you're on the ground, which just isn't cricket; so be prepared to go into the fray without your full complement of fuel or missiles.

This refuelling wasn't a problem in my early attempts since I seemed to be very proficient at ramming the enemy — which as you can imagine isn't a particularly cost effective form of defence. I managed to shoot down a couple of planes which resulted in a first game score of 100 points. The next couple of games saw a good many planes biting the dust, including some of the enemy's — and my first comical attempts to land for refuelling. It was then that I discovered the ruthless nature of my opponent as I lost a plane on the landing strip which made my decision to refuel early well worthwhile.

The aid and assistance of a passing Business Computing Editor saw off the first attack wave without loss but this was only replaced by another whose attempts to shoot me down were dashed only by a rather abortive victory roll.

Swapping to a more sturdy joystick which could take my heavy-handed approach certainly helped and I was soon shooting down wave after wave of enemy aircraft. As you progress through the waves the number of planes aimed at you increases. This starts at three but my final plane (of three) was shot down by an aircraft in an attack wave of five planes.

If you've got time during the game, you can observe the displays on the bottom of the screen which include a score/planes left display, a defender style radar and a section showing fuel and number of missiles remaining.

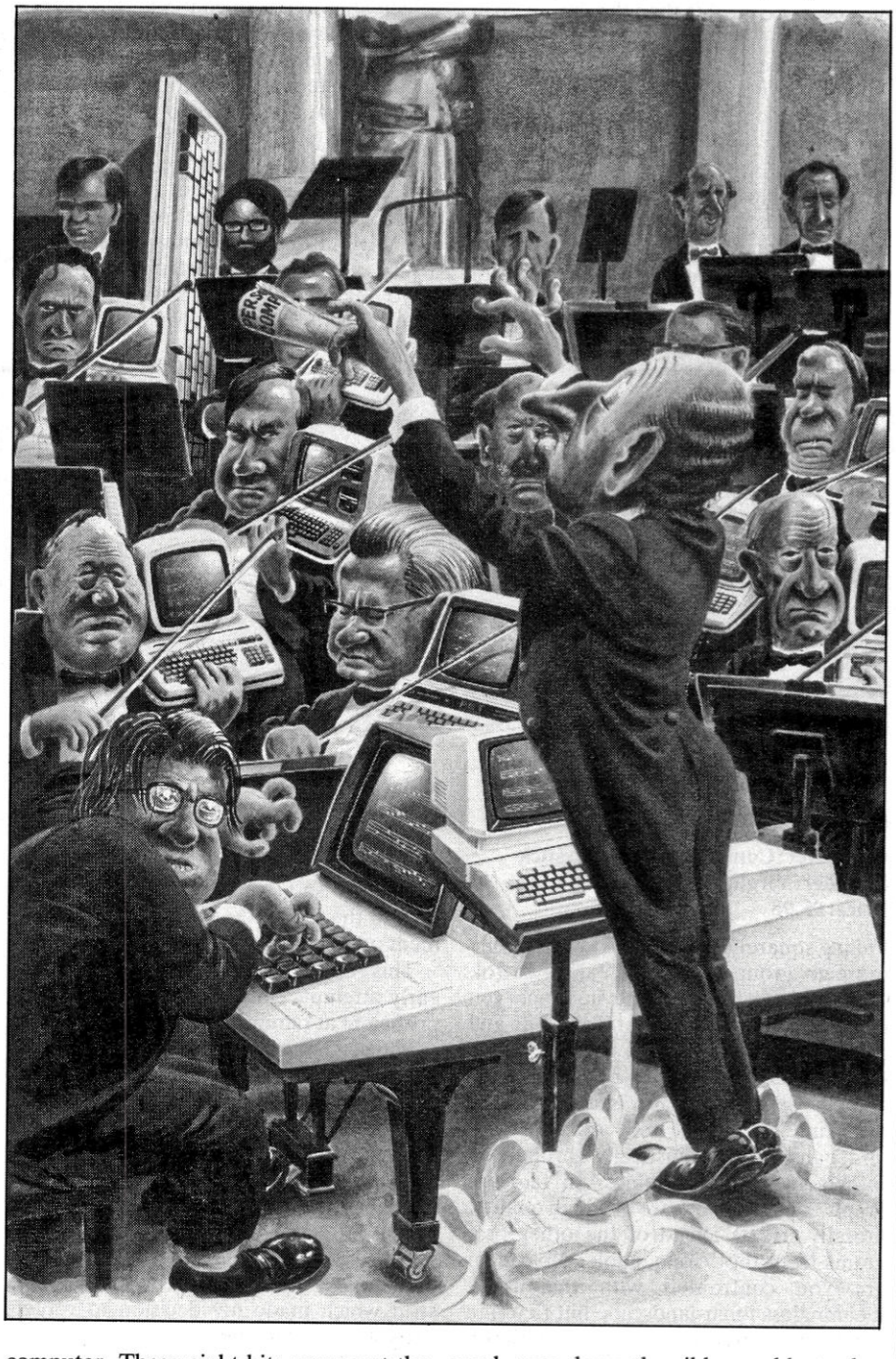
Should you play the game, try to look after your planes because they're actually quite remarkable. They look like Hawks (as used by the Red Arrows), and fly like Harriers armed with one hundred anti-aircraft missiles on board!

Presentation 4/8
Use of graphics 8/8
Addictive quality 7/8
Value for money 7/8

MUSIC MICRO, PLEASE

PART 2: DIGITAL SYNTHESIS

In the second of this three part series Simon Tait begins to set up a digital synthesis system on the BBC Micro. You'll have enough here to keep you working until the final part next month which completes the project.



The system described in this article needs a BBC Model B Computer (with OS 1.2) and a digital to analogue (D to A) interface board. The D to A board consists of three chips (two DAC 08 type multiplying D to A convertors and a 741 operational amplifier) and can be built by anyone with a little experience. Probably the most expensive part of the hardware is the ribbon cable and two speedblock connectors which plug into the computer. Power supplies needed are +9v and −9v which can be simply provided by PP3 type batteries. The output of the board (mono) is connected to the Phono input of a hi-fi amplifier. The circuit diagram is shown in Fig 1.

Software for the system consists of three programs which run one after the other, two of which are described this month. The third will be published next month. The first program, 'DIGISYN' (Listing 1) programs the function keys with some of the commands needed to operate the system and sets the PAGE to make room for the machine code. The other program 'SYN.ASM' (Listing 2) assembles the machine code to output the samples to the D to A board. When it has finished it puts the address of the start of the code into the variable M%. The final program 'SYN. BAS' provides the user interface doing the calculations needed to produce the sounds specified, and will appear in Part 3.

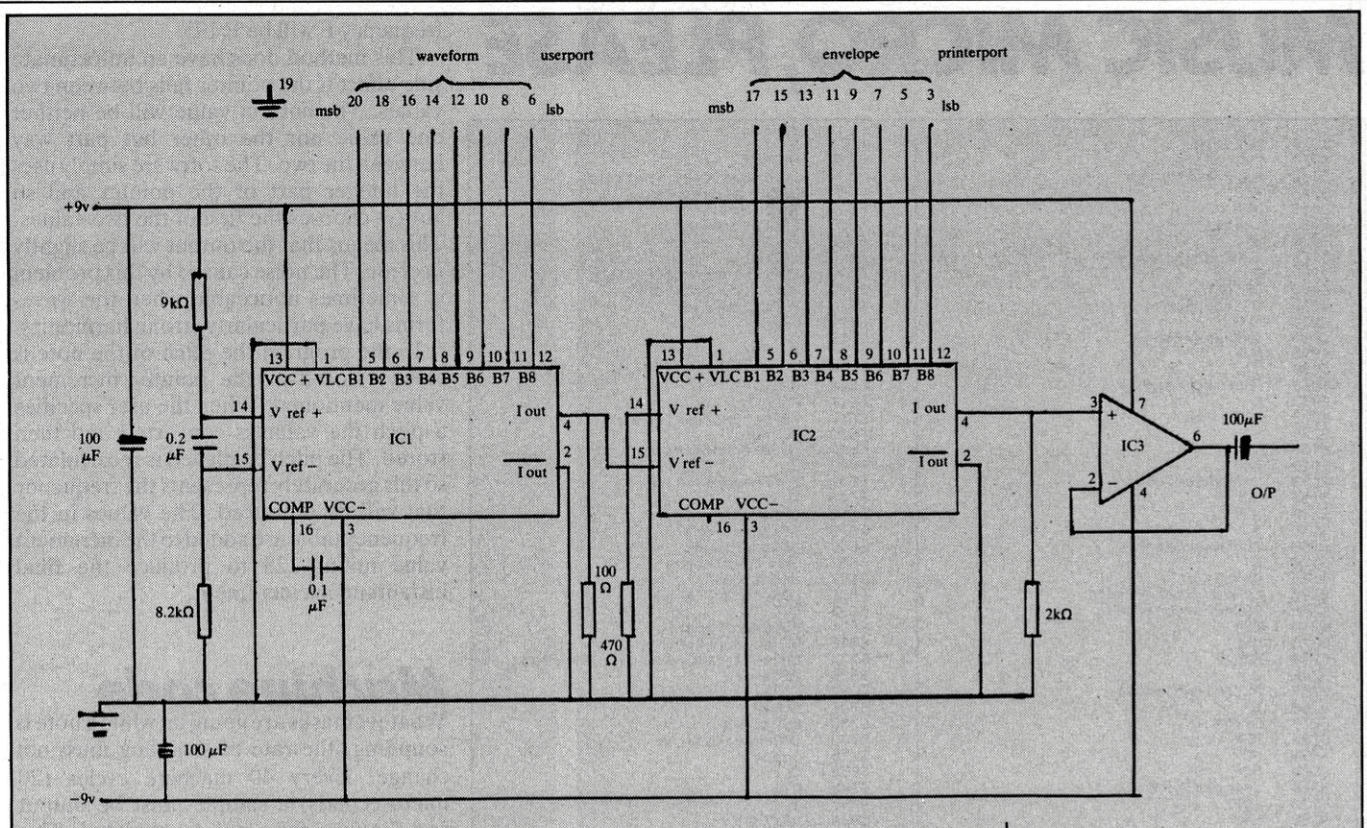
How the system works

Hardware:

The hardware has the function of converting numbers fed to the computer user and printer ports to an analogue signal. The two ports are both provided in the computer by a single 6522 Versatile Interface Adaptor chip. This device is very sophisticated, and provides extra functions apart from simple input/output. None of these special functions are used by the machine code which outputs samples via this chip. Once the ports are configured as simple outputs (lines 5220 to 5270 in 'SYN.ASM') the program can simply write numbers to the two ports as to any other memory locations in the computer.

Samples consisting of eight bit numbers or 'bytes' remain latched (stored) at the ports until they are rewritten by the computer. These eight bits appear at the connectors for printer and user ports in the form of eight pins, each of which can assume a voltage of 0v or 5v. The two sets of eight signals from the two connectors, together with other signals which are not used, pass down the ribbon cable to the interface board.

The two sets of signals arrive at their respective digital to analogue convertors. These convertors have the ability to multiply the quantity they are converting



IC	Type
1	NE 5008 N
2	NE 5008 N standard DAC
3	7 4 1 08 type

Fig 1. Interface board circuit diagram

```
 10 REM******** Digisyn 0.3 ********
 20 REM (c) S.P.Tait 24th March 1983
100 *KEY0 TABLE|M
110 *KEY1 HARMONIC|M
120 *KEY2 SEGMENT|M
130 *KEY3 NEXT|M
140 *KEY4 LAST|M
150 *KEY5 INSERT|M
160 *KEY6 DELETE|M
170 *KEY7 PITCH|M
180 *KEY8 DURATION|M
190 *KEY9 PLAY|M
200 CLS
210 PRINT'"        DIGISYN 0.3"
220 PRINT "        ___________"
230 PRINT'"Please wait for Program to load"
240 PRINT'''
290 PAGE=&E00+&200
300 CHAIN"SYN.ASM"
320 END
```

Listing 1: DIGISYN

by a reference input. On the convertor board a constant reference is used for the first convertor and the output of this convertor provides the reference for the second convertor. In this way an analogue signal, which represents the value of the sample at the user port multiplied by the number at the printer ports, is produced.

Since the analogue signals, with which the convertors deal, are currents, and the final output needed is a voltage, a further component is needed in the circuit. A resistor is connected to the output of the second convertor to produce a voltage signal. An operational amplifier buffers the voltage to provide the final output.

Software:

The subroutine to output samples to the D to A board is written in machine code. Samples must be output at the rate of 50000

```
  10 REM********* Digisyn 0.X *********
  20 REM (c) S.P.Tait 24th March 1983
 500 code%=PAGE-512:M%=code%
1000 mem%=&80
1010 soundoffset%=mem%
1020 tunePage%=1+mem%
1030 frequencyoffset%=2+mem%
1040 frequencyPage%=3+mem%
1050 envelopeoffset%=4+mem%
1055 envelopePage%=5+mem%
1060 controloffset%=6+mem%
1070 controlPage%=7+mem%
1080 Pitchoffset%=8+mem%
1090 Pitchfrac%=9+mem%
1100 duration%=10+mem%
1110 waveformoffset%=11+mem%
1120 waveformPage%=12+mem%
1130 waveformfrac%=13+mem%
1140 counter%=14+mem%
1150 Pitchfracstore%=15+mem%
1160 Pitchoffsetstore%=mem%+16
1200 via%=&FE60
1210 portenvelope%=via%
1220 ddrb%=via%+2
1230 ddra%=via%+3
1240 acr%=via%+&B
1250 pcr%=via%+&C
1260 portsound%=via%+&F
1300 tables%=&3000:?tunePage%=0
1310 noofParams%=6
1320 lastsound%=256/noofParams%-1
5000 REM*****MAIN MACHINE CODE********
5010 FORopt%=0 TO 3 STEP 3
5020   P%=code%
5200   [
5210   OPTopt%
5220   \set uP VIA
5230   LDA#0
5240   STApcr%
5250   LDA#&FF
5260   STAddra%
5270   STAddrb%
5280   \mask interrupts) set binary
5290   SEI
5300   CLD
5310   \zero offsets etc.
5320   LDA#0
5330   STAfrequencyoffset%
5340   STAenvelopeoffset%
5350   STAcontroloffset%
5360   STAwaveformoffset%
5370   STAwaveformfrac%
5380   STAportsound%
5390   STAportenvelope%
5400   \set uP a tune
5410   LDA#0
5420   STAsoundoffset%
5430   LDAtunePage%
5440   CLC
5450   ADC&439
5460   STAtunePage%
5470   \main tune
5480   .repeatsound%
5490   \Getinitial values
5500   LDY#0
5510   LDA(soundoffset%),Y
5520   CLC
5530   ADC&439
5540   STAfrequencyPage%
5550   INY
5560   LDA(soundoffset%),Y
5570   CLC
5580   ADC&439
5590   STAenvelopePage%
5600   INY
5610   LDA(soundoffset%),Y
5620   CLC
5630   ADC&439
5640   STAcontrolPage%
5650   INY
5660   LDA(soundoffset%),Y
5662   SEC
5664   SBC#&80
5670   STApitchfracstore%
5680   INY
5690   LDA(soundoffset%),Y
5710   SBC#0
5720   STApitchoffsetstore%
5740   INY
5750   LDA(soundoffset%),Y
5760   STAduration%
5770   LDX#0
5780   LDY#0
5782   LDA#0
5784   STAcounter%
5790   LDA(frequencyoffset%),Y
5800   ADCpitchfracstore%
5810   STApitchfrac%
5812   LDApitchoffsetstore%
5814   ADC#0
5816   STApitchoffset%
5820   LDA(envelopeoffset%),Y
5830   STAportenvelope%
5840   LDA(controloffset%),Y
5842   CLC
5844   ADC&439
5850   STAwaveformPage%
5860   .repeatnote%
5870   NOP
5880   ]
5890   PROCmacrosample
5900   [
```

Listing 2: SYN.ASM *continued . . .*

MUSIC MICRO, PLEASE

```
5910   OPToPt%
5920   DECcounter%
5930   BNErePeatnote%
5940   NOP
5950   NOP
5960   .rePeatnote%
5970   ]
5980   PROCmacrosamPle
5990   [
6000   OPToPt%
6010   DECcounter%
6020   NOP
6030   BNErePeatnote%
6040   NOP
6050   ]
6060   PROCmacrosamPle
6070   [
6080   OPT oPt%
6090   NOP
6100   NOP
6110   NOP
6120   .rePeatbrid9e%
6130   NOP
6140   NOP
6150   ]
6160   PROCmacrosamPle
6170   [
6180   OPToPt%
6190   LDAwaveformoffset%
6200   BPLrePeatbrid9e%
6210   NOP
6220   NOP
6230   NOP
6240   ]
6250   PROCmacrosamPle
6260   [
6270   OPToPt%
6280   NOP
6290   NOP
6300   NOP
6310   .rePeatbrid9e2%
6320   NOP
6330   NOP
6340   ]
6350   PROCmacrosamPle
6360   [
6370   OPToPt%
6380   LDAwaveformoffset%
6390   BMIrePeatbrid9e2%
6395   INY
6400   LDA(controloffset%),Y
6410   CLC
6420   ADC&439
6430   STAwaveformPa9e%
6440   ]
6450   PROCmacrosamPle
6460   [
6470   OPToPt%
6490   ]
6500   PROCmacrosamPle
6510   [
6520   OPToPt%
6530   LDA(envelOPeoffset%),Y
6540   STAPortenvelOPe%
6550   ]
6560   PROCmacrosamPle
6570   [
6580   OPToPt%
6590   LDA(frequencyoffset%),Y
6600   ADCPitchfracstore%
6610   STAPitchfrac%
6611   PHP
6612   ]
6613   PROCmacrosamPle
6614   [
6615   OPToPt%
6616   PLP
6617   LDAPitchoffsetstore%
6618   ADC#0
6619   STAPitchoffset%
6620   ]
6630   PROCmacrosamPle
6640   [
6650   OPToPt%
6670   CPYduration%
6680   BEQcontinue%
6685   JMPrePeatnote%
6687   .continue%
6690   LDAsoundoffset%
6692   CLC
6694   ADC#noofParams%
6700   STAsoundoffset%
6710   CMP#(lastsound%+1)*noofParams%
6720   BEQdone%
6730   LDA(soundoffset%,X)
6740   CMP#0
6750   BEQdone%
6760   JMPrePeatsound%
6770   .done%
6775   CLI
6780   RTS
6790   ]
6800   NEXTOPt%
6805 CHAIN"SYN.BAS"
6810 END
10000 REM*****MACHINE CODE SUPPORT*****
10010 DEFPROCmacrosamPle
10020 [
10030 OPToPt%
10040 LDA(waveformoffset%,X)
10050 STAPortsound%
10060 LDAwaveformfrac%
10070 ADCPitchfrac%
10080 STAwaveformfrac%
10090 LDAwaveformoffset%
10100 ADCPitchoffset%
10110 STAwaveformoffset%
10120 ]
10130 ENDPROC
```

per second and so Basic would be far too slow. There are just 20 microseconds for the software to produce the next sample; the 6502 microprocessor used in the BBC computer may typically execute 13 instructions in this time.

Although the sample rate is stated as 50kHz, not every parameter of the sound is changed every sample. The program outputs samples from the waveform table at the full 50kHz, or every 20 microseconds, but the frequency and envelope is changed after about six milliseconds or 256 waveform samples.

Frequency

If the program were to output all 256 values in a waveform table one after the other, the period of the waveform would be 256 x 20 microseconds, giving a frequency of 195 Hz. To achieve lower or higher frequencies one possibility would be to change the sample rate. For a moderately high note, however, this would mean a time between samples of less than the 0.5 microsecond machine cycle of the microprocessor.

The method used in the system gets around the problem by skipping values in the waveform table for a higher frequency and by lingering on a value for more than one sample for a lower frequency. This happens quite naturally if the pointer used to point to the value in the waveform table has integer and fraction parts. The integer part points to the value in the waveform table and the fractional part is ignored except when the pointer is moved on. The amount to add to the pointer for a frequency F will be F/195.

This method does have an unfortunate side effect if the pointer falls between two values. The correct value will be neither one value nor the other but part way between the two. The software simply uses the integer part of the pointer and so always chooses the first of the two values. This means that the output will be slightly in error. The noise caused by this problem is sometimes noticeable when the waveforms have particularly strong harmonics.

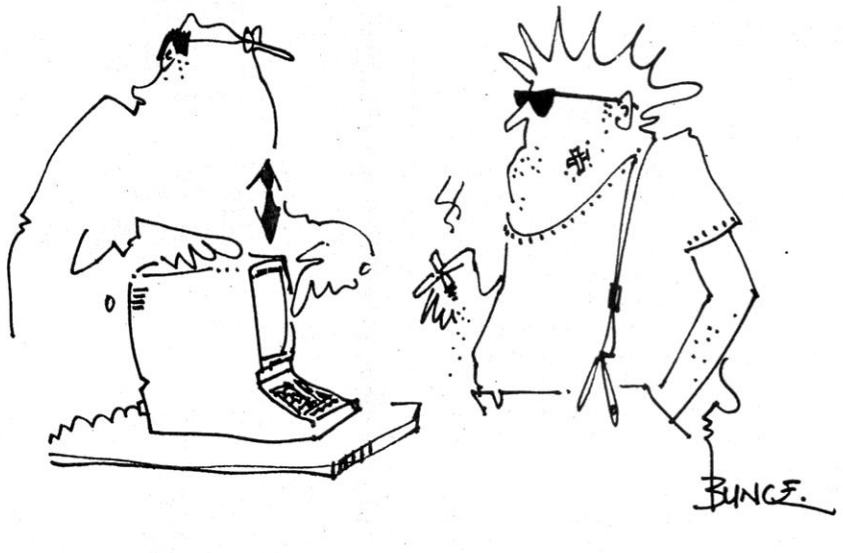
In the program the pitch of the note is always stored as the pointer increment value mentioned. When the user specifies a pitch the value is converted and then stored. The pitch displayed is recalculated so this accurately represents the frequency that will be produced. The values in the frequency table are added to the increment value minus 128 to produce the final instantaneous increment.

Machine code

Whatever tasks are going on while a note is sounding, the rate of sampling must not change. Every 40 machine cycles (20 microseconds) a sample must be output and the waveform pointer updated. This would seem to be an ideal candidate for a subroutine except that calling a subroutine takes 10 of the 40 cycles available. The code to output and update must therefore be written 'in-line' wherever it crops up.

To simplify matters this group of instructions is defined as a 'macro'. This means that a Basic procedure is written which will assemble this group of instructions whenever needed (lines 10000 to 10130 in SYN.ASM). After the sample is changed we have 13 cycles left before we must output the next sample.

Next month: Part 3 — Program 'SYN.BAS' and full instructions.



'Let me put it this way — it can remember what was in the charts last year but it can't remember why!'



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CHECKOUT

EASYSPEAK

A computer with speech synthesis is considered 'more intelligent' than one without, but electronic 'speech' is often unintelligible. Surya listens hard and reports.

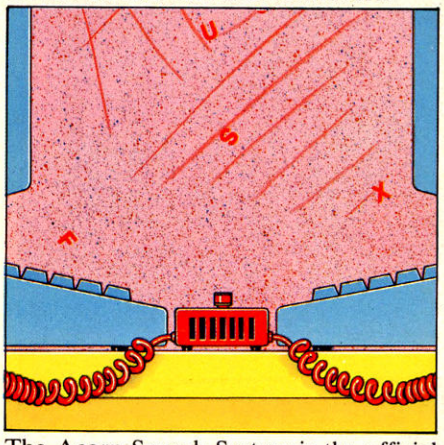
Speech synthesisers have an irresistible appeal. Logical or not, the connection people make between speech and intelligence is a natural one; a computer which talks certainly appears to be one step closer to intelligence than one which simply displays messages on a screen.

You have only to wander around a computer show to witness this appeal in action. The moment a metallic voice begins cackling inane remarks ('the B-B-C computer is good for you'), great masses of people make a beeline towards it.

As I said in my review of the 'Talking Computer' (November *PCW*), speech synthesis is very much in its infancy. Even sophisticated equipment costing several thousands pounds still sounds rather like a warped record played backwards at the wrong speed. Though the art has a long way to go before it approximates a life-like voice, speech synthesis units are currently available at a price which puts them within reach of hobbyists. In this Checkout, I shall be taking a look at four synthesisers for use with some of the most popular micros.

Acorn speech system

For use with: BBC Micro
Cost: £55 inclusive of fitting
Available from: Acorn dealers
Review carried out on: BBC Model B



The Acorn Speech System is the official Acorn speech synthesiser of Kenneth Kendall fame. The chips must be installed by an Acorn dealer; *PCW*'s Home Computing Editor and I spent around an hour with screwdriver and soldering iron fitting it ourselves, and we confirm that this ruling is not without reason.

The BBC speech synthesiser is unique among the products tested in this review in that it includes a dictionary of 165 words and part-words (—ing, —th, —ed, and so on) in ROM form. Acorn has coined the word PHROM (PHrase Read-Only Memory) to describe this chip. The dictionary is well-chosen, the words and part-words forming a useful base of pre-programmed words.

The quality of the sound is good. The data held in the PHROM is based on the recorded voice of Kenneth Kendall, the BBC (what else?) newsreader. Whether the sounds produced by the system bear even a passing resemblance to said newsreader depends upon the pitch setting of a variable resistor (VR2) on the main circuit board. On Issue 4 (and later) machines, this is to be found just behind the keyboard, next to the power supply. On the *PCW* machine at least, it is coloured yellow. It can be easily adjusted by removing the case of the machine and turning the screw to suit. When set to a fairly low pitch, the consensus of opinion among *PCW* staff was that, 'yes', it did sound like Kenneth Kendall. On a somewhat higher pitch setting, the voice bore more of a resemblance to a castrated duck.

Owners of earlier issue (2 and 3) machines are not given the luxury of a variable resistor. The only way to alter the pitch on these machines is to replace the fixed resistor connecting chips 98 and 99 with one of a different value. Acorn supplies two spare resistors in the upgrade kit for this purpose.

Producing words and sentences by compounding sounds from the PHROM is extremely easy. The syntax is SOUND —1,code,0,0 where code is the value of the sound as defined in the user guide. The code for the phonetic alphabet is the ASCII code of each letter: A is 65, B is 66, and so on. The ASCII codes of the characters 0 to 9 inclusive give the corresponding phonetic sounds. ASCII codes of lower-case letters produce commonly-used words beginning with the associated letter. Thus, 97 (ASCII code of 'a') produces the sound 'and', 98 (ASCII 'b') produces 'bad' and so forth throughout the alphabet. A full list of codes and the associated sounds is given in Fig 1.

Word or word-part number	Word	Word or word-part number	Word
127	(0.125)	160	ACORN
128	(0.25)	161	AFTER
129	(TONE 1)	162	AGAIN
130	(TONE 2)	163	AMOUNT
131	—D	164	AN
132	—ED	165	AND
133	—ING	166	ANOTHER
134	—S	167	ANSWER
135	—TEE	168	ANY
136	—TH	169	AVAILABLE
137	—T	170	B,BEE,BE
138	—	171	BAD
139	ZERO (0)	172	BETWEEN
140	HUNDRED (00)	173	BOTH
141	THOUSAND (000)	174	BUTTON
142	ONE,WON	175	C,SEE,SEA
143	TWO,TO,TOO	176	CASSETTE
144	2— (TWEN—)	177	CHARACTER
145	THREE	178	COMPLETE
146	3— (THIR—)	179	COMPUTER
147	FOUR,FOR,FORE	180	CORRECT
148	4— (FOR—)	181	D
149	FIVE	182	DATA
150	5— (FIF—)	183	DATE
151	SIX	184	DO
152	6— (SIX—)	185	DOLLAR
153	SEVEN	186	DONT
154	7— (SEVEN—)	187	DOWN
155	EIGHT,ATE	188	E
156	8— (EIGHT—)	189	EACH
157	NINE	190	ELEVEN
158	9— (NIN—)	191	ENGAGED
159	A	192	ENTER

193	ERROR	243	POINT
194	ESCAPE	244	POSITIVE
195	F	245	POUN—
196	FEW	246	PRESS
197	FILE	247	PROGRAM
198	FIRST	248	Q,QUEUE
199	FOUND	249	R,ARE
200	FROM	250	RED
201	G	251	RESET
202	GOOD	252	RETURN
203	H	253	RUN
204	HAVE	254	RUNNING
205	I,EYE	255	S
206	ILLEGAL	256	SAME
207	IN—	257	SCORE
208	INPUT	258	SECOND
209	IS	259	SMALL
210	J,JAY	260	START
211	K	261	STOP
212	KEY	262	SWITCH
213	L	263	T,TEA,TEE
214	LARGE	264	TEN
215	LAST	265	THANK
216	LINE	266	THAT
217	M	267	THE
218	MANY	268	THEN
219	MINUS	269	THIRD
220	MORE	270	THIS
221	MUST	271	TIME
222	N	272	TRY
223	NAME	273	TWELVE
224	NEGATIVE	274	TYPE
225	NEW	275	U,YOU
226	NO,KNOW	276	UH
227	NOT,KNOT	277	UP
228	NOW	278	V
229	NUMBER	279	VERY
230	O	280	W
231	O'CLOCK	281	WANT
232	OF	282	WAS
233	OFF	283	WERE
234	OLD	284	WHAT
235	ON	285	WHICH
236	ONLY	286	X
237	OR	287	Y,WHY
238	P,PEA	288	YEAR
239	PARAMETER	289	YES
240	PENCE	290	YOUR
241	PLEASE	291	Z
242	PLUS		

Fig 1 Acorn speech system codes and associated sounds

Accessing the PHROM dictionary is an easy way of producing recognisable speech. But, well-planned as the dictionary is, users also need some way of constructing their own words. The procedure necessary to do this is nothing less than horrendous.

Having received the Acorn chip at the last minute, I had very little time to experiment with user-defined words. But, reading the appropriate section of the user guide, the user is thrown head first into a mass of jargon: registers, op-codes, accumulators, 128-bit FIFO buffers, stack pointers and worse abound. A demonstration program is included, the first line of which is a REM statement which reads 'This program assumes you have already loaded the speech data into memory, starting at location SPEECH%.' Prior to this point in the guide, there had not been the slightest clue as to how you were supposed to construct and enter your data into memory.

In fairness to Acorn, I didn't have sufficient time to examine the process in any kind of detail, but I was not at all impressed either by the complexity of the procedure necessary to define new sounds or by the explanation offered in the user guide.

Acorn intends to bring out further PHROMs at a future date. The system allows for up to sixteen such to be simultaneously connected. No details of these were available at the time of writing.

So far as using the PHROM dictionary is concerned, this system is superb. It is easy to use, has a relatively life-like voice and is reasonably flexible. When it comes to creating your own base-sounds, however, the comments which come to mind are not exactly complimentary.

If Acorn produces the promised further PHROM dictionaries, and these are as sensible as the first, then the Acorn Speech system will be a very nice one indeed. Unfortunately, waiting for Acorn to produce promised products has been known as a rather time-consuming pastime. Despite this worry, the synthesiser is fun to use and the 165-word base-dictionary gives the BBC a suprisingly wide vocabulary.

Currah Microspeech unit

For use with: Spectrum at present; ZX81, Oric, Dragon & BBC promised 'soon'.
Cost: £29.95 including demonstration cassette
Available from: Spectrum dealers
Review carried out on: 48k Spectrum

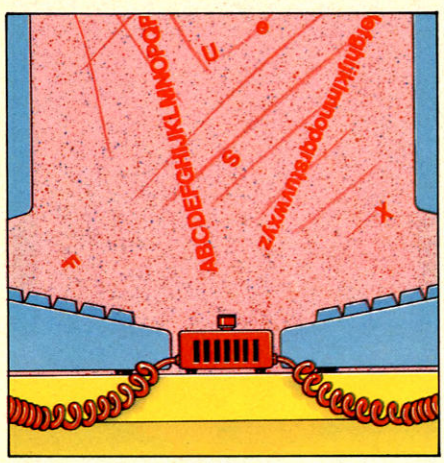
The Currah Microspeech unit is a small interface which is plugged into the back of the Spectrum. No internal wiring is required.

The unit itself is a compact 7.5×6.5×1.7cm. At one side is a flat socket which plugs into the edge connector at the back of the Spectrum. The unit has two leads coming out of it, one of which is plugged into the microphone socket, the other into the TV socket. The aerial lead from the TV set then plugs into the back of the Microspeech unit: a straightforward thirty-second job.

Once connected, simply plugging-in the Spectrum power lead and pressing the enter key switches on the unit. The unit will now voice whichever keys are pressed. Sound is sent to the TV set and voiced through the TV speaker. This gives you convenient control over the volume, but means that the unit cannot be used with a monitor. To switch off keyboard voicing, simply type 'LET keys=0'; to switch on again, 'LET keys=0'.

The keyboard voicing is very useful in itself. The Spectrum's multi-function keys mean that even seasoned users will appreciate confirmation that the correct key has been pressed. For the ZX81, of course, with its membrane keyboard, this would be even more useful.

Programming the Currah unit is done



using allophones (different variations of the same sound). Allophones either use single letters, or combinations of same, to represent different sounds, the letters

EASYSPEAK

giving a good indication of the sound. Brackets are used to indicate allophones comprising more than one letter. Thus, 'hello' would be expressed as 'he(ll)(oo)'. The Microspeech synthesiser supports 62 allophones (a full list is given in Fig 2).

Programming in allophones is quite easy, though obtaining the precise sound you want is very much a question of trial and error. I was able to get a vaguely recognisable voicing of 'Hello, I am Microspeech' after a few minutes experimentation at the press launch.

To produce speech, you simply assign the allophones you wish to voice to the reserved variable s$. Thus LET s$="sp(EE)k" will pass the sound 'speak' to the speech buffer. The buffer acts independently of Basic, so you can fill the buffer with a load of allophones and then let the program get on with something else while your speech filters through the buffer.

In the 'sp(EE)k' example, capital letters were used to give a higher pitch. This allows crude intonation.

Allophones can, of course, be assigned to variables other than s$ and then passed to s$ later in the program. For example, 10 LET a$="(bb)(ii)" . . . 200 LET s$=a$:pause 1. This allows dictionaries of words and phrases to be built up for later use. DATA statements would be ideal for this purpose.

When an allophone is passed to the Microspeech unit, it is voiced *ad infinitum* unless it is told to stop. Currah recommends the use of a PAUSE statement — as in the PAUSE 1 statement in the example above — following each s$. This is slightly annoying at first, but I quickly got used to it.

Documentation takes the form of a slim booklet. Although very brief, it is surprisingly comprehensive. I found it well-written and extremely easy to follow.

The quality of the sound cannot be compared to that of the Acorn system of a PHROM dictionary, but is recognisable if carefully programmed.

Allophones take a bit of getting used to, but once you have used them for a short time the system does begin to take on a logic of its own. The unit is simple to set up, easy to use and is good value at £30.

Allophone	Decimal	Hex
a	24	18
b	28	1C
c	8	08
d	21	15
e	7	07
f	40	28
g	36	24
h	27	1B
i	12	0C
j	10	0A
k	42	2A
l	45	2D
m	16	10
n	11	0B
o	23	17
p	9	09
r	39	27
s	55	37
t	17	11
u	15	0F
v	35	23
w	46	2E
y	49	31
z	43	2B
(aa) or (ay)	20	14
(ee)	19	13
(ii)	6	06
(oo) or (eau)	53	35
(bb)	63	3F
(dd)	33	21
(gg)	61	3D
(ggg)	34	22

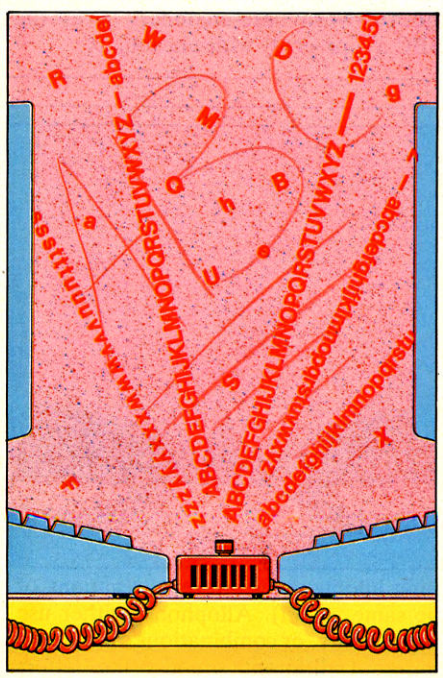
Allophone	Decimal	Hex
(hh)	57	39
(ll)	62	3E
(nn)	56	38
(rr)	14	0E
(tt)	13	0D
(yy)	25	19
(ar)	59	3B
(aer)	47	2F
(ch)	50	32
(ck)	41	29
(ear)	60	3C
(eh)	26	1A
(er)	51	33
(err)	52	34
(ng)	44	2C
(or)	58	3A
(ou)	22	16
(ouu)	31	1F
(ow)	32	20
(oy)	5	05
(sh)	37	25
(th)	29	1D
(dth)	18	12
(uh)	30	1E
(wh)	48	30
(zh)	33	21
(space)	1	01
	3	03
	4	04

This is a hybrid of two pauses (04+04)

Note that these only add up to 62 allophones. The two remaining ones are not implemented in the interpreter and are unlikely to be useful, although you can try them if you want — code 0 gives a 10ms pause, while code 54 (36 Hex) gives an allophone practically identical to the (dth) allophone.

Fig 2 List of Microspeech allophones

Chatterbox



For use with: ZX81, Spectrum, Nascom (remember that?), VIC, PET, BBC, Apple, TRS-80, IBM PC and others
Cost: £57 built, £46 kit
Available from: Various dealers, or direct from William Stuart Systems. Tel: (098064) 235
Review carried out on: 48k Spectrum

Chatterbox is a 15×10×6cm box which contains the speech synthesiser chip itself, a low-power amplifier and speaker. The review system had no controls of any kind, though the new models incorporate a pitch control. The method of connecting the system to your machine naturally depends on which computer you are using; in the case of the Spectrum, it is simply a case of plugging in a cable to the edge-connector.

Chatterbox is based on phonemes, the alternative to allophones. Phonemes are also variations of the same sound but they are more flexible than allophones. They are also less obvious and therefore more difficult to program. A complete list of phonemes supported by Chatterbox is given in Fig 3.

Programming the unit is achieved by POKEing the values into memory. This method is very unfriendly, not to mention incredibly boring. To make life easier, a Basic program listing is offered in appendix C of the documentation. This program allows you to compose and save to tape a dictionary of 50 words and phrases. This dictionary can then be loaded back into memory and entries called by a user program. A bit longwinded, but it does work.

The quality of the speech produced by Chatterbox is — on the review model at least — extremely poor. The demonstration cassette supplied voiced the greeting: 'This is a working Chatterbox made by wonderful William Stuart Systems Limited'. I know this is what it said because the words were displayed on the screen as they were voiced; without this prompting, I might have recognised perhaps two of the words.

WSS claims that the pitch control on the new models makes a great deal of difference to the sound quality. Having heard the difference in quality caused by varying the pitch on the Acorn system I

believe that this claim is probably justified. The quality of the review model, however, made it virtually useless. I would advise anyone considering the system to listen to it at a dealer's before purchase.

Assuming that WSS has managed to improve the quality of the sound, an attraction of the Chatterbox is the fact that it can be connected to a voice recognition system known as Big Ears. This is the same price as Chatterbox, but is not available in kit form. I was unable to review Big Ears since the hardware supplied was for the Spectrum while the documentation and sample listings were for the UK101. I doubt whether our Spectrum would have been impressed by UK101/Superboard POKEs.

The documentation supplied is of the 'rough & ready' variety — which makes a change from 'rough & almost ready' documentation, I suppose. Six photocopied sheets stapled together provide a very sketchy outline of the system which is totally inadequate for practical purposes.

The use of phonemes rather than allophones makes Chatterbox quite difficult to program, but offers more power to someone prepared to put in the necessary work. The method for entering phonemes into memory, too, is very tedious.

I like the idea of the synthesiser, amplifier and speaker in a single, self-contained unit. This makes the system very portable — capable of use with a large number of machines. This said, in my opinion Chatterbox simply fails to make the grade. The quality of the sound is mostly unintelligible and the documentation is hopelessly inadequate. While the former may be improved with the introduction of the pitch control, Chatterbox is still not a system I would recommend without greatly improved documentation.

letter	mnemonic	example	code
a	AA	ma	24
	AE	hat	26
	AO	aught	23
	EY	page	20
	AR	arm	59
	UX	above	15
	AIR	air	47
b	BB2	rib	63
	BB	builder	28
c	KK1	can	42
	KK2	sky	41
	KK3	comb	8
ch	CH	church	50
d	DD2	do	33
	DD1	could	21
e	EH	end	7
	EE	see	19
	EAR	ear	60
	ER	letter	51
	ERR	err	52
	AY	eye	6
f	FF	food	40
g	GG2	got	36
	GG1	guest	61
	GG3	wig	34
h	HH2	hoe	57
	HH1	he	27
i	IH	sit	12
	AY	size	6
	ERR	fir	52
j	JH	dodge	10
k	KK3	comb	8
	KK2	sky	41
	KK1	can	42
l	LL	lake	45
	EL	paddle	62
m	MM	milk	16
n	NN1	thin	11
	NN2	no	56
	NG	anchor	44

letter	mnemonic	example	code
o	AA	hot	24
	OH	low	53
	AO	aught	23
	UX	come	15
	OR	store	58
	UH	book	30
	UW2	food	31
	OW	out	32
	OY	boy	5
	UW1	to	22
p	PP	pig	9
qu	KK3-WW	square	8, 46
r	RR1	real	14
	RR2	brain	39
s	SS	test	55
	ZH	pause	38
sh	SH	ship	37
t	TT1	part	17
	TT2	two	13
th	TH	thin	29
	DH1	this	18
u	UW1	put	22
	UX	up	15
	UH	full	30
	UW2	rude	31
v	VV	vest	35
w	WW	wool	46
	WH	which	48
x	KK1-SS	expert	42, 55
y	YY1	yes	49
	YY2	yes	25
	AY	sky	6
z	ZZ	zoo	43
	ZH	azure	38
Silence		10ms	0
		30ms	1
		50ms	2
		100ms	3
		200ms	4

Fig 3 Phonemes for Chatterbox

Adman speech synthesiser

For use with: Commodore VIC 20
Cost: £49.95
Available from: Can be ordered through Dixons, or direct from AdmanElectronics (Tel: 0423-62642)
Review carried out on: Unexpanded VIC 20

The Adman Speech Synthesiser is quite similar to the Currah Microspeech unit. It plugs into the expander port of the VIC and its sound is fed through the TV set. As with the Currah unit, this means that it cannot be used with a monitor, but at least you have control over the volume (by the time I'd got around to reviewing this system, the novelty of speech synthesis had worn a little thin!).

Setting up is a thirty-second job. One DIN lead connects the synthesiser to the VIC, the other connects the TV to the synthesiser. This done, the unit voices the keyboard as keys are pressed. For some reason, the unit voiced only some of the keys: the alphanumeric keys, mathematical symbols and a few others. The quality of the voice is generally quite reasonable, though it had trouble with 'th' which sounded like a distorted hiss. The unit appeared to slow down the keyboard response when connected.

The unit is programmed using allophones. The set of allophones is assigned to any string variable, and followed by the statement 'SYS 41000'. So:– 10 a$="C/O/M/P/Y/OU/T/ER/"

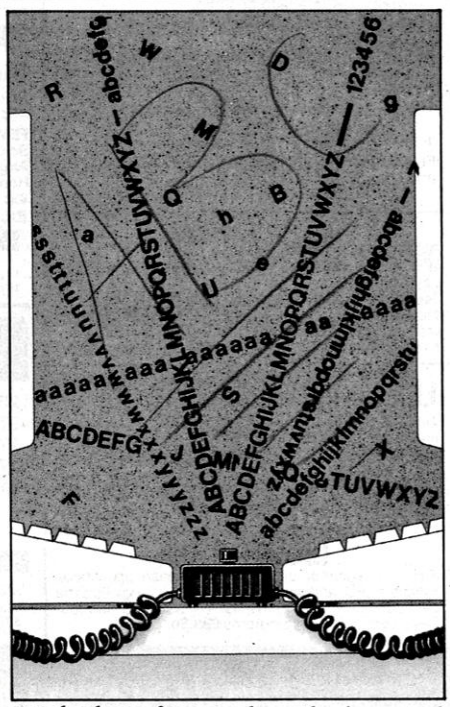
20SYS 41000' would voice 'computer'.

The documentation takes the form of a small but extremely thorough booklet which explains the background (albeit by reproducing part of a General Instruments applications report!) and the use of the unit, gives sample listings and plenty of examples.

I found the manual both useful and informative, covering the subject in detail while keeping in mind that the object of the exercise is to enable the user to develop practical applications.

The Adman Speech Synthesiser is simple to set up, easy to use and gives reasonable quality speech. The manual is excellent. The quite similar Currah unit makes the Adman synthesiser appear expensive by comparison. The price of the VIC 20 itself is continuing to fall, and this also makes the Adman unit seem pricey.

Fifty pounds, though, seems to be the standard rate for speech synthesisers, and the Adman unit gives the impression of a professionally presented, well-designed piece of equipment. END



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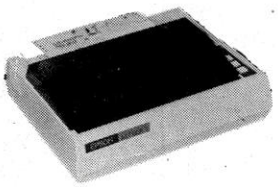

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DACOM BUZZBOX

A modem is an essential part of any hobbyist's set up but until recently they have all been extortionately priced. The DaCom Buzzbox costs well under £100 and is British Telecom approved. Peter Tootill makes the connection.

I have been convinced for some time that a tremendous growth of interest in the area of telephone networking is just around the corner, and all that is really needed is a modem at a price that the average hobbyist can afford.

UK modem prices have been dropping, but even so, until recently, one would still set you back around £200-£300, although acoustic couplers could be bought for £150 or so. Prices at these levels are enough to put off all but the most determined of hobbyists or home computer users. So it was with great interest that I learned of the launched of a 'direct connect' (that is, not acoustically coupled) modem which was to cost well under £100. Furthermore, it was to be Telecom approved. The DaCom 'Buzzbox' is now with us and at £79.95, including VAT, it is much nearer the sort of price the hobbyist can afford.

The Buzzbox is surprisingly small and neat. It is only 5in square, about 1.5in high and weighs just over a pound. The sturdy metal case is attractively finished in a chocolate brown, with the front and the 'Buzzbox' logo in orange. The front panel contains two switches and two LEDs. One of the switches is marked 'DATA', which is really the modem's on/off switch, and the other is used to select originate or answer mode. The two LEDs are marked 'DATA' and 'CD' (Carrier Detect).

The rear of the box has a 5 pin, 180 degree DIN socket labelled 'RS232', a miniature jack socket for the optional mains adaptor, and a two metre length of wire ending in a modular jack plug (that's the new type that BT fits these days). If you don't have a suitable telephone socket, you will need to have one installed. Alternatively you could ask for your modem to be supplied with spade connectors, or just cut the plug off, bare the wires and connect to the telephone point. This is, of course, only legitimate on private circuits. Even if you have a new style socket, you will still need a two way adaptor in order to connect the modem in parallel with the telephone, and this will set you back around £7.

No documentation was supplied with the modem, but the manufacturers tell me that an eight page manual will be available with production models.

Inside

Inside, the modem is neatly laid out, with part of the space being taken up by the two PP3 batteries which provide the power. The modem chip used is the MC14412 which has the facility to work with US Bell 103 as well as CCITT V21 frequencies, but this needs quite extensive changes to the filters. A Bell version of the Buzzbox is available, but is not Telecom approved. The battery area is one place where the design could be improved, as they are held in place by a strip of polyurethane foam and the lid of the case. While there is no danger of them moving once the lid is on, sliding the lid on from the front results in the batteries pushing against a couple of components at the rear. This could lead to problems, and it is better to slide the lid on from the rear, when the front of the case does the job of holding the batteries in place.

Setting up

Before you can use the modem you will need a cable to connect it to the RS232 output of your microcomputer. Here you could find your first problem, because, although more and more micros are being produced with RS232 interfaces, they seem to have departed from the normal 25 way connector that the standard specifies. The reason for this is, presumably, that these connectors are large and expensive, and anyway, only four or five of the pins are used in most applications. It is unfortunate that a standard for a 5 pin RS232 connector has not been produced in time to prevent the plethora of different types that are appearing. I have come across at least half a dozen recently.

A suitable 5 pin DIN plug is supplied with the Buzzbox, but you will need a fine tipped soldering iron to connect it up, as well as the appropriate connector for your micro. DaCom will supply a lead to connect the modem to a standard 25 way connector but at nearly £29 the price is extortionate. If you can't solder yourself, your local computer shop or even a radio and TV dealer should be able to produce a cable for you, if you give them all the details. Computer user groups are another useful source of expertise in these matters, so if you haven't joined your local one yet, it could be time you did! The pin connections are shown in Fig 1.

RS232 connections:
pin 1 transmit data (TD)
pin 2 ground
pin 3 not used
pin 4 receive data (RD)
pin 5 carrier detect (CD)
Fig 1

No special software is required to use the modem other than a standard terminal package, as no special features, such as auto-dial or auto-answer, are supported.

In use

Once armed with the right cable, and a telephone jack socket, complete with two way adaptor, the modem is simple to use. Having connected it to your micro and the phone point, and loaded the appropriate software, you dial the number of your nearest bulletin board or database (with the modem switched off). When you hear the tone simply push the 'Data' switch to turn the modem on and replace the receiver in its rest (the modem will hold the line), and the link should be established. The Carrier Detect light ought to tell you whether you've been successful, but unfortunately on both the review samples, it came on as soon as the modem was switched on, whether a carrier was present or not.

The CD line is brought out to the RS232 connector on the back of the unit, but suffers from the same effect as the LED on the front panel. The other LED is the transmit and receive data indicator, and blinks off whenever data is transmitted or received by the modem. This is a useful source of information if you do have problems. If it doesn't flicker when you press a key on your computer, you know that you're not transmitting, and if you're not getting anything from the remote system on your screen, the data LED will tell you whether or not data is coming down the line.

I found the modem generally reliable in originate mode, with only a few glitched characters, but in answer mode, it would badly corrupt received data on both samples I tried. The manufacturers tell me that on production models this has been improved.

Prices and availability

Buzzbox	£79.95 inc vat
Mains adaptor	£10.95 inc vat
Buzzbox to D25 cable	£28.75 inc vat

The Buzzbox should be available through your local computer dealer, or from the distributors: Pete and Pam Computers, Waingate Lodge, Waingate Close, Rossendale BB4 7SQ. Tel: (0706) 227011.

In case of difficulty contact DaCom at: DaCom Systems, 16 Alston Drive, Bradwell Abbey, Milton Keynes MK13 9HA. Tel: (0908) 311885.

Conclusions

If you are in the market for a 300 bit/sec modem (that is, not for use with the normal Prestel service) then there is little competition in the price range. I know of one other manufacturer making modems at a similar price, but these are not approved for connecting to BT lines.

Provided Dacom sorts out the problems with the answer mode, the Buzzbox is very good value for money. END



SPREAD THE WORD

Martin Banks speculates on the dangers of talking computers in education: will the parents opt out and let the children communicate in monotones?

Whence upon a time, somewhere out there in the dim and distant future, a small child will come up to its parent-person (all sexist expressions and denominations having been expunged from the language) and say: 'Deah pah rent per san, ma eyeee havva ba nan aaaaH?'

To this, the parent-person will look askance at the small child and say 'eh?'.

The time will have at last dawned when there is no longer any common ground for normal, verbal communications between what constitutes the old and *passé* (typified by said parent-persons the world over) and the new, dynamic and trendy. Small persons will be talking a strange kind of monotonic, monosyllabic anguish (sorry, English) that us older mortals — trained as we were in verbal interaction with someone who spoke something approaching something understandable by every one else — will be unable to comprehend.

These small persons will have acquired this strange language not from school, where most of us picked up at least the more 'fundamental' aspects of our communicative capabilities, but from little plastic boxes of various sizes and colours. These boxes will by that time have become to these small persons surrogate parent-persons to whom they will look for all sorts of necessary and unnecessary help and advice.

The boxes, as if you didn't know, are all these 'talking' computers, machines which,through a variety of techniques, synthesise the human voice and speak words that can be understood.

Speech synthesis is, in my 'umble opinion, one of the best things to come out of the application of new technology. It is, however, also one of the worst. Now I know this may look like another classic case of Banksey facing in two directions at once, but I feel I can justify such Beeblebroxianism.

It is one of the greatest things (speech synthesis, I mean) because it can be used in a variety of extremely important ways that are of great benefit to personkind. For example, there are a large number of applications in boring things like industry where the capability of a computer control system to enunciate clearly and, perhaps more important, rapidly a problem, danger or similar area of concern to a human operative can prove to be no less than a life saver. There are applications where the use of speech as an instructional tool to humans can be beneficial. The list is endless.

One entry on this list will be education. Indeed, it has to be on the list for it has already become one of the most popular applications of speech technology. It is here that my Beeblebroxianism starts coming into play, for I really do have my doubts about some of this.

At face value, the use of speaking boxes for education has a great deal of merit. Because they are driven by computers, which are themselves morons, they can be instructed to take a child methodically through its learning paces in a way (subject to programming, of course) that can be fun, inspirational and rewarding. Dammit, the kids seem to like being taught by these things.

This is all well and good, up to a point. My problem is that I wonder just where that point ought to be. The reason I feel that there is a problem at all stems from the fact that if these boxes are so popular with the kids, and if they do, as they seem to do, a reasonable job in educating children in the fundamentals of arithmetic, grammar, sentence construction and the like, there will be a strong temptation for parent-persons to opt out. This will be either from choice (more time to spend doing the washing, mending the car, doing the pools, going down the pub, etc) or from rejection by the kids because the parent-persons were more boring than the machines, anyway.

'... there could be children who speak a fractured kind of English learned at the knee of a talking computer ...'

Whatever the reason, such a trend is both sad and potentially harmful. It is noticeable, for example, how most parents will at some time refer to the way their children have changed since going to school. The 'pernicious' influence of teachers and other children markedly alters the horizons and perspectives of their 'one-and-only', and often that alteration is permanent.

Exactly the same effects can be achieved with more automated teaching environments, and the effect can be that much greater because the 'environment' can be brought home and set up in a bedroom or living room. These teaching machines carry with them an onerous responsibility on both the parents who buy them and (hopefully) oversee their utilisation, and on the manufacturers and programmers who constructed the machines in the first place.

The responsibility on the parents is that they do not succumb to the temptations that such teaching machines present. It would be very easy indeed to buy a specialised teaching system or concentrate of education software for a general purpose home computer, and assume that the best was being done by the children.

It would become an easy matter to restrict the overseeing of children to the level of ensuring that they were not wasting time playing Space Invaders, and taking no further interest beyond that point. It would be a very tempting prospect; many parents are already happy enough to opt out of a fair proportion of their responsibilities given half a chance. Human nature is, after all, human nature.

Now, it is difficult for most people to query the educational content of the material that children are thus given. At the simplest levels of education (2+2=4, etc) there often seem to be as many theories on how best to present the material as there are educationalists working in the field. At the higher levels, many parents probably wouldn't know the answers any better than the kids, so could not value-judge the efficacy of the education.

This holds true for all forms of education, be it in school with human-type teachers or at home with a computer or education machine. With some of the education machines, however, there are areas that could and should be overseen by the parents, especially where the machines use pseudo-human techniques of interaction.

As such machines go at present, extremely clever though they are to the completed adult, they fall far short of what we should be wanting for our children. The voices that emanate from these boxes are, to date, serious emasculations of what passes for the English language.

Technology is going to be used increasingly to create ever-more powerful and comprehensive educational systems. This in turn is going to give more parent-persons the opportunity to opt out of the responsibility (to use an old-fashioned word) of participating in their off-spring's education. If such opting out ever proves at some future date to have been a great mistake its discovery, as happens with all the best mistakes, will be too late. END



Illustration by Janet Woolley

CHECKOUT

GOOD HOUSEKEEPING

'What's the point of a home computer if all you can do is play games on it?' A commonly voiced sentiment and one which a lot of companies are now exploiting. But in the gradual realisation that micro owners want their micros to perform useful and time-saving tasks as well as provide entertainment, a spate of home accounting packages have appeared. Are they all they're cracked up to be? Peter Bright got his pen and paper ready to determine their value.

Is it possible to do anything useful with a home micro? This question is being asked more and more.

Traditionally, home micros have been put to two uses — learning about micros and programming, and playing games. Unquestionably many people have learnt a great deal in schools and at home by learning how to program, but many people (myself included) regard programming as a means to an end and are much more interested in what happens once the coding stops and the using begins.

As far as games programs are concerned I, for one, am becoming bored with zapping aliens. It doesn't matter how colourful or clever they are — once you've seen one alien you've seen them all.

'Using double entry principles to control humble home accounts is like using a sledgehammer to crack a nut.'

So, what useful things can you do with a home micro? Some standard applications trotted out are word processing and home accounts. I'll cover word processing in a future issue, but the idea of keeping your home accounts on a computer is interesting in that you will be able to keep track of where all your money is going to. This means that the next time you get a nasty letter from your bank manager saying that according to his computer you owe him money, you will be able to turn around and say that according to your computer you don't! Here I'll look at two home accounts programs — Oxford Computer Publishing's ('OCP') Finance Manager and Diamondsoft's Home Accounts.

Home Accounts

Supplier: Diamondsoft
Computer: BBC 32k
Price: £9.95

Diamondsoft's Home Accounts program runs on the BBC Model B Micro. The review copy of the software was supplied on a single audio cassette. The instructions for use were next to useless. They were printed on the back of the cassette insert which meant they were very brief. Apart from telling you how to load the cassette and giving some good advice about making backup copies of your data files, they provided very little information on how to use the package.

To give you an idea of the lack of thought that went into the instructions, I spent half an hour using the system before I found that instead of entering today's date I should have entered the date of the last 'week end' run. This useful piece of information was given right at the end of the instructions. It should have been shown with the signing on instructions at the start.

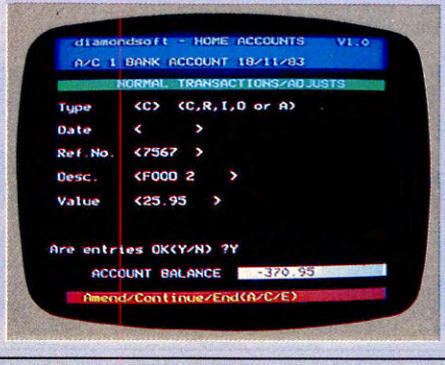
All that's needed to get the system up and running is to type "CHAIN "HOMEACCS"". The program is then loaded in the normal way.

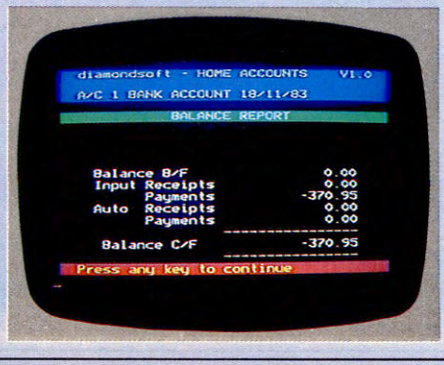
Once the main program has loaded, a message requesting the date is displayed. It was here I came unstuck and entered the current date. After the date has been entered the program goes on to read the account data, which is held in a file called HAMASTER. Finally, the main menu was displayed.

Once the program and the data have been loaded you are faced with the main menu. This has no less than 14 different options. If you are using the program for the first time you'll need to use option one first. This option sets up the account details. All you need to do is enter an account number and a description which will be displayed at the top of the screen. One point to remember here is that you can only work on one account at a time, and each account needs a different data file. This means that if you want to control your Bank Account and your Access Account you will have to set up two data files and run the program twice.

You can update a maximum of 20 regular payments/receipts using option two. This lets you enter details of all your standing orders and also any regular payments such as your salary. When entering data you have to tell the sysem whether the entry is a payment or a receipt, identification numbers, frequency of payment (monthly, quarterly, yearly), number of payments and the value for the payment/receipt. The value can only be in the range 0 to 999. This could prove to be a limitation, especially on yearly payments. Whenever data is entered into the system,







you are given the options of A(mending), C(ontinuing), or E(nding). Trying to amend any data means you will have to retype all the data because the system won't allow you just to edit a part.

The third option is the normal transactions option which allows you to enter all your normal day to day spending. This option contains one of the worst messages I have seen in a long time. When it asks for the transaction type, it asks you to enter either C,R,I,D, or A. Nowhere does it say what these letters mean. In fact, respectively, they mean Cheques, Regular Payments, Interest, Deposits and Adjustments. I found this useful information in the set up menu; I can't imagine what it was doing there! As if this was not enough, the 'A' option doesn't work. If you want to make any adjustments you have to use the 'Adjustments' option from the main menu.

When I was using this function I found that it was very easy to make payments from the account using any of the first three options. However, the only way to pay money into the account is to use the D(eposit) option which I assume refers to transfers from your deposit account. The only other ways of getting money into the account are to use the Adjustments option from the main menu or to use the Regular Payments option. When entries are made a running balance of the account is displayed at the bottom of the screen. If the account is in credit the balance is shown in black, if it is a debit the balance is shown in red and a bleep is sounded.

Option four allows you to enter any bills which haven't yet been paid. When you decide it is time you paid some of your bills, you can use option five to scroll through all your outstanding bills deciding which ones to pay and which ones to hold.

When you get your statement of account from the bank, you can use option seven to scroll through the account and check it off against the statement. If an entry checks out, it is marked for deletion and is removed from memory when the 'week end' run is performed. This is an important consideration because the program can only hold 175 transactions, so it will be necessary to clear down outstanding transactions quite frequently. The week end update posts any regular payments/receipts and clears down any cleared transactions. It also advances the date by one week.

Five different reports can be generated. The transaction report lists all the current transactions held on the system. If you need a hard copy of this report, press control C in the normal way. The other reports show Bills Waiting Payment, Audit Report (all the transactions entered in the current run), Cleared Transactions, and a Balance Report which shows the balances currently on the account.

This program is not as ambitious as the OCP program reviewed below — this may be no bad thing, at least this program works! The trouble is that because the ambitions of the program are so low, I have to ask if it is worth the hassle of loading and running the program. As far as I can see this program does not do anything that would not be possible to do using a pen and notepad. Generally I was not very impressed — the instructions were sparse and the program gave the impression of having been put together in a hurry. There were a large number of quirks that I found very annoying.

Finance Manager

Supplier: Oxford Computer Publishing
Computer: Spectrum 48k
Price: £8.95

Finance Manager is published by Oxford Computer Publishing which specialises in programs for the Sinclair Spectrum. The program is supplied on a standard cassette and is very well packaged in a colourful cardboard box proclaiming 'AUTOMATIC DOUBLE ENTRY' (more of which later).

The program is loaded in normal Spectrum manner by typing "LOAD". Once it has loaded the sign on menu appears asking if you wish to load a data file or apply standing orders. Assuming you are using the program for the first time you answer 'no' to both questions and go on to the main menu. This menu has seven options — process transactions, process standing orders, analyse expenditure, rename/mark acc, rename/mark des, change date and maintain file. One point to make here is that this program is totally menu driven. It is also written in machine code so it is very fast. All of the data entry menus can be edited using SYMBOL SHIFT E to erase the total field, SYMBOL SHIFT I to insert within a field and SYMBOL SHIFT D to delete within the field. The cursor can be moved by using the cursor control keys in the normal way.

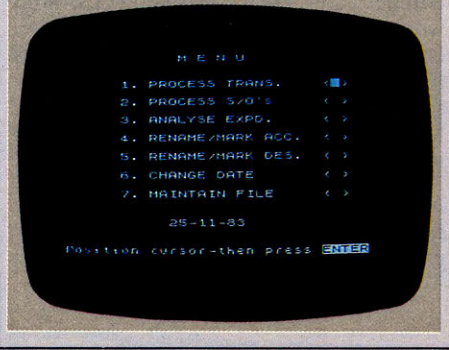
As this program purports to be based on double entry accounting principles and because it is a few years since I last did any accountancy, I decided to get the program checked out by an expert so I took it to Malcom Welstead who lectures in accountancy at the Hatfield Polytechnic . . .

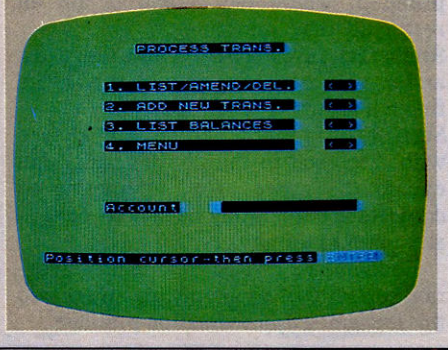
The first thing Malcom pointed out was the error in the user manual I told you about earlier. In fact he thought the whole manual was a disaster because it assumed some prior knowledge of accounting. Once he had got the bit between his teeth, Malcom went on to deliver the killer blow — the accounts produced by this package are next to meaningless. This is because the program is based on double entry which means that every time you spend money you take money out of one account and put it into another account (so there are two entries). Using double entry principles to control humble home accounts is like using a sledgehammer to crack a nut.

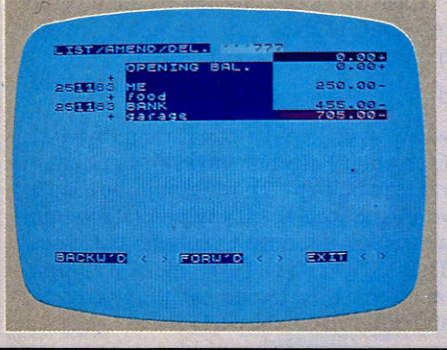
'. . . many people . . . regard programming as a means to an end and are much more interested in what happens once the coding stops and the using begins.'

The instructions for use are contained in a 21-page booklet — quite a contrast to Diamondsoft's offering. The only trouble is that it does contain a few errors, including one classic error which says 'The principle of double entry assumes that every transaction appears on two separate accounts, as a credit (+) in the account receiving the monies and as a debit (−) in the account paying out the same sum.' This is *wrong*. In double entry accounting money paid into an account is a debit and money going out of an account is a credit (I know that this sounds weird but that's the way it is.) If OCP can get such a fundamental point wrong it makes you wonder what else is wrong.

As if this were not enough this program does not even function in a true double entry manner. Consider this example. It is your birthday so you decide to go out to Luigi's for a meal. At the end of the evening you pay by Access. When you get home you try to enter this transaction into the system. The system allows you to post the transaction, but you are left with money posted to Luigi's account which you have no way of clearing out without







GOOD HOUSEKEEPING

fiddling the system. In effect the program only allows one source of funds (the bank account). The upshot of all this is that if you use this package, you will not be able to reconcile the accounts produced by the program back to your bank statement, or your Access statement, or any other statement.

Another point to bear in mind generally when you are looking at this kind of very detailed system is that you will need lots of self control to log everything you spend. But if you don't do this it will make a nonsense of the whole system.

It is a pity this program has such basic flaws because it is very well presented and works very fast (much faster than many business programs I've seen). It also has the ability to do some analysis on your expenditure which, had it been executed correctly, has the potential to be very useful. Another potentially useful feature is that the program has been designed to work with both a ZX printer and any Centronics compatible printer using the Kempston interface.

Conclusions

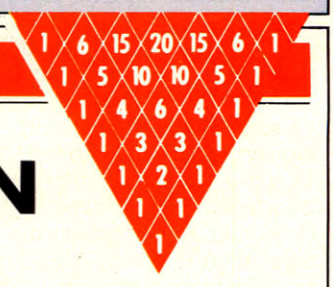
So what is the upshot of all this? I think more and more people are looking for something useful to do with their home computers. However, at the moment, I think, this smacks of 'I've got a home computer so I might as well buy the package to give it something useful to do'. This is the reverse of what should happen. You ought to be saying 'I have a problem. Can a computer help?'.

Home accounts is certainly an area in which a home computer could be useful. However in all honesty I can't recommend either of the programs I have tested here. The OCP Finance Manager is full of good ideas but is let down by its execution. The Diamondsoft Home Accounts works, but it operates at such a simple level that I doubt its usefulness. An ideal system would allow analysis of expenditure and some budgeting but would remain easy and quick to use.

If you feel you would benefit from having your home accounts done by your home computer it may be that your best bet is to buy a simple spreadsheet such as Vu-File, and use that.

END

NUMBERS COUNT



FRACTIONAL APPROXIMATION TO PRIME NUMBERS

New readers start here. The topics dealt with in this column attempt to reach the frontiers of knowledge in number theory with the minimal background information. The problems posed therefore have no complete solution known to the author, and readers are encouraged to submit their attempts at solution, however incomplete they may seem.

A Prime Number is defined to be a positive integer, greater than unity, which is divisible only by itself and unity. Thus the sequence of prime numbers commences 2,3,5,7,11,13,17,19,23,29 . . .

The Modulus of a number, x, written $|x|$, is identical with the Basic function ABS (x) and is defined to be the argument, x, made positive. $|x|=x$, if $x \geq 0$, else $|x|=-x$.

Readers will be familiar with ideas of (i) approximating a real number by a rational number (or fraction), and (ii) approximating a rational number in turn by an integer (or whole number); this latter being the process of rounding off to zero decimal places.

For example:

(i) π is approximately 22/7, $\sqrt{2}$ is approximately 141/100; and

(ii) 22/7 is approximately 3, while 397/400 is approximately 1.

We now ask how good an approximation to a prime number can be obtained using fractions of a restricted kind.

Case (i). If a_1, a_2, b_1 and b_2 are integers less than a given prime number, p, the minimum of

$$d_2 = \left| \frac{a_1.a_2}{b_1.b_2} - p \right|$$ is known to be obtained

when $a_1=a_2=p-1$, $b_1=1$, and $b_2=p-2$. Elementary algebra shows this minimum value to be $1/(p-2)$; which may be used to verify the accuracy of any general program written in response to subsequent cases. Thus (12)(12)/((1)(11)) is the best approximation to 13 by fractions of the given type, and differs from it by 1/11.

Case (ii). If a_1, a_2, a_3, b_1, b_2, and b_3 are integers less than a given prime number, p, we wish to minimise

$$d_3 = \left| \frac{a_1.a_2.a_3}{b_1.b_2.b_3} - p \right|$$

For example, if p=13 then $a_1=a_2=a_3=10$, $b_1=1, b_2=7, b_3=11$, yields the minimum d_3 value of 1/77.

Note. This result should also be used as a test case for any computer program generated in response to the more general problem posed below. There is a conjecture that the minimum of d_3 approaches $1/p^2$ as p tends to infinity: (becomes larger and larger). This case was investigated at Los Alamos c1960 for all prime numbers less than 100,000 — the evidence is consistent with the conjecture.

Problem

Case (n). n>2. Here we ask the question how good an approximation is $(a_1a_2a_3 \ldots a_{n+1})/(b_1b_2b_3 \ldots b_{n+1})$ to the prime p, where the a_i and b_i are all restricted to be less than p.

Section (a). Investigate this for a range of n and small values of the prime p, such as the first ten given in the introduction.

Section (b). Select a particular n, chosen with reference to the above results and extend the range of p, attempting to conjecture the limiting behaviour of d_{n+1} as p tends to infinity.

Readers are invited to submit a program, or suite of programs, to investigate this intriguing approximation problem.

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 March 1984, to Mr M R Mudge, Room 560/A, Department of Mathematics, University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Harshad Numbers August

Several enquiries showed an interest in this problem. However, no real progress can be reported. Did holidays interfere with computing, since subsequent problems have been very well supported?

I would ask any interested reader who has neither access to *PCW* August 1983, page 108, nor *Repunits and Repetends* by Samuel Yates, 1982, pages 111-112, or who would simply like further discussion to contact me directly, home telephone (0902-892141). Those who have now got results should please submit them by 1 March, 1984, when a deferred prize award will be made.

Note. Submissions can only be returned if a suitable stamped addressed envelope is provided.

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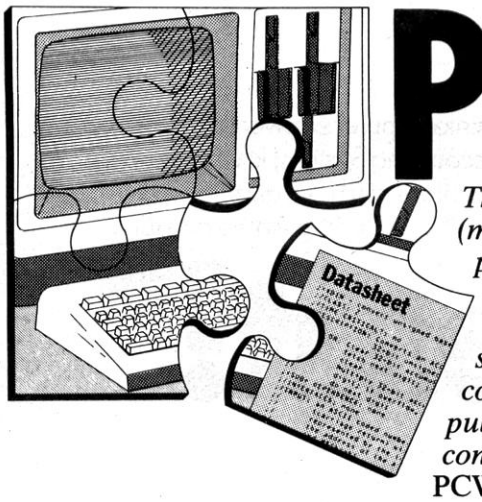


PCW SUBSET

These pages contain subroutines written in assembler language (mnemonics which are converted to hexadecimal codes by an assembler program). In order to use them you will first need to know how to program your machine in assembler. Those of you who are still reading will be able to build up your library of general purpose routines, documented to the standards developed by Alan Tootill and David Barrow. You can contribute a Datasheet, improve or develop one we print or translate a published routine to run on a different processor. PCW *pays for contributions selected for publication, which should be sent to Sub Set,* PCW, *62 Oxford Street, London W1A 2HG.*

6502 SUPERSET

Since we mentioned (August '83 issue) that Andrew Johnson of Winchester had sent in a long list of unspecified 6502 op codes, so many of you have asked for these that we have decided to print them after all.

Some sub-setters do not approve of our bothering with op codes that should not be used in serious software. But one of the purposes of the series is to discover all we can about the popular processors and to share these discoveries with each other. Much serious computing involves discovering what the equipment supplier fails to reveal (either by neglect or design) so ferreting out unspecified op codes can be good practice for more serious work. Let us know if any of Andrew's instructions do not work on your 6502 processor.

This first group of instructions (Fig 1) operates on the byte in the page zero address zz, or the address as modified by the X or Y register:-

Op Code	Effect
07 zz	ASL zz ORA zz
17 zz	ASL zz,X ORA zz,X
27 zz	ROL zz AND zz
37 zz	ROL zz,X AND zz,X
47 zz	LSR zz EOR zz
57 zz	LSR zz,X EOR zz,X
67 zz	ROR zz ADC zz
77 zz	ROR zz,X ADC zz,X
87 zz	SAX zz (store A ANDed with X)
97 zz	SAX zz,Y (store A ANDed with X)
A7 zz	LDX zz LDA zz
B7 zz	LDX zz,Y LDA zz,Y
C7 zz	DEC zz CMP zz
D7 zz	DEC zz,X CMP zz,X
E7 zz	INC zz SBC zz
F7 zz	INC zz,X SBC zz,X

Fig 1

In the next group (zz,X), Fig 2 refers to the byte at the 16-bit address at zero page zz modified by the X register and (zz),Y refers to the byte at the 16-bit address as modified by Y at zero page zz.

Op Code	Effect	
03 zz	ASL (zz,X)	ORA (zz,X)
13 zz	ASL (zz),Y	ORA (zz),Y
23 zz	ROL (zz,X)	AND (zz,X)
33 zz	ROL (zz),Y	AND (zz),Y
43 zz	LSR (zz,X)	EOR (zz,X)
53 zz	LSR (zz),Y	EOR (zz),Y
63 zz	ROR (zz,X)	ADC (zz,X)
73 zz	ROR (zz),Y	ADC (zz),Y
A3 zz	LDA (zz),X	LDX (zz),X
B3 zz	LDA (zz),Y	LDX (zz),Y
C3 zz	DEC (zz,X)	CMP (zz,X)
D3 zz	DEC (zz),Y	CMP (zz),Y
E3 zz	INC (zz,X)	SBC (zz,X)
F3 zz	INC (zz),Y	SBC (zz),Y

Fig 2

The next group (Fig 3) operates on either the byte at the absolute address zz zz, modified where shown by X or Y, or the number nn immediately following the op code:

Op Code	Effect
OF zz zz	ASL zz zz ORA zz zz
1F zz zz	ASL zz zz,X ORA zz zz,X
2F zz zz	ROL zz zz AND zz zz
3F zz zz	ROL zz zz,X AND zz zz,X
4F zz zz	LSR zz zz EOR zz zz
5F zz zz	LSR zz zz,X EOR zz zz,X
6F zz zz	ROR zz zz ADC zz zz
7F zz zz	ROR zz zz,X ADC zz zz,X
8F zz zz	SAX zz zz
9F zz zz	SAX zz zz,X
AF zz zz	LDX zz zz LDA zz zz
BF zz zz	LDX zz zz,Y LDA zz zz,Y
CF zz zz	DEC zz zz CMP zz zz
DF zz zz	DEC zz zz,X CMP zz zz,X
EF zz zz	INC zz zz SBC zz zz
FF zz zz	INC zz zz,X SBC zz zz,X
OB nn	AND #nn
1B zz zz	ASL zz zz,Y ORA z zz,Y
2B nn	AND #nn (again)
3B zz zz	ROL zz zz,Y ORA zz zz,Y
4B nn	AND #nn LSR A
5B zz zz	LSR zz zz,Y EOR zz zz,Y
6B nn	AND #nn ROR A
7B zz zz	ROR zz zz,Y ADC zz zz,Y
8B nn	TXA AND #nn
CB nn	SBX (A.X) #nn (subtract without carry nn from A ANDed with X)
DB zz zz	DEC zz zz,Y CMP zz zz,Y
EB nn	SBC #nn
FB zz zz	INC zz zz,Y SBC zz zz,Y

Fig 3

The new instructions that combine a shift with a logical operation give, in effect, new addressing modes to the shift instructions. The new addressing modes are absolute indexed by Y, indirect indexed by Y and indexed by X indirect. For the flags to be set as for the shift operation, the codes used are shown in Fig 4.

1. LDA #0		A9 00
(ASL zz zz,Y	ORA zz zz,Y	1B zz zz
(ASL (zz),Y	ORA (zz),Y	13 zz
(ASL (zz,X)	ORA (zz,X)	03 zz

Fig 5

2.	LDA #$FF		A9 FF
	(ROL zz zz,Y	AND zz zz,Y	3B zz zz
	(ROL (zz),Y	AND (zz),Y	33 zz
	(ROL (zz,X)	AND (zz,X)	23 zz
3.	LDA #0		A9 00
	(LSR zz zz,Y	EOR zz zz,Y	5B zz zz
	(LSR (zz),Y	EOR (zz),Y	53 zz
	(LSR (zz,X)	EOR (zz,X)	43 zz

Fig 4

In all cases, C, N and Z flags are set correctly and the A register, as well as the memory location, holds the result of the shift operation.

Additional single byte NOP's, are given by op codes 1A, 3A, 5A, 7A, DA and FA. Two byte NOP's, with the second byte ignored, are given by 80 xx, 04 xx, 14 xx, 34 xx, 44 xx, 54 xx, 64 xx, 74 xx, F4 xx and 89 xx. Three byte NOP's, with the second and third bytes ignored, are given by OC xx xx, 1C xx xx, 3C xx xx, 5C xx xx, 7C xx xx, DC xx xx and FC xx xx.

There are also HALT instructions which cause the processor to stop executing instructions until reset or possibly interrupted. They are as follows: 02, 12, 32, 42, 52, 62, 72, 82, 92, B2, C2, D2, E2, F2.

And finally, you try any of these instructions at your own risk.

6809 GRAND PRIX

PRX from Jeff Shepherd of Littleborough is a 6809 version of the 6502 Datasheet PRAY (May '83).

PRAY converts the binary value input in the 6502's 8-bit A and Y registers into an unsigned decimal value and prints it out with leading zeros suppressed. Due to the frustratingly small number of registers available to the 6502 programmer, PRAY uses the stack as workspace.

The 6809 has rather more registers than the 6502—two 8-bit accumulators, two 16-bit index registers and two 16-bit stack pointers. It also has a plethora of instructions with which to manipulate them. Consequently, PRX has the value input in the 16-bit X register and works only on registers, not stacked values. It does, however, store the decimal digits temporarily on stack in the same way as PRAY.

DATASHEET

```
;=BRX - Print the value from X.
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  Prints the binary value from X as an unsigned
;/               decimal number with leading zeros suppressed.
;/ ACTION:  A = $80
;/          REPEAT:
;/             PUSH A
;/             X = X/10: A = REMAINDER
;/          UNTIL X = 0
;/          REPEAT:
;/             PRINT A AS ASCII DECIMAL DIGIT
;/             PULL A
;/       UNTIL A' = $80
;/ SUBr DEPENDENCE:  'CHROUT', a subroutine to print the ASCII
;/                   character in A.
;/ INTERFACES:  Any output device used by CHROUT
;/ INPUT:  X = binary value to be output.
;/ OUTPUT: Value of X printed in decimal form.
;/ REGs USED:  X
;/ STACK USE:  8 min./13 max.  + CHROUT stack use.
;/ LENGTH:  40
;/ PROCESSOR:  6809

PRX:    PSHS   CC,A,B,X      ;save regs.                    34 17
        LDA    #$80          ;initialise to terminator.     86 80
NXTDG:  STA    ,-S           ;push digit (term. 1st time).  A7 E2
        LDB    #16           ;16 bit counter for rotate.    C6 10
        CLRA                 ;clear accumulator and Carry.  4F
ROLL:   ROLA                 ;divide X by 10 using binary   49
        ADDA   #$F6          ;long division, shifting X one 8B F6
        BCS    SUB           ;bit at a time into A and      25 02
        SUBA   #$F6          ;subtracting 10 which sets     80 F6
SUB:    EXG    D,X           ;C if sub goes, else add 10    1E 01
        ROLB                 ;back and reset C. Rotating X  59
        ROLA                 ;by means of A & B both shifts 49
        EXG    D,X           ;X bits into A and shifts      1E 01
        DECB                 ;result bits into X. Do 17     5A
        BPL    ROLL          ;times to get last result bit. 2A F0
        LEAX   ,X            ;test X and repeat if          30 84
        BNE    NXTDG         ;X is not zero.                26 E7
PRDG:   ORA    #$30          ;make into ASCII digit, call   8A 30
        JSR    CHROUT        ;CHROUT to print digit in A.   BD XX XX
        LDA    ,S+           ;pull next digit off stack and A6 E0
        BPL    PRDG          ;repeat if not terminator.     2A F7
        PULS   CC,A,B,X,PC   ;restore regs and return.      35 97
```

Z80 OWN SPACE TRANSPOSE

John Hardman started the ball rolling in June with his Z80 routine MATRAN. This reconfigures an in-RAM matrix from row-by-row storage to column-by-column (or vice versa) but puts it in a new area of memory.

In November, Vernon Webb gave us TRANS—a 6502 routine to transpose a matrix in its own space. Apart from a few bytes of page zero memory for variable storage, no other workspace is used by TRANS during the process.

Now Brian Prescott-Decie has written from Athens with a Z80 own-space transposition routine, OSMTRN.

Interestingly, at 35 bytes, it is the same length as MATRAN.

Although Brian wrote OSMTRN before seeing TRANS, the two routines are based on a similar method. This involves a great deal of memory shifting just to move one element of the matrix. The time taken to transpose a large matrix could be not inconsiderable, even in OSMTRN which uses the very powerful Z80 block transfer instruction LDIR.

Fig 5 shows the action of OSMTRN on a 3 by 4 matrix. Brackets enclose the sequence of elements about to be left rotated.

Cols	Rows											
4	3	(a1	a2	a3	a4	b1	b2	b3	b4	c1	c2	c3 c4)
4	2	a2	a3	a4	(b1	b2	b3	b4	c1	c2	c3	c4 a1)
4	1	a2	a3	a4	b2	b3	b4	(c1	c2	c3	c4	a1 b1)
3	3	(a2	a3	a4	b2	b3	b4	c2	c4	c4	a1	b1 c1)
3	2	a3	a4	(b2	b3	b4	c2	c3	c4	a1	b1	c1 a2)
3	1	a3	a4	b3	b4	(c2	c3	c4	a1	b1	c1	a2 b2)
2	3	(a3	a4	b3	b4	c3	c4	a1	b1	c1	a2	b2 c2)
2	2	a4	(b3	b4	c3	c4	a1	b1	c1	a2	b2	c2 a3)
2	1	a4	b4	(c3	c4	a1	b1	c1	a2	b2	c2	a3 b3)
1	3	(a4	b4	c4	a1	b1	c1	a2	b2	c2	a3	b3 c3)
1	2	(b4	c4	a1	b1	c1	a2	b2	c2	a3	b3	c3 a4)
1	1	(c4	a1	b1	c1	a2	b2	c2	a3	b3	c3	a4 b4)
0		a1	b1	c1	a2	b2	c2	a3	b3	c3	a4	b4 c4

Fig 5

DATASHEET

```
;= OSMTRN - Own-space matrix transposition
;/ CLASS:  2 (registers not saved)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts an in-RAM matrix from sequential row
;/               to sequential column storage in same space.
;/ ACTION:  FOR each column
;/             FOR each row
;/               Rotate left from element at (row,col) to
;/               end of matrix.
;/     NEXT row.
;/ NEXT column.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  RAM containing matrix.
;/ INPUT:  DE = matrix start, HL = matrix end
;/         B = no. of rows, C = no. of columns
;/ OUTPUT: Transpose of matrix in source matrix space.
;/         DE, HL & B unchanged, C = 0, A = matrix last byte.
;/ REGs USED:  AF B C DE HL
;/ STACK USE:  8
;/ LENGTH:  35
;/ PROCESSOR:  Z80

NXTROW:  LD     A,C       ;address next byte to be moved     79
         DEC    A         ;to matrix end by adding no. of    3D
         ADD    A,E       ;columns left to do.  Minus 1 to   83
         LD     E,A       ;account for last rotation moving  5F
         LD     A,+0      ;elements down 1.                  3E 00
         ADC    A,D       ;                                  8A
         LD     D,A       ;                                  57
NXTCOL:  LD     A,(DE)    ;get byte to be moved to end.      1A
         PUSH   DE        ;save source pointer and row       D5
         PUSH   BC        ;and column counters.              C5
         AND    A         ;clear Cy and calculate no. of     A7
         SBC    HL,DE     ;bytes to be shifted down,         ED 52
         LD     B,H       ;matrix end - source point,        44
         LD     C,L       ;into BC as block move count.      4D
         LD     H,D       ;HL becomes block move source,     62
         LD     L,E       ;and DE block move destination,    6B
         INC    HL        ;move elements above (row,col)     23
         LDIR             ;down 1 byte to fill space.        ED B0
         POP    BC        ;restore counters and next         C1
         POP    DE        ;element pointer.                  D1
         DEC    HL        ;HL back to matrix end and         2B
         LD     (HL),A    ;put byte to matrix end.           77
         DJNZ   NXTROW    ;repeat for all rows this col.     10 E5
         POP    BC        ;restore counters and restore      C1
         POP    DE        ;pointer to matrix start.          D1
         DEC    C         ;repeat till all columns done      0D
         RET    Z         ;then return.  Else not done so    C8
OSMTRN:  PUSH   DE        ;start: save matrix start pointer  D5
         PUSH   BC        ;and row and column counters.      C5
         JR     NXTCOL    ;go process this column.           18 E5
```

KEW FOR A MICRO

Hidden away among the plants and flowers of the Herbarium at Kew Gardens, a micro is busily performing the complex and time-consuming task of fern classification. Jerry Sanders fought his way through the greenery to find out how its owner is deriving maximum benefit from the machine.

The Herbarium at Kew Gardens is less well known to the general public than are the gardens proper. Most of the plants in it are dead but not buried, and about to get a new lease of life from an Epson portable computer in the hands of a lady fern expert, Dr Frances Jarrett.

The Royal Botanic Gardens, Kew takes its name from the Kew House Estate where, in 1759, the widow of Frederick Prince of Wales created a small nine acre botanic garden. This was acquired for the Nation together with the adjoining Richmond Estate in 1841. There are now upwards of 320 acres at Kew, which is part of the Ministry of Agriculture, Fisheries and Food.

The Herbarium, founded in 1852, has a beautiful Victorian wing. This is a large hall on three floors, each with 30 bays. Natural light with a pale green tinge from the gardens outside filters in through tall windows at the end of each bay. This provides illumination reminiscent of Victorian days although more modern lighting is available. At either end of the hall a dull pink wrought-iron spiral staircase leads to more white-painted specimen cupboards.

Specimens have been arriving from lands far and near since the Herbarium was founded. Botanists come from all over the world to identify the flora of their native countries.

Pages of history

On the day I visited I met Sonam Tshering from Butan and a Dr Santisuk from Bangkok, each ensconced in the shady cool of a plant graveyard bay. Some four to five million specimens are housed in the building, carefully mounted on card and wrapped in newspapers dating from the very day they were collected. On the smooth oak table tops you can encounter some of the greatest pages in history wrapped around the yellow and dark brown shapes of nature's humblest plants. *The Bulawayo Chronicle,* for example, dated Thursday, 11 November 1937, declares 'Mr Ramsay Macdonald dies at sea!', and the wrinkled leaf resting on the newsprint echoes the sentiment in its shrivelled lifelessness. Names like Acanthaceae and Monimiaceae are faintly legible through the brass surrounds of filing cabinets.

The classification of the general herbarium specimens into families, genera and species follows the order of a 19th century publication, the *Genera Plantarum* of George Bentham and J D Hooker. About 50,000 specimens a year are received from overseas countries to be named by the experts at Kew, among them plants of the vegetable sub-kingdom termed Cryptogamia — ferns to you and me.

'Botanists come from all over the world to identify the flora of their native countries.'

Dr Jarrett has strong views about ferns: so strong that after 20 years work as a taxonomist involved in the naming of ferny parts she has taught herself computing and developed a new method of fern classification.

'We all agree what the actual groups of ferns are but no-one has managed to support the received views with a practical demonstration,' she explained, as we walked across Kew Green to her office in the Herbarium. 'The problem is not so much concerned with identifying specimens — although this we do — but with validating the classifications which are currently accepted. The Fern Herbarium at Kew was arranged by WJ Hooker, father of JD. He was very conservative, and it's not easy to find useful commentaries in ferns.'

Dr Jarret believes that the limited number of readily visible characters of ferns is the main reason for the knowledge gap. 'It wasn't really until 1937 that a classification worthy of being regarded as satisfactory for the time was published. By then the classification of the flowering plants had been more or less resolved, although there will always be arguments about some of them.'

Breadfruit mutiny

Dr Jarrett is a shy, energetic lady of 52, quick of eye and of mind. Her first substantial piece of botanical research was into breadfruit. Remember Marlon Brando as Mr Christian in *Mutiny on the Bounty?* Captain Bligh cut the sailors' water ration to save the potted breadfruit he was bringing home. This was the last straw for Mr Christian; he joined the mutineers and after seeing Bligh off the Bounty they ditched the plants over the side. In the film the Bounty sails off into the sunset leaving a trail of breadfruit pots bobbing in the briny.

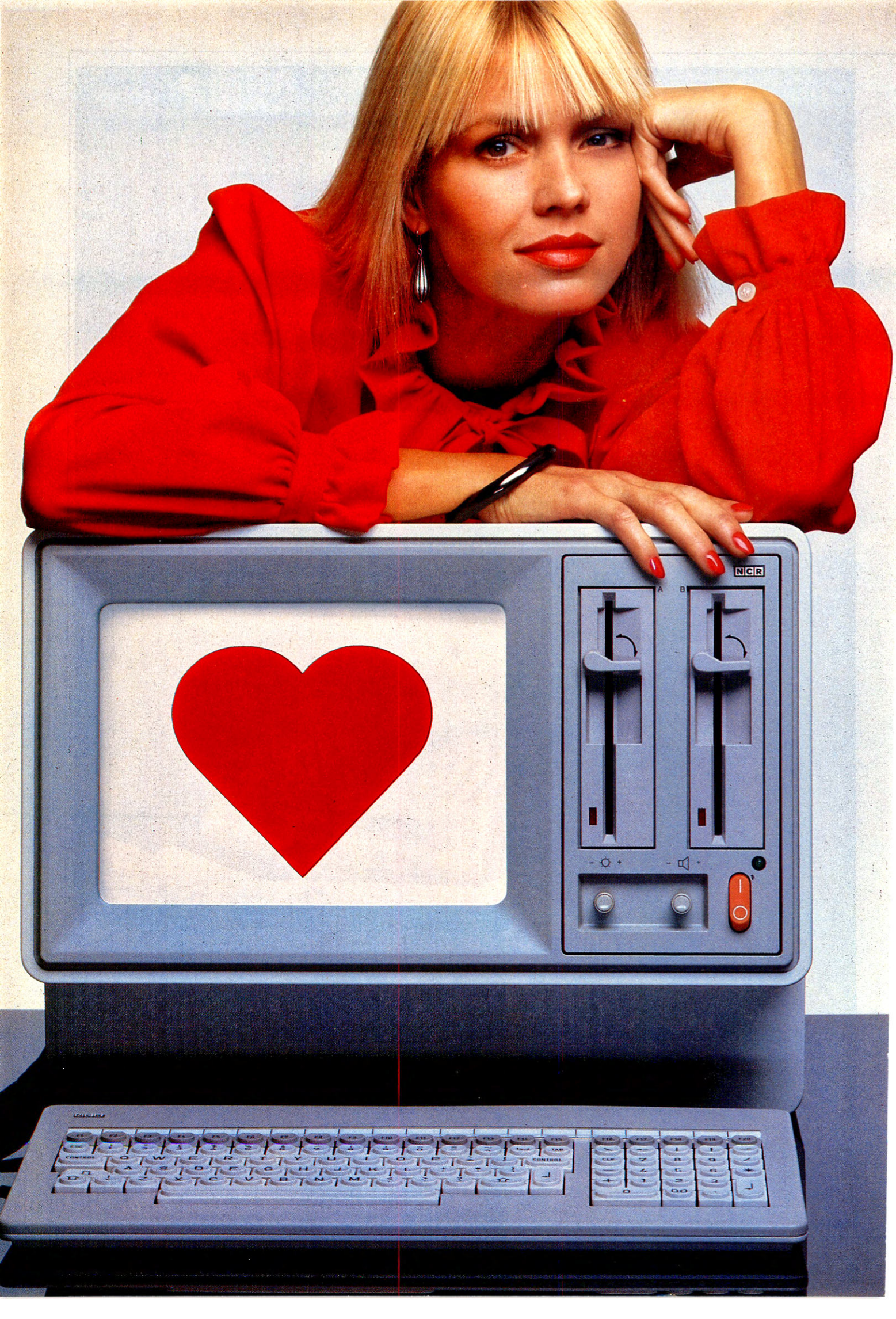
Bligh had been instrumental in the first major influx of ferns into England from the tropics when he delivered 37 species in a viable condition to our shores in 1795. Ironically he was about to be made redundant by technology, as the previous year success in raising ferns from spores was reported in London. There followed a craze for ferns in Victorian England which was comparable with today's micro boom. 'Ferns in every home' was the cry of unscrupulous traders. Publications to aid and abet the craze followed close behind, some of them containing the purplest of prose. This extract comes from an extremely popular work, *The Fern Garden*, of 1872.

'Ferns, my friends, belong to the sub-kingdom of vegetables termed CRYPTOGAMIA, a sub-kingdom so named because it is the custom of the population to celebrate marriages in the dark, so that it can scarcely be averred of them to a certainty that they really marry at all. In this sub-kingdom there are several large tribes but the ferns or filices are the most noble of all, associating with others freely, but towering above them in apparent consciousness of the right to rule.'

You could be forgiven for thinking you were reading a micro ad. But that's just where Dr Jarrett found the machine she



Photography by Michael Bennett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KEW FOR A MICRO

was looking for; an Epson advert in the pages of *PCW*. Dr Jarrett is a convinced enthusiast. Her interest in computing stems from the research which she does into the characters of the various fern families. Not dramatic characters — in the taxonomical world a 'character' is what we non-specialists would call a characteristic.

At first she had envisaged working as a numerical taxonomist, using 'all sorts of complicated formulae which, if you believe them, give you a classification based on the degree of similarity or difference between the various units — in this case families — you are trying to distinguish.'

She started out using a Hewlett Packard HP97 programmable calculator. This was, and still is, a powerful desk-top machine capable of holding up to 227 instruction steps in memory. It could not, however, hold the increasingly large amounts of data collected from both specimens and her reading of the relevant literature: a microcomputer was called for, so Dr Jarrett moved on to a PET after attending an Open University course. Dr Jarrett herself takes up the story.

'Before I took the OU course I had decided to do a numerical kind of taxonomic analysis. I'm not ancient enough to have been one of the Cambridge people recruited to do intelligence work, which is how many people first came into contact with computing, but since computers were looming up on the ordinary person's horizon — this was in 1978 — I thought it best to get educated before buying one. I enrolled on an Open University course in Computers and Computing, a broad ranging scheme. It deals with social applications and systems analysis as well as the practicalities of programming. There was no summer school but I had a tutor for whom I did homework about once a month. This course gave me access to a mainframe, a Hewlett Packard, I think, from a remote terminal at Kingston Polytechnic, which was just right for me to pop into on my way home from work. This was only basic, but I got a very good grounding in it. Computing in that environment was a very congenial activity that I slotted into very well. I'm afraid since then it's become more of a solitary pursuit — in fact once I got busy I found I didn't really have time to go to user group meetings, although I am a member of the HX-20 user group and get the newsletters.

'Taxonomy is most easily defined by looking at a garden. You would recognise a rose when you saw one, you might even recognise different kinds of rose. There are the hybrid tea ones that go into flower beds, and there are shrub roses: they are all recognisable as roses because they have the same sort of flower and many of them produce hips — that is what we call a genus. Within that you could then recognise several different species such as the shrub roses and hybrid tea roses. In both cases there has been quite a lot of hybridisation and unnatural selection going on, so it's not a perfect comparison with the world of wild flowers where hybridisation is rather rare. Anyway, you would, as a taxonomist, group together into a family which also contains hawthorns, apples and pears. All of them belong to different genera, but looking at the flowers they seem rather similar to one another. In the case of the flowering plants, you can go on to recognise a series of different families, many of which don't grow in England. The taxonomist works at deciding how many species or families or genera can be distinguished and provides a description for the unit, and says where it is distributed. Some of my Epson programs are all about providing a key for the purposes of distinguishing between plants by taking a series of choices and hopefully ending up by identifying the right plant at the end of it.

'My first computer was a PET. After I got it I was talking to someone connected to the academic world who said that he'd never heard of a private individual having one before. It was a 3032 with 32k of memory: back in 1978 you were being fairly ambitious if you had 8k! I changed to the Epson in January 1983 mainly because of the convenience of the portable format. Having done so I found that the more advanced Basic is something I wouldn't like to give up. Routines like 'SWAP' (for exchanging two variable values) are available without the user having to write a machine code program to do it.

'I developed my own structured design method for writing my programs, because the importance of structure was well put across on the Open University course. Originally, what I wanted to do was to examine my plants by defining a whole lot of characters. Was it hairy or smooth, for example? I could then store it as '1' for hairy and '0' for smooth. This is a two-state character, and I realised that it wasn't going to work out when I came across a kind of taxonomic key in which instead of recognising only two states for a given character you may take quite a complicated character and record various possible conditions. It was while I was on a Hellenic cruise in 1979, trying to identify a relative of the carrot in the Flora of Turkey, I realised that the method being used could be a way of organising my fern data.

'With a numerical taxonomy, control of the classification is in effect handed over to the particular statistical method chosen. What I have done is to take back control in three ways. In the first place, I make initial qualitative decisions about what are *good* characters, choosing those in which well defined character states can be observed (see Fig 1). Secondly, I actually define these states myself. I can then use as elaborate a description as I like for each state, since each will eventually be coded with a single letter. Finally, I can decide in what order the characters will appear for the whole group under study. At this stage I can validate (or otherwise) my choice of characters according to whether a clustering of characters can be demonstrated.

'The four programs I wrote for use on the Epson provide a summary of the classification and a multi-access key showing how the families can be distinguished, with an explanation of the codes that are used. The first program holds the family names and "formulae" in data statements with line numbers derived from the family numbers. This facilitates alterations to the data in the absence of a FIND command. The data can also be listed for checking. Options for output format (key or summary), order of characters and recoding are provided here, and the formulae are sorted accordingly. 5300 bytes are CLEARed for RAM files and a file for each data type is set up in this protected area. Either the key or the summary program is then loaded and accesses the RAM files. Both these programs are essentially formatters for outputting tables, but the multi-access key program was also used to optimise the arrangement of the characters to produce the best matches between formulae and/or the clearest distinctions between different family groups. For this the microprinter was used to list family numbers and formulae with the original codes I had assigned (Fig 2). The ease with which the order could be changed by re-running the files program greatly helped in finding the "best" arrangement (Fig 3). The ability to do the final recoding using this program was important in avoiding errors.

The fourth program of the suite holds definitions of the character states which can be re-arranged and recoded to match the final arrangement of the characters (as

G Sporangial symmetry and the annulus.

S Sporangia bilaterally symmetric at maturity with a lateral or subapical patch of thick-walled cells; dehiscence sagittal along a line of elongate, thin-walled cells.
T Sporangia bilateral with an equatorial or oblique annulus; dehiscence as A.
U Sporangia bilateral with a contracted distal ring of thick-walled cells; dehiscence as A.
V Sporangial structure asymmetric with an oblique or vertical annulus having about 40 thick-walled cells; dehiscence oblique or transverse, through a lateral stomium.
W Sporangial structure and annulus as V but the latter with up to 25(−35) thick-walled cells; dehiscence as V.

Fig 1 A character with its associated states.

'Some of my Epson programs are all about providing a key for the purposes of distinguishing between plants . . .'

shown in Fig 3).

In a difficult group of plants, characters will have tended to evolve in the same direction in other unrelated groups as well: the task is to identify characters which hold the group together. 'I'm currently working with 13 different characters, each of which may be present in up to six different states. To take a simple example of a state we could consider veining on the leaf. This could be completely "free", or else form a net, or there might be little veinlets within each part of the mesh of the net. Spore-cases *(sporangia)* are another good example.

'The programs are in these four modules so that I can get everything onto the machine. The files are stored in an area reserved for files at the top of memory. I've one criticism of the HX-20 manual here: the diagram in appendix H-1 doesn't make it clear that with the expansion of memory to 32k the RAM file area sits at the *top* of memory. Otherwise it's a very good manual.

'Before the first program runs it asks for an output option. This can be either a classification, or take the form of a multi-access key. This kind of key, which has only recently been developed, is of use when attempting to validate currently accepted classifications. As a result of the correlations shown up by the sort of routine to which the classification data is subjected, it has been possible to provide sound definitions for the recognised fern families (see Fig 4). In at least one case, a fern has been discovered to belong to a totally different group. For those in the know, the fern in question is the Monachosorum.

ORIGINAL

CHARACTERS & CODES

```
G Sporangial symmetry
                S T U V W
F Stele
                N O P Q R
I Gametophytic hairs
              0 4 5 6 7 8
D Stomata
                  - J K
E Antheridia & stalk
                1 2 3 4
M Abaxial indusia
                    5 6
K Sporangial stalk
                  $ % + /
B Stipe traces
                D E F G
A Venation
                A B C

UNUSED IN SORT

C Hairs/bristles/scales
                  H I M
H Capsule faces
                  # * Y ^
L Spores mono/trilete
                  1 2 3
J Abscission of stipe
                  7 8 9
```

Fig 2

RECODED

CHARACTERS & CODES

```
A Sporangial symmetry
                A B C D E
B Stele
                F G H I J
C Gametophytic hairs
              K L M N O P
D Stomata
                  Q R S
E Antheridia & stalk
                T U V W
F Abaxial indusia
                    X Y
G Sporangial stalk
                  a b c d
H Stipe traces
                  e f g h
I Venation
                  i j k

UNUSED IN SORT

J Hairs/bristles/scales
                  l m n
K Capsule faces
                  o p q r
L Spores mono/trilete
                  1 2 3
M Abscission of stipe
                  4 5 6
```

Fig 3

'The Epson is rather slow at accessing arrays, so if I'm going to access an array element more than once or twice I assign it to a variable using x, y and z which I keep at the front of the variable table. I also use DEFINT and DEFSTR to save memory space by specifying the kind of variable in advance.'

Close analysis

The microscope is the key to much of Dr Jarrett's work — it wasn't around in the days the Herbarium was founded. 'It's quite remarkable' — says Dr Jarrett — 'how much microscopic detail there is to find. Take spore shape, for example. In my original work on spore shape using two states I put it in at the end as a character of some interest, but not of enormous use. Furthermore, if I coded it for more than two states there was a big increase in the number of formulae. There's been parallel evolution from a pyramidal spore shape to a bilateral bean-shape with some families containing both states, so I added a third state to indicate mixed shape.

'On the other hand, something had been niggling me about one family until I realised that I could sort it out if I coded each *genus* for this character. It was extremely satisfying. I did it last January and I still tell everybody about it! If I had used spore-shape as my first character there would have been absolute chaos. I had to identify which characters stated true relationships and which ones were varying a lot. The latter couldn't be used to study relationships. The way I identified relationships was by pairing of successive formulae. Did the characters match, and if so, to what extent? I shifted them around until I got as high a degree of matching as I could.

'With this method the amount of measurement data used is reduced drastically. Practically the only numerical data I use is the number of bundles that carry water up the stalk of a frond (fern leaf). The most common number is one or two, but there are some groups which have several. Two of the very commonest ferns in Britain are very easily distinguished if you look at the number of bundles in the stalk . . . if you weren't trained to notice this you wouldn't be able to tell them apart: in fact it's a very good way of convincing a group of doubting students that there *is* a difference. But you wouldn't normally use that sort of character too early because otherwise you are ignoring all the other characters which tell you where the plant really belongs. That's why I need to be able to contrast as many characters as I possibly can.'

Gymnogrammoid group

```
14     W00J3 5%DA M# 17
17.1              M* 17
20.1              H# 17
15     W00J3 5+DA MX 17
16                MX 17
17.1              H* 17
                  I* 17
                  IX 17
                  M* 17
                  MY 17
  .2              H* 17
  .3              M# 17
  .4              M* 17
                  MX 17
18                M* 27
                  MX 27
                  MY 27
```

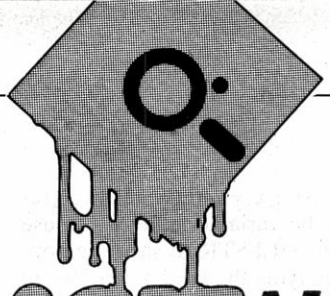
Fig 4 Sorted character state formulae. Notice the large blank area. This indicates a natural group where there are a lot of agreement of characters.

Dr Jarrett's work with the Epson will enable the classification of ferns to be updated on a par with flowering plants, behind which they lag.

Her work and programs are due to be published in the course of 1984. She already has plans to apply her methods to another area of fern taxonomy. As she herself believes, at 50, she was young enough to get started as a computer user, and hopes her story might encourage other 'mature' people to take up the challenge. I'm sure she's right.

END

'The four programs I wrote for use on the Epson provide a summary of the classification and a multi-access key . . .'



DATABASE BENCHTEST

DATA COLLATER 1983

In Part 2 of the database round-up, Kathy Lang explains the tests used to measure the speed of packages and gives a summary of the Benchmark timings.

This article should be read alongside the round-up of qualitative features of data management systems in the December 1983 issue of *PCW* ('Data Collater 1983'). Here you will find summaries of the Benchmarks carried out on most of the packages reviewed in this series in the last two years. Some of the Benchmarks differ slightly from those published with the original articles, in an attempt to make them more universally applicable, and most have been renumbered — see the Postscript. All but two of the packages (not DataPrism or MicroPen) have been re-tested with the new Benchmarks, and the results are shown in Figs 1 and 2.

Before I begin, I'd like to repeat the comments I made on copyright in the December 1983 Data Collater feature. Most readers will know that material in *PCW* is protected by copyright, as is any published material in a country like Britain which is a signatory to the Berne Convention. However, a few do not. So I'd like to take the opportunity of reminding all readers that *the material in this article is protected by copyright law. The article may not be copied or redistributed, in whole or in part, in any form without the written permission of the copyright holders.* If you want to use the material, write to the *PCW* Editor in the first instance.

The purpose of Benchmarks

The purpose of these Benchmarks is to provide a very crude measure of the performance of the packages in handling a set of data of reasonable size. When you see a package demonstrated by a dealer, it is almost certain that you will see a demonstration version of the package which has been restricted by the supplier to hold a maximum of ten or fifteen records. Any package should work fast in those conditions! Even if it is a full copy of the package that you see, it is very unlikely that the file being shown will contain more than a few dozen records.

So Benchmarks can be of some help in comparing packages. They are of less help in predicting exactly how a particular package will perform on your system, since timings are of course dependent on hardware as well as software. Probably the greatest variations in timings which you may notice will be in the case of much larger files accessed sequentially, and in comparing times between hard and floppy disks. This is especially important if you are contemplating a multi-user system, as you will undoubtedly need a hard disk system for this anyway.

If Benchmarks can only be of limited help when choosing packages, where else can you turn? Well, the obvious and most valuable source of help is other users. It really can't be stressed enough that before you buy a package costing a lot of money in your terms, you should see it running on another user's system, preferably on files at least as large as you are ever likely to need. Benchmarks can give you comparative information, but real life is the acid absolute test.

Carrying out the Benchmarks

In order to make it possible to compare the Benchmark times realistically without having to worry about the effects of varying hardware, all the Benchmarks reported here were carried out on a Sirius, using the native 8088 5.6MHz processor if possible, otherwise using a 6MHz Z80 card. I have not noticed any appreciable difference between the two processors, and would not expect to: firstly, because the processors are very similar in speed; secondly, because most data handling packages are limited more by disk access than by processor power, and this is of course common to the two processors; and, thirdly, because very few companies have taken advantage of the extra facilities offered by the additional memory on the 16-bit systems to increase the amount of index space in memory in order to improve access times for indexed records.

The Benchmark file consists of 1000 records, each 152 characters long, in 21 fields (8 numeric, 12 alphameric, and one date field). This is not, of course, a large file. But it is large enough to show up considerable disparities between the packages; in particular, some packages are sufficiently slow for me to worry about the effects of the constant pounding of my disk drives, and to use smaller number of records and scale the results up accordingly (where this has been done, it is shown in the footnotes to Figs 1-3). A raw data file containing the 1000 records is created by being written from a program — in Basic if the system permits it, if necessary, Pascal, and very occasionally in the system's own 'programming language'. Most packages now have some method of importing a text file written in this way, though in some systems the process is very slow. In the main reviews I report the time this took, but I have not shown those times in this summary for two reasons. Firstly, several of the packages have had new versions which could still read data files created in the previous release; to quote the correct importing time would have required repeating this often slow process as well as all the other tests. Secondly, it is only of importance to people who regularly need to ship information between micros and mainframes, or between two different micro packages. I may be able to give further information to people with this problem if they care to get in touch with me through *PCW*.

There are two reasons for creating a file of 'synthetic' data, through a program, to use in Benchmark tests. Firstly, the volume of information is such that it would

be quite impracticable to type it in by hand. But equally important, with a synthetically generated set of data, the distribution of the information is known. So I can, for instance, tell you that each record has a unique value for its first field, and that the fourth field contains values, each of which occurs twenty times in the file, spaced at regular intervals, so that the 1st, 51st, 101st, etc, records will all have the same value for field four. This makes it easier to generalise from performance with this particular file than it would be if 'real' data, with all its vagaries, were used.

What Benchmarks are used?

Two main groups of tests have been used. The first five are concerned with interactive use of the information — with entering and retrieving individual records or small groups of records. The first test simply measures the time taken by the system to store away a newly-entered record and display a blank for the next. The second shows retrieval time on the 'primary key' (five characters long in this test). In some systems, such as DMS, this means just what it says: one key — usually one field, the first — is the main key, through which access is gained to records needing amendment. In others, like InfoStar, only one key is available at any one time, so in a sense only primary key access is allowed. In yet others, like dBaseII, many keys are allowed and no one is pre-eminent, so in a sense any key may be a primary key, and here the time is the same as in the third test, which shows the time taken to retrieve a record through the secondary key (where the key field is three characters long). With this test, it is particularly important to be aware of the action taken by the system, if any, to keep such secondary keys up-to-date, since a package may be very quick to retrieve information but inconvenience you by obliging you to do a re-indexing operation each time the file is amended or records are added. You can check which way each package works by looking at the December Data Collater feature.

The fourth test uses exactly the same search as test three, but seeks for the match sequentially rather than through an index, giving you some feel for the time taken to carry out *ad hoc* searches. By using exactly the same test as the secondary key search, it also gives you the chance to compare indexed and sequential search times. The fifth test looks for a match using a 'wild code', if the package allows it: that is, it looks for a field value beginning with a single character though the field actually contains three characters. If the package allows such a search to use an index, then my test takes advantage of that, which is one reason for some of the variations in speed. Another is that some packages find all the occurrences of the match first, and then allow you to browse through them until you find the one(s) you are after, while others search for each one as you finish with the previous record. Naturally, the first approach leads to a longer 'lead time' before any records are found, and a shorter time between the display of each record thereafter, than the second approach.

When comparing timings on any of the searches, you should also bear in mind the difference between packages which expect you to set up a 'search rule' in one process, and then to execute it in another, separate action, those which permit this but do not enforce it, and those which always carry out the search immediately. This was one of the functions compared in last month's feature.

Opinions differ as to what is an acceptable time for this sort of activity. When I was involved with Benchmarking large interactive systems, I regarded 'under two seconds' as a desirable aim for the time taken for the system to respond to a user's request, and this is shown in the tables as 'Inst(antaneous)'. Research suggests that for tasks which are truly interactive — that is, they require continuing response from the person at the keyboard, response times over about seven seconds for most interactions, with up to 10 seconds as an occasional aberration, leads to increasing user dissatisfaction.

The second group of tests involves tasks which tend to be carried out on records 'in a batch', such as sorting. Here you can expect times in minutes rather than seconds, since the operation must involve, at the very least, the reading and writing of 1000 records once each. The sixth test involves indexing the file on the field of three characters used for selection tests 3, 4 and 5. For those packages which do not automatically keep secondary indexes up-to-date, or which allow only one index at a time, this figure is of considerable importance unless you almost never want to access your information by an alternative field.

Test seven is a sort, carried out on a five-character field. Some packages do not actually sort the data, they just create a sorted index, in which case you would expect the times for tests 6 and 7 to be similar. However, these times may also depend on the nature of the field values. All other things being equal, it may take substantially longer to order a file on a field containing duplicate values compared by ordering on a field with unique values. So the information that the field used for

Package	BM1	BM2	BM3	BM4	BM5
Beta	2secs/rec	2secs/rec	2secs/rec	2mins10secs	1min30secs
BusiPost@	Inst	Inst	NP	2mins12secs	Inst
CardBox	Inst	Inst	Inst	1min40secs +Inst	8secs +Inst
Condor	2secs/rec+	2secs/rec+	2secs/rec+ (+BM6)	5secs/rec+	2secs/rec+
Dataprism	Inst	3secs/rec	3secs/rec	NT	NT
dBaseII	Inst	Inst	Inst	3secs/rec; Inst	Inst
DBMSIII	3secs/rec	Inst	NT	4secs/rec	NP
Delta	2secs/rec	3secs/rec	3secs/rec	4mins 15secs#	10secs+ 3secs/rec
DMS	Inst's	10secs/rec	7secs+ 3secs/rec	1min 44secs#	4secs+ 2secs/rec
FMS80	5secs/rec +35secs	3secs/rec	3secs/rec	3mins 5secs#	5secs+ 2secs/rec
InfoStar	Inst	Inst	Inst (+BM6)	Inst	Inst
MPen	6secs/rec	2secs/rec	2secs/rec (+BM6)	NT	NT
Omnis@	2secs/rec	2secs/rec	2secs/rec	10secs– 18secs/rec	2secs– 18secs/rec
Optimum@	2secs/rec	3secs/rec	NT	12mins 55secs#	12mins 54secs#
Rescue	Inst	3secs/rec	3secs/rec	1min5secs +3secs/rec	1min15secs +3secs/rec
SuperFile	Inst	Inst	Inst	NA	Inst
Tomorrow's Office	1sec/rec	3secs/rec	53secs+ Inst (+BM6)	7secs/rec	3secs/rec

Notes:
@ Scaled-up figures. Original tests were done on: Omnis-800 records, Optimum-250 records, BusiPost-600 records. Figures for BM1 do not include time to enter data from keyboard. Where two figures are shown: for BM1 the times are given as 'access time per record'/'time to update index at end of session'. For BMS 2, 3, 4, 5 the times are given as 'access time to record in this search operation'/'access time for each subsequent record'. For Condor, + means '+10 secs per search session' (possibly including several search operations). For dBaseII BM4, times are 'access to 1 record/screen'; 'access to records listed 15 per screen'. NA=Not appropriate. NP=Not possible. NT=Not tested. Inst=<two seconds. #=includes time to display records where this is inseparable. Times are based on most recent version of package as supplied to me by September 1983.

Fig 1 Benchmarks 1 to 5

DATA COLLATER 1983

indexing contains each field value twenty times, spread evenly across the 1000 records, while the field used for sorting contains only unique values, may help to explain some otherwise puzzling discrepancies between the two tests in Fig 2. (It was of course intentional that the two fields should exhibit different characteristics, to make the tests more generally applicable.)

Some packages are very slow at sorting: in particular dBaseII: though quick at most tests, it is comparatively slow here. However, before deciding whether this is important, you should check whether the package allows secondary indexes, and whether it keeps its indexes up-to-date automatically. If the answer is yes to both questions, then you will probably never need physically to sort the file. The point to watch is the chance that you will need to export your file to another system, where it must arrive in a particular order. Some packages, again including dBaseII, allow you to achieve this through indexing, but this is not universal — you may need sorting just for this purpose.

Test eight involves computing a new value for an existing field, for each of the 1000 records. This is the kind of amendment you might want to make to increase all the prices of your stock items by 10%, or add the value of the most recent order to a cumulative order total held in a customer file. Not all packages can do this, and several that do achieve it only by 'programming'. Test nine also involves computation, but this time across records rather than within them: it totals the values of each of three numeric fields in the record. Some packages allow you to do this only by printing a full report with a detail line for each record as well as the totals, so if you occasionally want just totals or summary statistics, you should check whether this is possible.

The final test, BM10, measures the flexibility of the package in reorganising the data structure. It involves adding one field to the record format, which for some packages involves copying the data out onto a plain text file, altering the record structure and copying the data back — hence the rather lengthy time taken by some packages. Where this procedure necessitates re-indexing the file, the time for this has been included.

Package	BM6	BM7	BM8	BM9	BM10
Beta	NA	11mins40secs	NP	2mins40secs	30mins44secs
BusiPost@	NA	37mins30secs	NP	NP	NP
CardBox	NP	NP	NP	NP	MD
Condor	2mins10secs	8mins10secs	5mins30secs	35secs	4mins18secs
DataPrism	1hr40mins*	22mins	PL	20mins	1hr43mins
dBaseII	9mins53secs	36mins5secs	3mins52secs	1min10secs	6mins55secs
DBMSIII	as BM7	F→	18mins35secs	12mins30secs	PL
Delta	4mins4secs	3mins30secs	9mins55secs	12mins9secs	26mins15secs
DMS	4mins51secs	5mins30secs	12mins30secs	14mins	58mins30secs
FMS80	4mins35secs	30mins50secs*	NT	10mins	34mins12secs
InforStar	1min20secs	5mins	1hr11mins	2mins30secs	1hr23mins
MPen	1hr20mins*	NP	NP	NP	NP
Omnis@	NP	28mins	31mins27secs	32mins49secs	NT* (3hr26mins+)
Optimum@	NP	56mins56secs	1hr45mins	57mins20secs	MD
Rescue	see rev	4mins10secs	NP	3mins	MD
SuperFile	NT*	2hrs18mins@	PL	1min30secs	Inst
Tomorrow's Office	5mins	4mins45secs	8mins	5mins20secs	40mins

Notes:
@ Scaled-up figures — see Fig 1 for number of records used as base, except for SuperFile sort, based on SF's estimate of sort as 60% complete.
*DataPrism and MicroPen — figure is for index on 25-char field (not 3-char field).
*FMS80 — allows Sort only on primary key field, indexing replaces sorting completely otherwise.
*Omnis — addition of field possible only through writing a DIF file and reading it back; time in brackets is for reading DIF file only.
*SuperFile — indexing only necessary after a substantial number of changes.
NA = Not applicable. NT = Not tested. NP = Not possible. Inst = <two seconds.
PL = function requires use of programming language (eg, Basic). F = Test not timed because of failure during execution. MD = Time to modify data format only. Times are based on most recent version of package as supplied to me by September 1983.

Fig 2 Benchmarks 6 to 10

New Benchmark Test Numbers	Test	Corresponding Old Benchmarks
BM1	Time to add 1 record	BM2
BM2	Time to select record by primary key	NE
BM3	Time to select record by secondary key	NE*
BM4	Time to access 20 records from 1000 sequentially on 3-character field (matches in 3rd, 53rd, 103rd and every succeeding 50th record	NE#
BM5	Time to access records using 'wild code' — as BM4, but only first letter of field given for matching	NE
BM6	Time to index 1000 records on 3-character field	NE$
BM7	Time to sort 1000 records on 5-character field	BM7
BM8	Time to calculate on 1 field per record and store result in record	BM8
BM9	Time to total 3 fields over 1000 records	BM9
BM10	Time to add 1 new field to each of 1000 records	BM1

Notes:
* Equivalent to 'per record' times for old BM5.
# Equivalent to old BM4 except that previous test extracted 50 records on fields totalling 25 characters, and timings do not distinguish overheads from 'per record' times once selection carried out.
$ Equivalent to old BM6, except that old test indexed on two fields totalling 25 characters.

Fig 3 Benchmark Test Correspondence

Conclusions

Benchmarks like these can give you some help in comparing the performance of packages which are similar in features. They can also help to check that features you need frequently do not take a lot of time, particularly for functions which are to be carried out interactively. It is, of course, important not to put too much weight on Benchmarks — certainly not on those tests which measure the speed of functions you don't very often need!

Observant regular readers may note that the Benchmark test numbers used in this summary do not correspond with those in the original reviews. So many of the packages have had new versions since I reviewed them, having to be re-tested, that I was able to take the opportunity to revise the tests used. Fig 3 shows each new Benchmark test number with its function, together with the number of the corresponding Benchmark, if any, used in previous reviews. END

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If you've invested in an IBM PC XT or an IBM PC expansion unit, you're probably doing important things with your computer. Office work, lots of word processing or spreadsheets, even your whole company's accounts. Well done.

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What is the incredible JACK of All Trades?
JACK is an integrated applications software package for Apple II computers. "Integrated" means that JACK can do Word Processing, Data Base Storage and Retrieval, and Calc Analysis all at the same time. Because it is integrated JACK lets you do all these things with just one simple set of commands.

Who should buy JACK?
JACK is perfect for the first-time computer buyer who works with information, be it words, numbers, or lists with words and numbers in them. You can learn JACK just once and do three times as much with your computer as with any single-function software. And JACK costs far less than buying three different programs! Experienced computer-users who need to integrate their applications should also consider JACK. If you've ever wished you could integrate a document and a calc model without scissors and glue, or 'printing to disk', JACK is for you.

What kinds of work can I do with JACK?
If your work consists of words, lists, or numbers, JACK can probably handle it. If you work with words and numbers at the same time, or lists with numbers, or even lists with words, JACK will make that work easier than any other software you can buy. Things you can't do with most software are easy with JACK: write a memo with calculations-and do those calculations at the same time; or create form letters from a mailing list with a single command, or make a list of 'what-if' options and select the best one by simply telling the computer what you want.

What else makes JACK special?
Convenience. Most people use computers to prepare documents, to handle information, and to answer "what-if"-type questions. Without JACK, it takes a separate program to do each task. But most people don't work that way. We work on tasks that involve words, numbers, and record-keeping all together. And those tasks don't conveniently sort themselves into "word processing tasks", "calc tasks", and "data base tasks". By allowing you to work on one task in all three ways, at the same time, JACK offers greater convenience than single - function software packages. JACK is THE software that lets your personal computer work the way YOU do, instead of the other way around.

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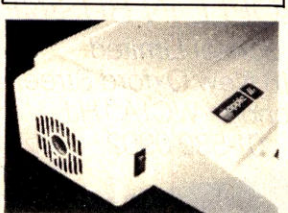

HELLO FAN!

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This neat fan with power surge suppression and neon lit front facing switch will help to keep your Apple cool and avoid possible data errors by smoothing current flow and keeping the Apple's power supply and circuitry at a lower temperature. The fan is a high-quality unit at

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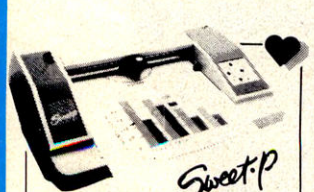

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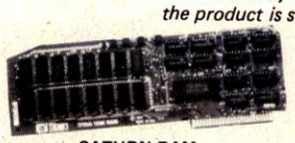

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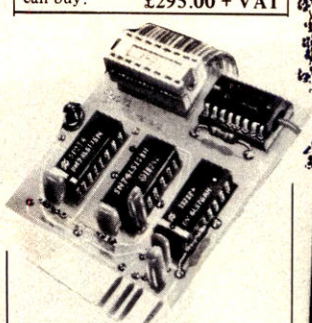

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An accidentally erased disk can cost you weeks of time waiting for an expensive replacement. Making backup copies of all your important programs is an essential element of sensible computer use. SNAPSHOT TWO is the powerful, fast, and easy-to-use hardware/software system that gives you the power to copy your valuable software. Just boot your disk, and press the trigger. SNAPSHOT TWO removes copy protection, and copies most programs in 30 seconds, even programs that baffle other copiers. Backups are ordinary DOS 3.3 disks that will immediately boot and run on any 64K Apple (and, often, on any 48K Apple) without SNAPSHOT TWO Present.
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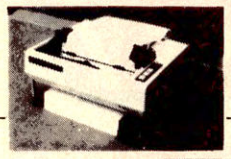

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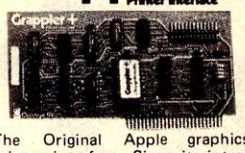

The Original Apple graphics printer interface. Since its introduction three years ago, the Grappler has been initiated by many, but never matched. Now with Dual Hi-Res Graphics for side by side reproductions and Mixed Mode screen dumping, the Grappler+ remains the most intelligent interface available. Over two dozen commands give Apple users full control over any graphics or text on the Apple screen, including a new 80 column text dump.

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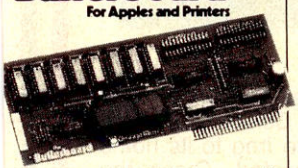

The economical way to add printer buffering. The Bufferboard easily adds memory to your current Apple interface system, freeing your computer for additional input. Easily upgradable from 16K, the Bufferboard can store up to 20 pages of text. It fits neatly inside your Apple, "docking" onto your existing printer interface. No clumsy boxes or cables, no external power supplies... just convenience and economy.

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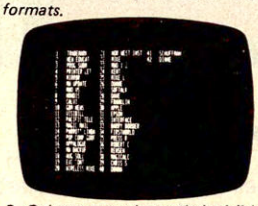
Both the Apple II (minimum 48K) and the new IIe are supported, as well as expanded memory cards up to a total memory of 512K (four 128K cards). There are 254 rows and 63 columns of work space on the spreadsheet. The program works in 40 or 80 columns (most of the 80-column cards are supported). A 70-column format is provided using Hi-Res graphics. Both uppercase and lowercase entry/display are allowed. The program can be used with multiple drives including hard disks.

Q. What advanced spreadsheet features does MAGICALC have?

A.1. Columns may be different widths to fit your data and formats.



2. Columns may be made invisible to hide data or to operate as a third-window on the data (bring first and last quarter figures together, for example, while leaving the title and other windows unchanged).

3. Individual cells may be made invisible to hide sensitive data.

4. Cells may be protected to prevent inadvertent erasure.

5. Cells may be protected to allow only numbers or labels to aid in the setup of templates.

6. A "tab" to the next unprotected cell is provided for fast data entry into templates.

7. On-screen indication of Global Computation Order is provided, as well as Manual or Automatic Computations mode.

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MultiMate™ has the most complete set of cursor positioning capabilities available today.

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The standard functions such as Insert, Delete, and Move, as well as the more complex functions, are self-prompting and are performed with a minimum number of keystrokes.

Formatting Functions

Full control over tab settings, line spacing and line length are provided by MultiMate™'s format line feature. An unlimited number of format lines may be included in your document. Format line modification results in automatic text readjustment from the modified format line to the next format line or the end of the page.

Printing Functions

MultiMate™'s complete printer control capabilities allow full utilization of the features available on your printer. MultiMate™'s Header and Footer facility is unsurpassed in flexibility and ease of use. Alternate Headers and Footers are supported as well as the ability to change Header or Footer text as often as needed within a document.

Printer Control Codes provide special printing functions unique to your printer.

Document printing is performed in a "background" mode so that while a document is being printed, you may create or revise another document. Foreground printing is also provided.

The Printer Queue Control allows you to control the documents to be printed by: deleting a document from the queue, placing a document on hold or releasing it from hold, moving a document to the top of the queue, and restarting a document currently printing.

Advanced Functions

MultiMate™'s Library function allows you to store an unlimited number of boilerplate phrases, paragraphs, or forms (up to one page each) on a diskette. These Library entries may be recalled for insertion into your document whenever specified.

Merge, Repaginate, Column Manipulation and the other advanced functions are also available and equally easy to use.

With the Column Manipulation function, you may Move, Copy, Delete, or Insert columns of text or numerical data in a page of your document with a few keystrokes.

Column Calculation functions provide you with the following math capabilities: Vertical and Horizontal Addition to sum columns or lines of numerical data; Subtraction, which is accomplished by designating a number as negative, and thereby is equivalent to adding a negative number. Combined, these column-oriented functions yield you considerable flexibility and versatility when creating or editing documents with numerical data.

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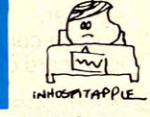
Pete & Pam Computers



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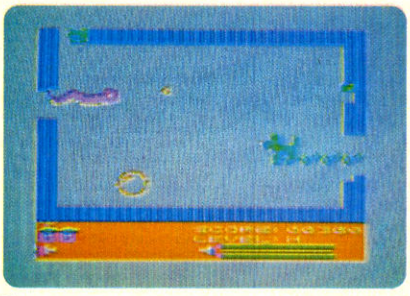

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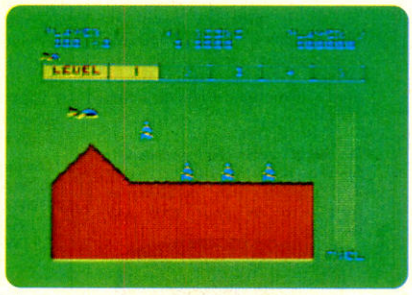
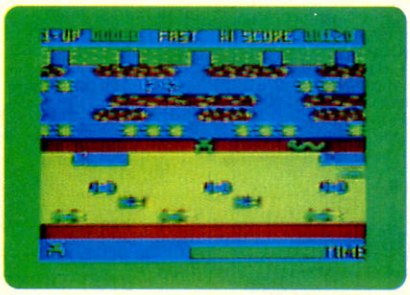


B



C

A **CRAZY PAINTER.** A high-speed arcade action game! Try your hand at painting the floor! Sounds easy? Yes, if the dogs, moths, caterpillars, boys, balloons etc. don't keep walking over the paint! Eight levels of difficulty. The catchy tunes played while you paint will have you "singing while you work". Keyboard or joystick controls. **26-7305**

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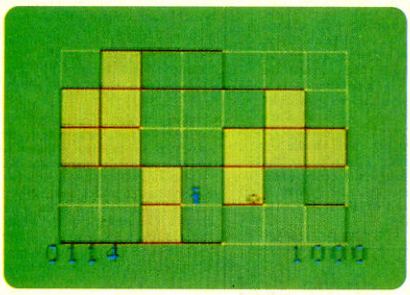
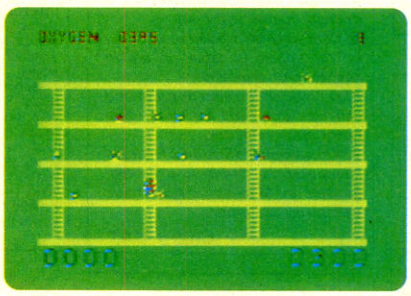
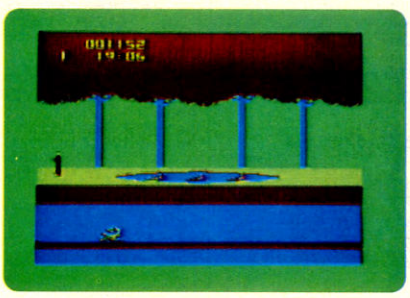
C **FROGGER.** The popular arcade game for the Tandy Colour Computer. Safely manoeuvre the frog to its home within the time allocated. Cross the highway without getting run over and cross the river without falling in. Avoid the traffic, snakes, crocodiles and diving turtles. For one or two players. Joysticks optional. **26-7304**



D



E



F

D **CUTHBERT GOES WALKABOUT.** Cuthbert must turn the lights of the lunar landing pad on by walking across the switches before the invading Moronians get him. Watch him do his victory dance before he tackles the next "pad" and another, larger, set of invaders. Superb colour graphics with music. Keyboard or joystick control. **26-7302**

E **CUTHBERT GOES DIGGING.** Cuthbert is guarding the site for a new launch pad. However the Moronians are still determined to get him! One touch and Cuthbert is electrocuted. The only way he can kill them is to trap them in a hole and hit them with his insulated hammer before they escape. Keyboard or joystick control. **26-7303**

F **CUTHBERT IN THE JUNGLE.** A high speed arcade action game with full colour graphics! Cuthbert failed to overcome the Moronians so he has been sent to the jungle! He must fight his way out collecting treasures, jumping pits and swinging over alligators whilst being aware of the killer scorpion. One joystick required. **26-7301**

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A BEGINNER'S GUIDE TO PROGRAM CONVERSION

APPLE II GRAPHICS

This month Surya looks at graphics on the Apple II as part of his analysis on each of the machines on the PCW *Converter Chart (see September issue).*

The Apple II has three variations: the Apple II, the Apple II Europlus (Apple II+) and the Apple II Enhanced (Apple IIe). All three support Applesoft Basic and therefore use the same graphics-handling statements.

Applesoft supports three screen modes — text, low-resolution graphics and high-resolution graphics. These are called by the statements TEXT, GR and HGR respectively.

Text

The normal text screen comprises 24 lines by 40 columns. An 80-column screen is available by installing an optional circuit board; any *PCW* programs written for an 80-column machine will have this clearly stated in the accompanying notes.

Text mode has ten statements which may be used to format text output on the screen:

HOME clears the screen and positions the cursor at the top left-hand corner. On most machines, this is achieved by the statement CLS.

Applesoft supports no less than four forms of tab statement: SPC, TAB, HTAB and VTAB. SPC (x) prints x spaces. So, SPC(10);"Hello" would move the cursor ten columns forward and then print 'Hello'. TAB (x) moves the cursor to column x. If x is less than the current cursor column, then the statement is ignored. Thus SPC moves the cursor relative to its current position, wrapping around lines as necessary, whereas TAB moves to the absolute screen column specified.

HTAB (Horizontal TAB) is similar to TAB, but can move left as well as right. HTAB (x) moves the cursor to column regardless of the cursor's current position. VTAB (Vertical TAB) is used to position the cursor vertically. VTAB (x) moves the cursor to line x leaving its column position unchanged.

As an example:

```
100 REM: Tabulating on an Apple II
110 HOME: REM clear screen, position
    cursor top-left
120 PRINT TAB(10); "Line 1, column
    10"
130 PRINT "Line 2, column 0"; SPC(5);
    "column 22"; HTAB(16); "and";
140 REM Above line would appear on
    screen as Line 2, column 0 and column
    22
150 PRINT VTAB(12); HTAB(19); "*":
    REM centre of 40-column screen
160 END
```

To find the current cursor position, the POS (POSition) statement is used. POS (x) returns the current cursor column. The expression x is a dummy value (that is, the value has no effect) but must be a valid expression which Applesoft can evaluate.

INVERSE switches on the inverse video attribute, and is cancelled by the NORMAL statement. So:

```
100 HOME
110 INVERSE
120 print "This will be printed in inverse"
130 NORMAL
140 PRINT "This will be printed nor-
    mally"
150 END
```

FLASH works in a similar fashion to INVERSE, switching on the flashing attribute:

```
100 HOME
110 FLASH
120 PRINT "This text will flash"
130 NORMAL
140 PRINT "And this text won't!"
150 END
```

Finally, the SPEED statement allows the user to control the speed at which text is displayed on the screen. By default, the Apple prints text to the screen as fast as it can, but other speeds can be selected. Slow speeds (<100) are useful for displaying instructions and so on, where the display speed is set to the average reading speed.

The statement takes the form SPEED=x, where x is an expression between 0 (slowest) and 255 (default):

```
100 HOME: SPEED=0
110 PRINT "This will be printed very
    slowly. . ."
120 SPEED=255
130 PRINT "And this will be printed at the
    normal speed"
140 END
```

The easiest way to simulate slow printing on other machines is to place the text into DATA statements and use a FOR-NEXT loop to print one character at a time. A delay loop is used after each character is printed to achieve the reduced speed:

```
100 REM: This solution is designed to be
    portable, not elegant!
110 FOR a=1 TO 3: REM number of data
    statements to read
120     READ a$: REM read line of text to
        be printed
130     FOR b=1 to LEN(a$)
140         PRINT MID$(a$,b,1);: REM
            print one character of a$
150         FOR c=1 to 12: NEXT: REM
            empty loop to cause delay
160         REM adjust value of above loop
            to vary speed
170     NEXT b: REM repeat for next
        character in data statement
180     PRINT: REM move cursor onto
        next line
190 NEXT a: REM repeat for next data
    statement
200 DATA This text will be printed slowly
210 DATA So will this
220 DATA And this
230 END
```

Low resolution graphics (GR)

The low-resolution screen on the Apple is addressed as 40 columns by 48 rows. Sixteen colours are available. The bottom four lines (8 rows) are normally reserved for text, but the oft-used POKE –16302,0 makes these available for graphics use. (The CALL–1998 statement which usually follows the above POKE simply sets the extra rows to black.

Once in GR mode, there are five graphics statements available:

COLOR=x sets the foreground colour, where x is in the range 0–15 and is defined:

```
 0 black
 1 magenta
 2 dark blue
 3 violet
 4 dark green
 5 grey
 6 medium blue
 7 light blue
 8 brown
 9 orange
10 a different shade of grey!
11 pink
12 green
13 yellow
14 aqua
15 white
```

Although I just said that x must be in the range 0-15, it is possible to use any value up to 255. But since 16 is equivalent to 0, 17 to 1 and so on, this fact is not spectacularly useful.

PLOT x,y is used to light up the specified block in the current foreground colour, where x is the column and y is the row. In GR mode, the origin (0,0) is top-left.

HLIN x1,x2 AT y is used to draw a Horizontal LINe in the current foreground colour from (x1,y) to (x2,y), where x1 and x2 are different column numbers and y is the row.

VLIN y1,y2 AT x — of course — draws a Vertical LINe from (x,y1) to (x,y2) where x is the column number and y1 and y2 are different rows.

SCRN (x,y) returns the code of the colour at position (x,y). On most machines, this is achieved using the POINT (x,y) statement.

Next month: Apple II high resolution graphics and sound, and the TRS-80/ Genie. END

RML 380Z COMBINED RESOLUTION PRINTING

Using photographic techniques to produce combined high and low resolution hard copy from the screen of an RML 380Z computer is both expensive and time consuming. Here Max Westby describes a method of achieving quality illustrations from VDU display by converting graphics data into output a printer can understand.

Many 380Z owners may have wished to produce hard copy of combined high and low resolution pictures displayed on the video screen. I was in just such a position not long ago and initially opted for the expensive solution of photographing the screen with a Nikon 35mm oscilloscope camera. Quite apart from the darkroom time involved, this had many disadvantages — such as ensuring identical printing of every frame for comparison of results and blacking out the lab while taking pictures. I therefore started investigating other possibilities and finally decided on the method described here which was to use a high quality daisywheel printer (Diablo 630) as the hard copy device and write a program which would produce an exact copy of the display on paper.

The program is in two parts:-

i) the point plot routine which uses the Diablo's programmable horizontal and vertical motion to give X and Y increments of approximately 0.42mm (1/60in) and 0.53mm (1/48in) respectively. This results in a picture 135 × 102mm — very close to the dimensions of the video graphics display area on a 9in monitor; and

ii) the character plotting routine which, by judicious fiddling with the horizontal and vertical motion indices, exactly superimposes on the point plot any text present in the low-resolution graphics memory. Both 40 and 80 character width displays are supported.

The whole program therefore reproduces everything visible on the screen — as long as the characters are printable and logical intensity two or three is used for the high resolution picture (it would be a trivial problem to alter this as explained below).

I realise, of course, that since I wrote the program, RML's Level 2 HRG support has appeared for Basic V5 along with its screen dumping subroutine DUMP. This is excellent if you happen to have the obligatory Anadex printer. However, if you are not in need of the full intensity resolution and you do want to superimpose the low resolution display, then the following is for you. As you will see, with a good ribbon, publication quality illustrations can easily be produced. Although the program was written for the Diablo 630, the escape sequences can be modified, with a bit of thought, to enable plotting on any daisywheel printer with programmable vertical and horizontal motion, or for the less expensive dot-matrix printers with graphics capability, such as the Epson MX-80 type 2 or 3.

Plotting the high resolution picture

The RML High Resolution Graphics (HRG) board contains 16 kbytes of graphics memory. Like the memory-mapped VDU, this block of memory is inaccessible to the programmer unless it is first 'opened', then read from or written to, and finally 'closed'. Opening and closing HRG memory is a complex matter and requires selection of memory pages and logical operations with masks to be carried out at the video memory control ports. The reading operation must also be synchronised with line or frame blanking to avoid flicker. I got round this problem by using the HRG support subroutine GSAVE. This copies the entire contents of the HRG memory into a reserved block of RAM just below CP/M. The Basic statements CLEAR,,15*1024: CALL"GSAVE",0 achieve this. The special form of the CLEAR command reserves 15k of 'cache' memory. We can now PEEK the intensity value of any of the 61248 pixels displayed on the screen without any of the access problems described above.

Having got this far the next task is to sort out the correspondence between the XY coordinates of a point displayed on the screen and the position in memory of a) the byte and b) the bits within that byte coding the intensity of the pixel in which we're interested. After that a set of loops must be defined which will cycle a pointer through the graphics data in such a way as to produce an output which can be sensibly interpreted by the printer.

Graphics memory organisation

At high resolution the display matrix is 192 × 319 pixels. The XY coordinates run from (0,0) at the bottom left corner to (318,191) at the top right hand corner. The picture is stored as 'pages', dividing the screen horizontally into 12 blocks of 16 rows. Each row within a page, as Fig 1 shows, consists of 80 bytes — at high resolution each of these bytes represents four points giving the 320 pixels per row. We thus have two bits/pixel to code the intensity from 0 (off) to three (maximum). For example, a video byte with the binary contents 11001001 represents four adjacent pixels of intensity 3,0,2 and 1 respectively.

To code the X screen coordinate we need nine bits (since Xmax = 318 decimal = 1 0011 1110 binary). The least significant two bits of the X coordinate determine the bit pair within a given byte so the seven remaining higher order bits give us the 80 bytes in a row (0 → 100 1111). The maximum Y value is 191 and so requires only eight bits (1011 1111). Remembering that the picture is divided horizontally into 12 pages it is easy to see that the four higher

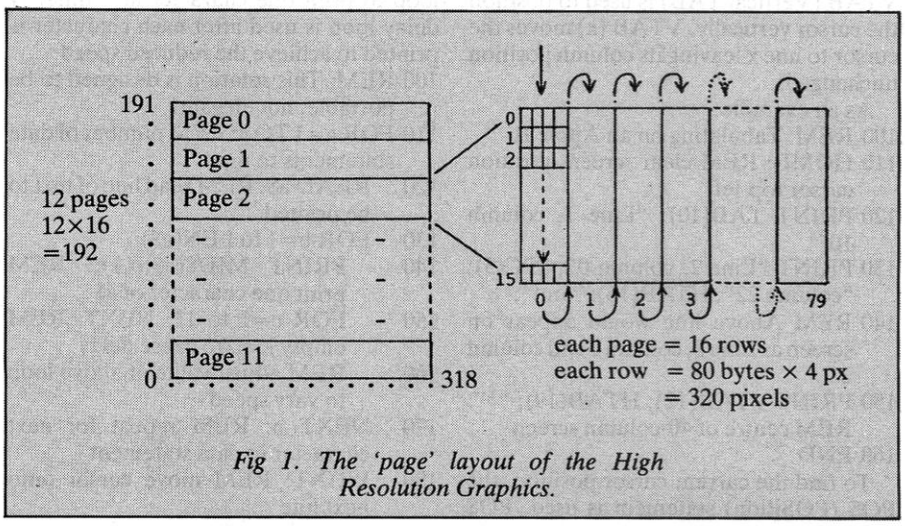

Fig 1. The 'page' layout of the High Resolution Graphics.

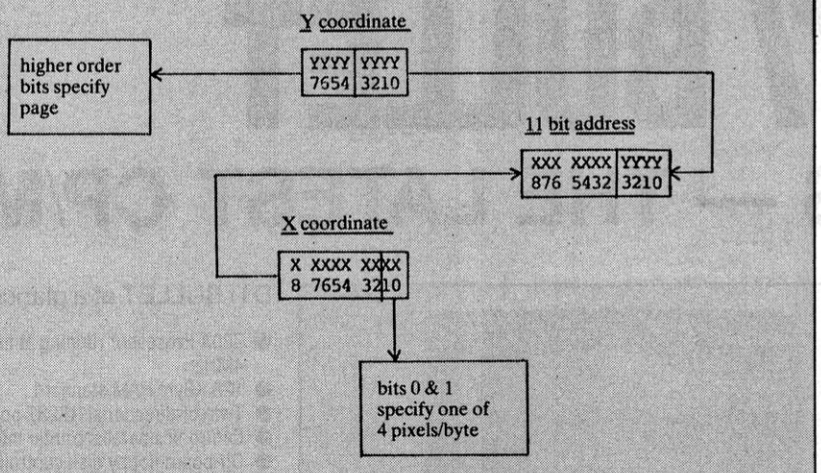

Fig 2. Construction of the video address from the XY coordinates.

order bits specify the pages 0 → 11 and the others give us the 16 lines per page.

Now for the real nasty! Within a page, a given video byte of four pixels has an address relative to the beginning of that page, determined as shown in Fig 2.

The 11-bit displacement from the beginning of the page is formed from the seven more significant bits of the X coordinate plus the row number, specified by the four least significant bits of the Y coordinate. This means that successive addresses scan downwards through each column in turn advancing from left to right — but keeping within a page. The actual memory address of a specific four-pixel byte can now be calculated as:
CA + (Page Number × 1280) + 11-bit address defined above where CA = cache start address.

Now it's necessary to look at the problem in reverse — how do successive bytes in graphics memory correspond to the points on the screen? As we saw above, consecutive memory locations contain four-pixel strips in columns 16 high. Therefore in order to scan a video page in raster fasion, such that successive bytes in a row are encountered in order from left to right, the program must jump through memory in steps of 16. This will increment the X coordinate correctly (see above) and only when the end of a row is reached must we increment the least significant four bits, thereby stepping down one row.

The program

After copying the graphics memory into cache at line 64960 we proceed to define the daisywheel control characters and the two plotting characters — space for pixel off and full stop for pixel on. SCREEN identifies a 40 or 80 character VDU display. Next the printer is initialised, setting Top-of-Form and the Horizontal and Vertical Motion Indices to 1/60in and 1/48in — by sending the escape sequences on lines 65030 and 65040. We are now nearly in a position to set up the memory scan but first we must PEEK the start of cache which is the address after that held at ENDMEM (11C and 11D Hex). Line 65100 generates the masks which will be used to decide which pixels in a word are on or off. The four masks held in the array MASK() are 2, 8, 32 & 128. ANDing these masks with a given video byte will therefore detect the presence of the higher order intensity bit of the pixel, that is intensity two or three. By modifying this line the program can detect pixels of any desired intensity — even inverting the graphics to produce a 'negative'.

The memory scan is carried out at lines 65140-65180. It can be seen that the outermost (PG) loop jumps through memory giving the start (top left-hand corner) address for each page, while the Y and X loops scan each of these pages a display row at a time — by stepping appropriately as explained above. At 65150 the value of the current video byte is PEEKed and immediately checked to see if it is zero. If it is, then we know that all four pixels in that byte are off and we need waste no more time. This IF statement saves a great deal of time since most pictures are only 10% display points at maximum. If this test is non-zero then control passes to the innermost loop on line 65160. Here the four masks are ANDed in turn with the video byte to determine the state of each display point — when a pixel is found to be on the program jumps to the subroutine at 65360.

Before I describe this subroutine, a word about the counter C which retains the current X coordinate. At 65140 it was set to three — the left margin offset. This is necessary to ensure correct superposition later on with the character display. C is incremented by four if a null word is detected and by one when single pixels are examined.

The subroutine's task, therefore, is to decide how best to move the print head from the left margin or the previous point plotted (retained by variable T). Advancing the head as each byte is examined is far too time consuming. Moving from display point to point is also done vertically by sending only a Line Feed at the end of each line scan. The rationale behind the subroutine is therefore to 'follow' the graphics wherever possible — for example, a curve of the type shown in Fig 3. When plotting this power spectrum the print head jumps between the three points on each line (where all three occur) thereby greatly minimising head movement. In a simple plot, such as a diagonal line across the screen, the print head follows the trace exactly.

The Diablo 630 can execute absolute Horizontal Tabs (the ESC HT sequence) which is clearly the ideal way of moving the print head from one point to the next on a line. Unfortunately the maximum distance the HT sequence will take the head is 126 HMIs or less than halfway across the display. Line 65380 checks to see if we are <=126 from the left margin — if we are, it doesn't matter where the previous point is, we send out a Horizontal Tab to that position and print the point. The rest of the subroutine deals with the case where the position is further than 126 points from the margin. To move optimally, we must now compare the required horizontal position (C) with the current one (held in T). If it is more than two HMIs away the head is first moved to position 126 and then the HMI itself is modified appropriately (lines

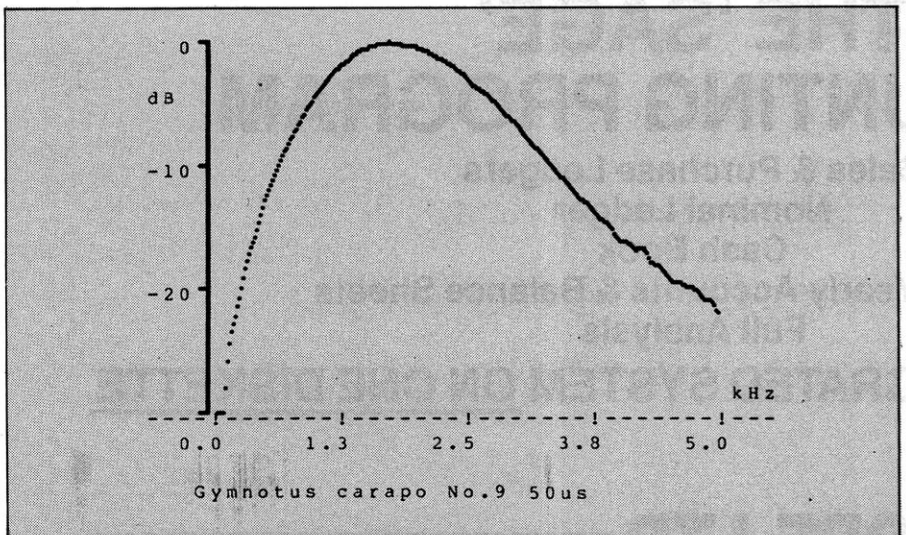

Fig 3. Fourier Power Spectrum of a single electric organ discharge (EOD) of the weakly electric fish, Gymnotus carapo *(the Banded Knifefish). Original EOD sampled at 20kHz (1024 points). NB The 40 character VDU was used here.*

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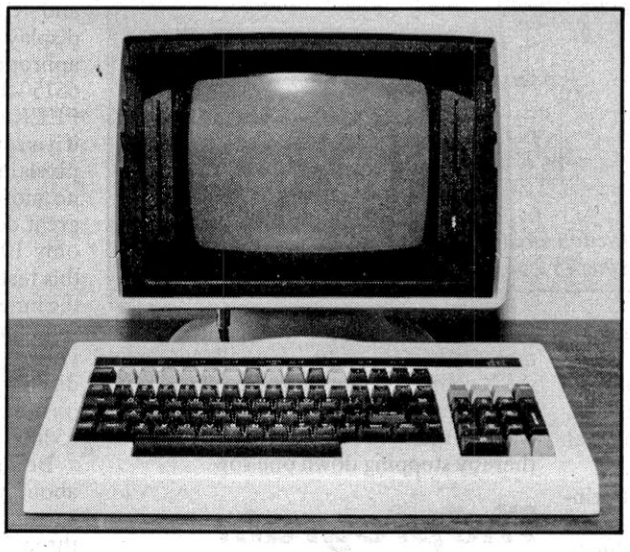

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65480 & 65490), so that printing large spaces will take the head to the required position. The HMI is also limited — to 62 points (at the 1/60in resolution) — so that at worst four outsize spaces may have to be printed. All this is deemed unnecessary if the new point is within +/− 2 of the previous one (line 65400) in which case the program simply sends the right number of backspace or space codes before the point is printed.

Once the whole HRG picture has been plotted a Vertical Tab (ESC VT sequence) winds the paper back to the top of the picture (line 65230). There is also a slight offset here to adjust for superposition of the low resolution graphics. The HMI and VMI are increased to give the character spacing required for 24 rows of 40 or 80 characters as appropriate. Printing is very rapid — there are far fewer character positions and absolute Horizontal Tabs can always be used (line 65310). There are a number of quirks, however — principally that blank areas of the screen may be spaces (ASCII 32), if they were plotted as such, or else ASCII 128 if they were virgin screen areas cleared with a GRAPH command. The other problems are dealt with on line 65280 onwards. If the PEEK returns zero (for some unkown reason a capital 0), 95(−) or 96(') then these must be recoded as standard ASCII characters 79, 35 and 45 respectively.

Plotting time improvements

I do not lay any claim for a high speed optimised program (it is written in Basic after all) — the examples shown in Figs 3 and 4 take four to five minutes to plot since a lot of memory has to be scanned. If you cannot, like me, be sure of gaining access to a daisywheel printer whenever you like, then you will be keen to produce as much graphics hard copy as possible in the time available. Enormous time savings can be made by dumping all the control and printing characters to a disk file as they are generated by the program. By simply changing every occurrence of PUT#2 to PUT#10 all output will be directed to disk. You will need, of course, to CREATE the file first and CLOSE it when the scan is complete. Then, when the printer is available the hard copy can be produced using a very short program of the form:

```
10 OPEN#10, (filename)
20 ON EOF GOTO 40
30 PUT#2,GET(#10):GOTO 30
40 END
```

The speed increase is quite sensational since Basic has practically no work to do. To give you an idea of the time savings involved — the total printing time for Fig 3 (using 9600 baud data transfer rate, that is, at the mechanical speed limit of the printer) is reduced from 4mins 22secs to 40secs and even for a complex picture, such as Fig 5, where a large number of points have to be plotted, the reduction is from 17mins to 8mins. The savings are of course in the time taken to scan the two video memories and calculate the control sequences.

Sending the program output to disk file with Fig 5 in the HRG memory takes 15mins 20secs. The file consumes 54k of disk space — due to the very large number of display points in the picture. For Fig 3 the program runs for 4mins 45secs and the resulting file is only 3k long.

Finally a note about using the program. Great care must be taken not to leave any undesired characters on the screen when the program is started up. If you run the program on its own then issue the direct RUN command after clearing the bottom four lines when in GRAPH mode — for example, by typing PUT12:RUN. I mainly use the Diablo program by MERGEing it with an FFT program used to calculate power spectra (hence the high line numbers). A Control-Z is trapped from the keyboard and a GOTO 64960 is executed. The CLEAR statement of course destroys all the variables used in the main program so beware! **END**

```
64850 REM ================================================
64860 REM
64870 REM                Program DIABLO.BAS
64880 REM
64890 REM
64900 REM
64910 REM          RML Extended Disc Basic Version 5.0A
64920 REM
64930 REM
64940 REM ================================================
64950 REM
64960 CLEAR,,15*1024: CALL"GSAVE",0:REM Copy HRG memory to cache
64970 REM
64980 REM constants & ASCII control codes
64990 T=500:SP=32:P7=46:I=73:P=80:LF=10:CR=13:VT=11:HT=9:ESC=27
65000 RS=30:US=31:SUB=26:BS=8:SL=47:FF=12:SCREEN=40:REM or 80 ch/line
65010 REM
65020 REM Initialise Daisy:set TOF, HMI=1/60", VMI=1/48"
65030 PUT#2,ESC,SUB,I:A=GET(100)
65040 PUT#2,ESC,US,3,ESC,RS,2
65050 REM  Peek cache start address
65060 CA=PEEK(&11C)+256*PEEK(&11D)+1
65070 REM
65080 REM Define loop constants & generate AND masks
65090 P2=1280:P1=P2*11+CA:PL=15:LL=79:COL=16:X1=LL*COL
65100 FOR X=1 TO 4:MASK(X)=2^(2*X-1):NEXT
65110 REM
65120 REM     ** High Resolution Memory Scan **
65130 REM
65140 FOR PG=CA TO P1 STEP P2:FOR Y=0 TO PL:C=3:FOR X=0 TO X1 STEP COL
65150 WD=PEEK(PG+X+Y):IF WD=0 THEN C=C+4:GOTO 65180
65160 FOR PX=1 TO 4:C=C+1:IF WD AND MASK(PX) THEN GOSUB 65380:T=C
65170 NEXT PX
65180 NEXT X:PUT#2,LF:NEXT Y,PG
65190 REM
65200 REM     ** Low Resolution Memory Scan **
65210 REM
65220 IF SCREEN=40 THEN V=6:H=17 ELSE V=9:H=9
65230 PUT#2,ESC,VT,V,CR:REM return to TOF with fine adjustment (V)
65240 PUT#2,ESC,US,H,ESC,RS,11:REM set HMI=8(16)/120", VMI=10/48"
65250 FOR Y=19 TO -4 STEP -1:FOR X=0 TO SCREEN-1
65260 CH=POINTS(X*2,Y*3)
65270 IF CH=128 OR CH=32 THEN 65320
65280 IF (CH>0 AND CH<95) OR CH>96 THEN 65310
65290 IF CH=0 THEN CH=79:GOTO 65310
65300 IF CH=95 THEN CH=35 ELSE CH=45
65310 PUT#2,ESC,HT,X+1,CH
65320 NEXT X:PUT#2,LF:NEXT Y
65330 PUT#2,FF:END
65340 REM
65350 REM
65360 REM     ** Diablo Control Subroutine **
65370 REM
65380 IF C<=126 THEN PUT#2,ESC,HT,C,PT:RETURN
65390 IF C-T>2 THEN 65470
65400 ON C-T+3 GOTO 65420,65430,65440,65450,65460
65410 GOTO 65470
65420 PUT#2,BS
65430 PUT#2,BS
65440 PUT#2,BS
65450 PUT#2,PT:RETURN
65460 PUT#2,SP,PT:RETURN
65470 PUT#2,ESC,HT,126:S=C-126
65480 IF S>62 THEN PUT#2,ESC,US,124,SP:S=S-62:GOTO 65480
65490 PUT#2,ESC,US,S*2,SP
65500 PUT#2,ESC,US,3,PT:RETURN
65510 REM
65520 REM ================================================
```

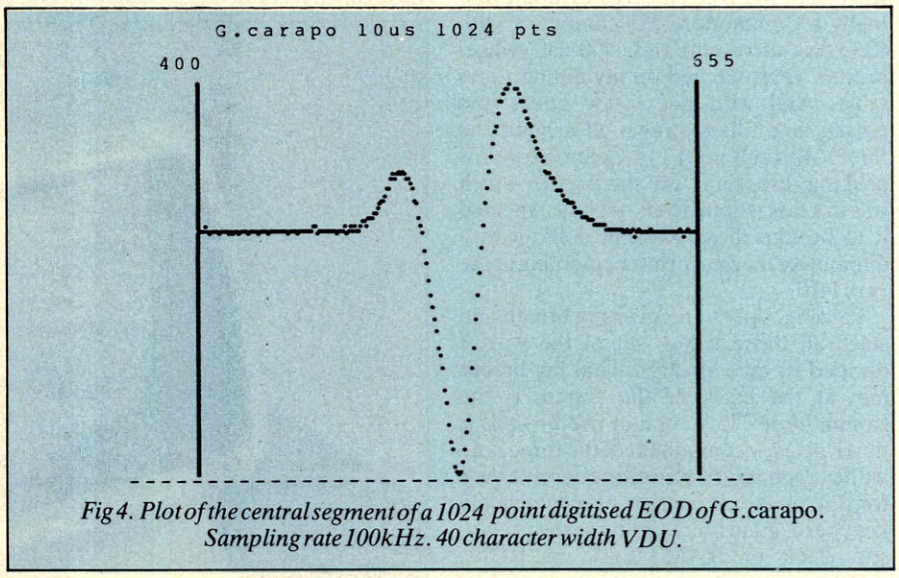


Fig 4. Plot of the central segment of a 1024 point digitised EOD of G.carapo. *Sampling rate 100kHz. 40 character width VDU.*

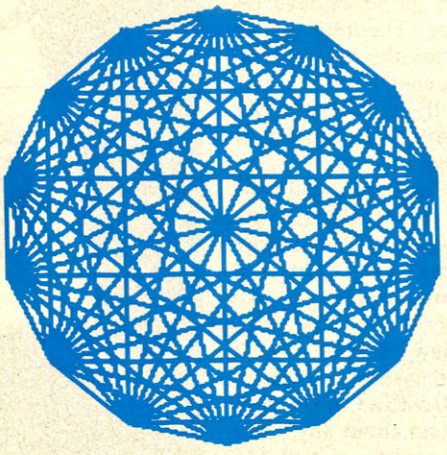


Fig 5. A 'still' from the RML demo program HISTAR

BENCHTEST

COMMODORE 715

After a series of false starts and problems, the Commodore 700 range of business machines has finally arrived. Mike Liardet examines the 715 . . .

Who says that computing is a sedentary profession? Not when you've got a Commodore 700 to review, it isn't! Having arranged to take delivery, at my flat, of the aforesaid machine I was somewhat disconcerted when the delivery man unloaded three small wardrobes at the front door. Anyway after much wheezing, heaving and puffing your chronically unfit reviewer finally secured the three items in his dining room.

Right — now for the unpacking! More wheezing, heaving and puffing and eventually a Commodore 715 computer, with 8250 disk drive unit and 6400 daisywheel printer were perched on my dining room table. And with not a few boxes and polystyrene fillers strewn all around the floor. Well full marks to Commodore for packing, especially for the printer which was in a box within a box — I half expected it to be like those Russian dolls, with a diminutive thermal printer emerging at the very last!

Pausing, only to recover my breath and stack all those boxes out of the way, I decided to take stock of what lay before me: at the heart of the system is the Commodore 715 computer itself — this is the really new component of the three, and we have actually been waiting nearly a year for it to arrive. It consists of a detachable keyboard, main box containing the processor, 256k of RAM, Basic in ROM, and has a monitor secured on top of it. Other members of the 700 series have less RAM, or no monitor. Theoretically, at least, it is possible to use this unit without disks, and just with a cassette tape drive, but at a price around the £1000 mark, this sort of configuration will not be causing Sir Clive any sleepless nights.

The second unit contains two one megabyte disk drives. Externally it is very similar to the disk units that Commodore has been manufacturing for some time, but the capacity has recently been upped to a million characters per drive. The third component in my review installation was a Commodore 6400 daisywheel printer, actually a TEC F10-40 with a Commodore label, but of course just about any other type of printer could have been substituted for it.

Finally, the total cost of this unaccustomed load on my dining room table amounted to about £3400, exclusive of VAT.

Exploring the 700

Readers will get some impression of the 700's appearance from the photographs. The 700 seems to be quite photogenic, and this is not a compliment: it does not look as graceful 'in the flesh' as it does in the photos. I think this is because it is actually a fair bit bigger than you would expect.

Hardware reviewers are currently fond of referring to 'desk footprint', the desk space consumed by a machine. Well, the 700 has got big feet! It is roughly the size of a Sirius or IBM PC, but unlike them, this does not include the disk drives, which are housed in a large separate box.

The keyboard is detachable and connected to the main box by a plug at the end of a coiled flex. You need very nimble



The Commodore 715: a Mostek 6509 processor, 256k RAM and Basic in ROM.

Photography by Crispin Thomas

fingers to insert this plug, as its socket is awkwardly placed, but the 700 is not a portable machine so you are unlikely to be doing this very often. The keys themselves are well laid out and have a good feel to them. I should imagine touch-typists would feel quite happy with them. There are 94 keys in total, including all the keys you would expect, and a few that you would not. There is a separate numeric keypad, row of function keys and arrow keys in addition to a fairly standard qwerty layout. The front of most of the keys is embossed with graphics symbols. These graphics characters, identical to the PET's, can be typed directly when in graphics mode: a single key toggles between upper/lower case mode and upper case/graphics mode. On the number keypad there is a key marked with two zeros, and pressing it generates — you've guessed it — two zeros. Other unusual keys include one marked 'π', and another marked 'CE' for rapid 'clear entry' on the numeric keypad.

The monitor is firmly fixed to the main processor box, but can be swivelled and tilted to your preferred angle of view. The 12in screen is somewhat 'set back' in its case — rather like a lens surrounded by a lens-hood. This obviously helps shield it from reflections, but looks rather inelegant. The screen surface is anti-glare, and this seems to work quite well. I used it, with my back to a window, without any trouble.

The display itself is a restful green phosphor, 80 characters wide by 25 rows high. This is one row more than most VDU displays, so the extra row can be usefully employed for system status messages, etc.

Moving round to the back are reset and on/off switches, a 240 volt mains socket and several interface 'ports' for connecting the 700 to other devices. In particular, its IEEE-488 interface can connect to a range of Commodore disk units: from a 165k single floppy drive right up to a 7.5 megabyte winchester disk. It can also connect to various matrix and daisywheel printers. Although there is only the one output socket, it is possible to connect to more than one device by 'piggy-backing' the plugs. There is also a cassette port which, along with the IEEE-488 port, is not a proper socket, but an edge connector from the main circuit board. You might expect this sort of thing on a cheap £100 machine, but not on a £1000 one. Finally there is an RS232 port and audio video outlets. It is a bit surprising to find a sound facility on a business machine — sound effects being usually confined to games software, but doubtless a hard-worked businessman would like to relax with some ear-splitting arcade game at the end of a hard day.

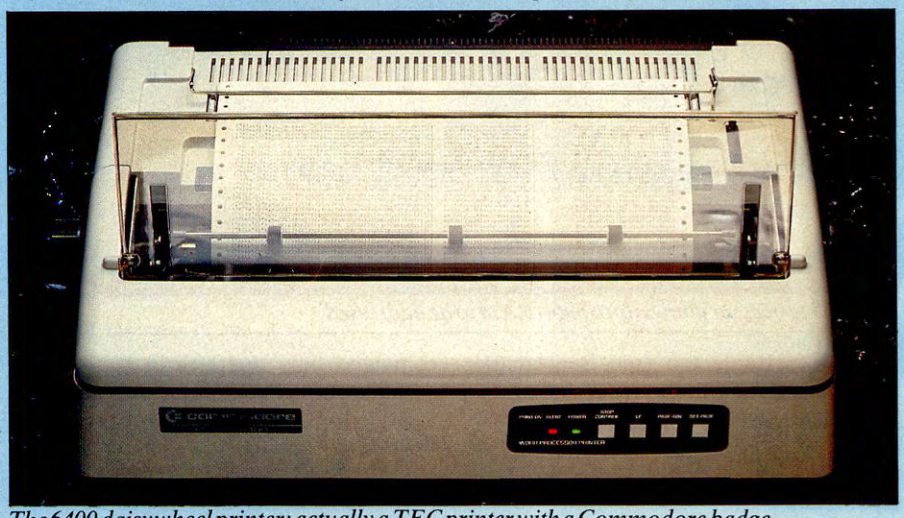
Undoing two bolts at the back allows the top of the main case to hinge forward, monitor and all. Actually, the bolts were missing on my review machine, but normally you will find them there. Unfortunately there is an earth-wire from the top of the case to the bottom, and this has to be unfastened before the case can be fully swung open.

At the bottom of the case lies a single circuit board, about the same size as a tabloid newspaper, but just printed with component identifiers and no sign of a page three anywhere. The larger chips are socketed, and right in the centre lies the Mostek 6509 processor. This processor is compatible with the well-known 6502 that has driven a whole generation of home computers, including the PET and Apple II. The main difference between the 6502 and the 6509 is that the 6509 has two extra instructions that can be used for accessing memory outside the normal 64k limit. Thus the 700 can be equipped with 356k of RAM, and with a theoretical expansion up to 896k (when Commodore get round to building the RAM boards).

The 700 is also billed as having provision for other processors to run concurrently. I suspect that this claim does not amount to much. After all the Apple II was built with no special provision for other processors, but in spite of this it is possible to buy a Z80 card for it for under £50. I wonder if Commodore's extra processors will be that cheap?

Getting started

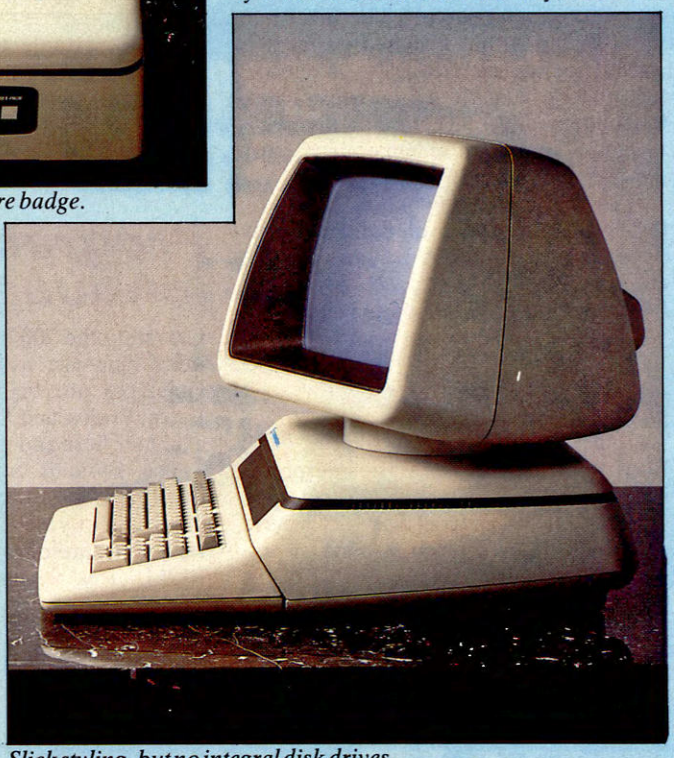
Ever since the PET was first introduced, back in 1979, Commodore has had an unenviable reputation for providing poor documentation, and the signs are that the 700 will not be an exception to this rule. Currently the 700 has to share its documentation with the 500 and 600 series, in a poorly photocopied manual of just 113 pages covering all three systems. Naturally there is just not the room to impart enough information in this limited space. Evidently a new manual is on the way, but I was



The 6400 daisywheel printer; actually a TEC printer with a Commodore badge.



Ninety-four keys — including some you wouldn't expect.



Slick styling, but no integral disk drives.

unable to find out any more about it, and with Commodore's reputation in this department it is a fairly forlorn hope that it will be a substantial improvement when it does arrive.

Anyway, once the system is unpacked, the three components need to be wired together using the very stout cables and connectors supplied. The back of all three have IEEE outlets — proper sockets on the printer and disk drives, but on the 700 itself there is just an edge connector from the main circuit board. One cable connects the 700 to the disks and the other connects the disks to the printer. This latter connection must be secured 'piggy-back' fashion to the plug already in place at the disk drives, since there is only the one IEEE outlet available there. This connection is securely bolted in place, so there is no danager of it coming loose or making poor contact.

Each unit needs its own power supply, so after fitting three mains plugs comes the big moment — hide behind the settee, fingers in ears and switch on! Actually after switching on you are greeted with total silence — not even the sound of a disk drive whirring in order to boot up the operating system.

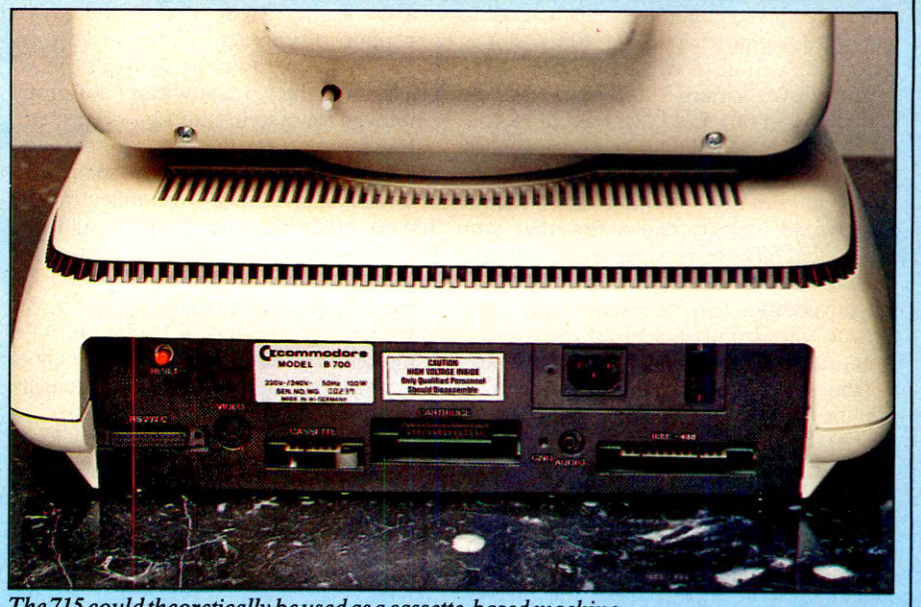
And at this point I hit my first problem, eventually solved only by a call to Commodore. I had inserted Commodore's Demo disk in the drive (main drive is on the right, not the left like all other systems I have seen), but I was totally unable to access its disk directory to discover what files resided upon it. In addition to this I was a bit perturbed that the system had not booted up when I first switched it on. Perhaps there was something wrong with the disk drives? Needless to say the manual was not very helpful.

In fact, it transpires that the operating system does not need to be booted when the machine is first switched on, as it is already 'burned in' in ROM — an unusual feature for a machine in this price bracket, but neither advantageous nor disadvantageous. The other problem was caused by the manual failing to explain the correct syntax for the disk commands. In fact the CATALOG (printed in the manual in upper case) command is needed to see the contents of a disk, but this should actually be typed in as "caT" — quite elementary when you know how!

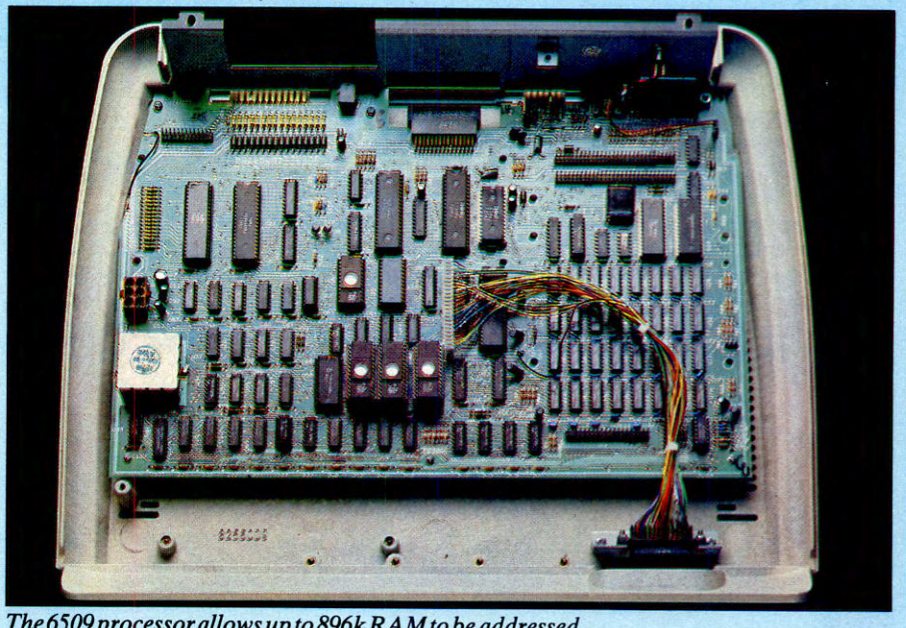
Benchmarks

At this point, I decided to run the *PCW* Basic Benchmarks. The Basic interpreter is permanently resident in ROM, so there is no need to load it from disk — it is there and available as soon as you switch on. Praying that there were no peculiarities in the 700 version of Basic (after all I was sure the manual would not bale me out if there were), I keyed in and timed all eight test programs.

In the event the 700 Basic caused no problems, behaving much like any other good version of Basic. The times were quite respectable too (see Benchmarks table). Referring to the *PCW* December '83 summary of Benchmarks which describes the tests and lists the results for 87 machines, the Commodore 700 would be 31st.



The 715 could theoretically be used as a cassette-based machine.



The 6509 processor allows up to 896k RAM to be addressed.

Programming language

Currently the 700 has only one programming language available: Basic. Other languages are being promised: Pascal, Forth, Prolog and Logo, but they are not available here and now.

The Basic is active as soon as the machine is switched on, and is available independently of the disk drives. In fact the Basic interpreter is embedded in 28k of ROM. This version of Basic includes commands to access the disk drives, if they are there, and contains a few extra commands, not available in most Basics:

* **BANK** — This allows the Basic program to operate in more than 64k of RAM. With a full complement of RAM there are 16 'banks' available, each of 64k. This command only operates in conjunction with a few of the other Basic commands, so it is still quite a problem to write programs that need more than 64k of RAM.
* **TI$** — It is possible to access the system clock through this variable, to an accuracy of one tenth of a second, thus introducing automatic timing to your programs.
* **KEY** — This can be used to assign functions to function keys.
* **PRINT USING** — This command greatly facilitates numeric formatting.
* **BACKUP** — This is a disk command that can be used to copy disks.

Apart from the above, the Basic appears to be fairly typical. Although the 700 has fairly sophisticated sound generation facilities, a 6581 chip permitting three separate voices of nine octaves each, there are no Basic commands (documented) with which to access it, so any sound effects have to be implemented in machine code.

Software

It is often said that it is software that really sells machines — for example, the VisiCalc spreadsheet system is generally acknow-



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ledged as a major reason for Apple's phenomenal success with the Apple II. And Commodore's own advertising says: 'Although . . . (it) offers outstanding hardware features, its true value lies in the tasks it can perform . . .' Certainly I would advise anyone contemplating a computer purchase to look for the software first, then choose from the machines that will run it. So what incentives does Commodore provide for buying its machine?

Well, firstly, my review system came with a complete range of accounting packages by Pegasus. I won't cover them in detail as they will be reviewed separately in a future issue but generally they seem well documented and implemented, with neatly laid out screens. Pegasus has made extensive use of the 700's block graphics characters to produce very neat boxes around all the different parts of the display, making them easier to read and also giving an overall feeling of quality software.

By the way, Pegasus uses a 'dongle' to protect its software from illicit copying. The dongle is a small plastic plug, on a key ring, that slots into the cassette port at the back of the 700 — about the only sensible use for a cassette port on this price of machine. The software can be copied as much as you like, but will only run on a machine that has the dongle present.

Apart from the Pegasus software, there would appear to be a fairly full range of Basic software packages available. The publicity material mentions:

⋆ **Information management.** Facilities include sorting and searching, reporting, and also a link to the wordprocessor (see below). This latter facility can be used for carefully selected mailshots, with the wordprocessor printing a 'personalised' letter, based on a standard text, merged with the details of the addressee which are received from the information manager.

⋆ **Wordprocessor.** There are 'several sophisticated wordprocessing packages available'.

⋆ **Financial management, management planning and vertical market software.** There is a full range of payroll, stock control, and accounting systems. There are also spreadsheet and other modelling packages, including critical path analysis.

And finally Commodore claims that the 700 has a range of specialist software for anyone from an estate agent to a newsagent.

The main items missing from the above list are the magic words CP/M, MS-DOS and CP/M-86. Nor will you find the slightly less magic words UNIX or UCSD. For the benefit of the newcomer, let me explain that these are the names of industry standard operating systems, available on a vast range of microcomputers, and roughly in the order I have given, each providing the key to a huge choice of software.

Commodore, like its rival pioneer of the personal computer, Apple, has steadfastly refused to adopt any of the standard operating systems, and arrogantly persisted with its own. The Apple III was launched without access to CP/M, and was something of an anti-climax after the Apple II. And so, a couple of years later, the question is: Is Commodore simply going to repeat Apple's mistake?

To a certain extent it is hedging its bets. As I have already mentioned, the circuit design for the 700, based around a Mostek 6509 processor, includes provision for a second processor. This will be either a Zilog Z80 or Intel 8088, running concurrently. These processors are an essential prerequisite for running CP/M or MS-DOS and CP/M-86. However, Commodore has not exactly left a spare socket simply to drop the processor into. And these operating systems do actually need to be modified to work on the 700. So you cannot just go out and buy a Z80 chip and a CP/M disk — Commodore needs to put a lot more work in first! What all this does mean is that these operating systems *might* be available one day, and the Commodore can mention them now in its brochures.

A tale of two disk drives

The 8250 disk drives supplied with the review machine worked reliably enough and provided two megabytes of storage, which is above average for 5¼in floppies. They are, however, housed in a sharply angular box. Doubtless this box blends in well alongside Commodore's PETs and 8000 range, which have similar angular features, but sticks out like sore thumb when placed next to the rounded 700. At the recent *PCW* Show all the disk units on Commodore's stand were kept well out of public view, under the desks, so presumably Commodore does not think much of their styling either.

The 700 was orginally planned to have internal disk drives, and indeed many of the illustrations of it show these drives in place. Certainly the main box of the 700 has enough space for a pair of disk drives — that is one of the reasons it is so large, but evidently Commodore has got cold feet on this idea. If this is the case then it is a great pity since it leads the 700 way off from the existing market trends towards transportability and elegance. On these points it just does not compare with new machines like ACT's Apricot, the Hyperion, Future Computer's FX-20, to name but three machines recently reviewed in *PCW*.

Prices

(Exclusive of VAT)	£
700B—128k RAM without monitor:	795
710B—128k RAM with monitor:	995
715B—256k RAM with monitor:	1195
8250—2 × 1 megabyte disk drives:	1295
6400—daisywheel printer:	995

Conclusions

For a machine that has now been launched, there are still a surprising number of essential features and facilities not yet available on the 700. At the time of writing this review (mid-October) we are still awaiting new manuals, CP/M and MS-DOS options and programming languages other than Basic. There is also a cloud of uncertainty hanging over the integral disk drives.

I would advise anyone thinking of buying a 700 to wait and see if these problems are sorted out. Until such time as these extras are available the 700 does not have a great deal to offer. A particularly weak point is that it does not (yet) offer any of the standard operating systems. I know Apple's Lisa may very well succeed with a non-standard operating system, but this is because that machine has so much to offer. Commodore's operating system is very rudimentary in comparison.

My final word to would-be purchasers is: Wait! And if you can't wait then take a good look round at the opposition. There are plenty of rival manufacturers who have got their act (no pun intended) together.

END

Benchmarks

BM1	1.1
BM2	6.5
BM3	12.0
BM4	12.3
BM5	14.2
BM6	22.1
BM7	35.3
BM8	7.2
(or 72 secs for 1000 iterations)	
Average	21.94

All timings in seconds. For an explanation of the Benchmark programs, see PCW December 1983.

Technical specifications

Processor:	MOS 6509 (6502 compatible).
Memory:	256k (Model 715B), 128k (710B & 700B).
Screen:	12in green phosphor. 25 lines of 80 characters, each defined on 9 × 14 matrix. Full ASCII character set plus 64 graphics characters available.
Keyboard:	94 keys, qwerty layout, 10 function keys, numeric keypad and arrow keys.
Disk:	Range from single 5¼in (164.5k), through 2 × 1 megabyte 5¼in (8250 drives used in review), to 7.5 megabyte winchester. Connected via IEEE-488 interface.
Interface:	RS232C, IEEE-488, cassette, cartridge slot and audio and video outputs.
Language:	Basic.
Dimensions:	Keyboard—450mm wide × 245mm deep. Main unit—460mm wide × 350mm deep × 460mm high.



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SPECTRUM SCREENERY

Here is a short machine code subroutine to convert the conventional screen POKE into the Spectrum's more exotic version. The m/c can be relocated to anywhere in memory and is used in the following manner:

Let C=N + USR (TV)

where N is the conventional screen location 0-6143 (0-top left corner). TV contains the starting address of the m/c routine.

What the m/c does:

When called as recommended the code removes the last no (ie, N) from the calculator stack (after first checking it is there), turns it into an integer and swaps the three most and least significant bits shown as B and C on the diagram. The plus sign must be used to separate the variable and the USR command as the value of BC on returning to Basic is zero.

Now for the song and dance:

This routine opens up a new aspect to the Spectrum's excellent graphic capabilities. Ex Atom, PET, RML (and so on) high res users can now convert those PEEK and POKE graphics routines for the Spectrum. Also the full 192 by 256 resolution can now be used directly from a simple m/c call from Basic. Two programs are shown here to demonstrate the new command.

1 "Screen invert"
2 "X,Y Plotter"

These are listed separately. The conversion routine can also be used as a subroutine in a m/c scroll up, down, left and right (the list is endless).

B Elbourn

Disassembled listing of Screenery

Hex		Z80 Mnemonics	Decimal
2A 65 5C		ld hl,(STKEND)	42,101,92
ED 5B 63 5C		ld de,(STKBOT)	237,91,99,92
A7		and a	167
ED 52		sbc hl,de	237,82
7D		ld a,l	125
FE 05		cp 5	254,5
30 01		jr nc,OK	48,1
CF		rst 8	207
CD 99 1E	OK	call UNSTACKBC	205,153,30
60		ld h,b	96
69		ld l,c	105
3E 07		ld a,7	62,7
A4		and h	164
07		rlca	7
07		rlca	7
07		rlca	7
07		rlca	7
07		rlca	7
57		ld d,a	87
CB 84		res 0,h	203,132
CB 8C		res l,h	203,140
CB 94		res 2,h	203,148
3E E0		ld a,224	62,224
A5		and 1	165
0F		rrca	15
0F		rrca	15
0F		rrca	15
0F		rrca	15
0F		rrca	15
CB AD		res 5,1	203,173
CB B5		res 6,1	203,181
CB BD		res 7,1	203,189
B4		or h	180
67		ld h,a	103
7A		ld a,d	122
B5		or l	181
67		ld l,a	111
11 00 40		ld de,16384	17,0,64
19		add hl,de	25
44		ld b,h	68
4D		ld c,l	77
CD 2B 2D		call STACKBC	205,43,45
01 00 00		ld bc,0	1,0,0
C9		ret	201

Operation:

HL— 010 00 000 000 00000
A B C D

Explanation,

A The group of eight character lines B Pixel row in character C Character row
D Represents the character column number.
The above routine swaps block B and C to produce the correction.



Demonstration program

```
 10 REM PROG 1 SCREEN INVERT . . . TV CONTAINS START ADDRESS
 20 PRINT "THIS PROGRAM INVERTS SELECTED PARTS OF THE SCREEN"
 30 FOR H = 1 TO 19: PRINT "THIS IS A TEXT SAMPLE": NEXT
 40 REM
 50 INPUT "CHARACTER LINE FOR INVERSION (0-23)";L
 60 INPUT "COLUMN (0-31) FROM ";S;" TO ";F
 70 PRINT#1;"XXXXXXX"
 80 FOR I=L*256 TO L*256+256
 90 LET C = I+USR(TV): REM CONVERSION MADE HERE
100 FOR J=C+S TO C+F
110 POKE J,255-PEEK(J)
120 NEXT J: NEXT I
130 GOTO 50: REM ---------------------------------------------
200 REM PROG 2 THIS PROGRAM DRAWS A SINE WAVE IN THE BOTTOM TWO
    LINES
210 FOR X=0 TO 255 STEP 5
230 LET Y=8+SIN(X/15)*8
240 GOSUB 9000: REM PLOT ROUTINE
250 NEXT X
260 PRINT AT 11,5;"Tomorrow the world !!!"
270 PRINT AT 13,2;"Press any key to end program"
280 PAUSE 0: STOP : REM ---------------------------------------
9000 REM X,Y PLOTTER (256*192) SUBROUTINE (TV CONTAINS START
     ADDRESS)
9010 REM X HORIZONTAL COORDINATE (0-255)
9020 REM Y VERTICAL COORDINATE (0-191)
9030 LET C=(INT(X/8)+INT(191-Y)*32)+USR (TV)
9040 LET J=PEEK C+2 ↑ (7-(X-INT(X/8)*8))
9050 POKE C, J*(j<=255)+PEEK C*(J>255): REM PSEUDO 'OR' OPERATION
9060 RETURN
```

Machine code loader

```
10 INPUT "START ADDRESS";S
20 FOR I=S TO S+67
30 PRINT I,
40 INPUT "BYTE ?";B
50 POKE I,B: PRINT B
60 NEXT I
70 PRINT "FINISHED"
80 SAVE "TV CONV" CODE S,68
90 VERIFY "" CODE
```

VIC ACCELERATOR

I have here a little subroutine for a VIC 20 which will change the operating speed of a program. I recommend it be placed at the start of the program—just after the instructions is usually the best place.

Here is a breakdown of the routine.

Lines 1060 set up a menu.

Line 70 sets up the input and gives it the name K; line 80 checks to see that K is legal.

Line 90 prints an error message if it's not and line 100 POKEs the value K into the correct location to control the speed.

```
10 CLR: PRINT "00-32 VERY
SLOW"
20 PRINT "33-65 SLOW"
30 PRINT "66-128 AVERAGE"
40 PRINT "129-190 FAST"
50 PRINT "191-255 VERY
FAST"
60 PRINT: PRINT: PRINT
70 INPUT "HOW FAST"; K
801 FK>0 AND K<256 THEN
100
90 PRINT "CHOOSE AGAIN":
GOTO 70
100 POKE 37879, K
```

You could also use this POKE code during a program, to make it speed up gradually, such as in a game, that is,

```
1000 IF SCORE 1* 1000
THEN K=K+100
```

But nothing is perfect. When you change the operating speed of your VIC, the real time clock is no longer real time, so you must decide between time-keeper and speed.

Kiaran Smyth

SIMULATED 'REPEAT UNTIL' FUNCTION

Most Basic interpreters, including Microsoft Level II, do not support a REPEAT UNTIL command. One method of simulating this function is to execute a FOR NEXT loop with a very high 'TO' value and to jump out of the loop before it has been completed. For example, the following program would find the lowest integer with a square greater than 150:

```
10 FOR X=1 TO 100
20 IF X ↑ 2<150 THEN NEXT
X
30 REM Rest of program
```

Unfortunately this method unbalances the stack and would disrupt outer loops in a nested system. This serious disadvantage may be overcome as follows.

The Basic listing below loads a machine code routine into the top of memory. This routine is called by the TRS 80 CLOSE command (not used in non-disk systems). When called, it cancels an incompleted FOR NEXT loop, and then continues execution of the Basic program. The syntax is the same as that of NEXT, ie CLOSE cancels current FOR NEXT loop; CLOSE N cancels the FOR NEXT loop which uses variable N.

```
10 CLS
20 REM Adjust memory size
30 N=PEEK
   (16561)+PEEK(16562)
   *256-58
40 POKE
   16561,N-INT(N/256)*256
50 POKE 16562,INT(N/256)
60 REM Enter vector for
   'CLOSE' command
70 N=N+1
80 POKE
   16774,N-INT(N/256)*256
90 POKE 16775,INT(N/256)
100 REM Enter machine code
110 FOR A=N TO N+57
120 READ N
130 POKE A,N
140 NEXT A
150 PRINT "DONE"
160 CLEAR 110
170 END
200 DATA 17, 0, 0, 196, 13, 38,
   34, 223, 64, 205, 54, 25, 194,
   157, 25, 43, 43, 43, 235, 237,
   115, 38, 65, 42
210 DATA 38, 65, 235, 229,
   175, 237, 82, 68, 77, 209, 33,
   16, 0, 25, 235, 43, 237, 184,
   237, 115, 38, 65, 42, 38
220 DATA 65, 17, 17, 0, 25,
   249, 42, 223, 64, 201
```

The following additional program verifies that the new command has been implemented correctly:

```
300 ONERROR GOTO 380
310 For A=1 TO 10
320 CLOSE B
330 CLOSE
340 NEXT
350 IF A=3 THEN PRINT "ALL
   OK": END
360 PRINT "CHECK
ENTERED CODE WITH
LISTING"
370 END
380 A=A+1
390 RESUME NEXT
```

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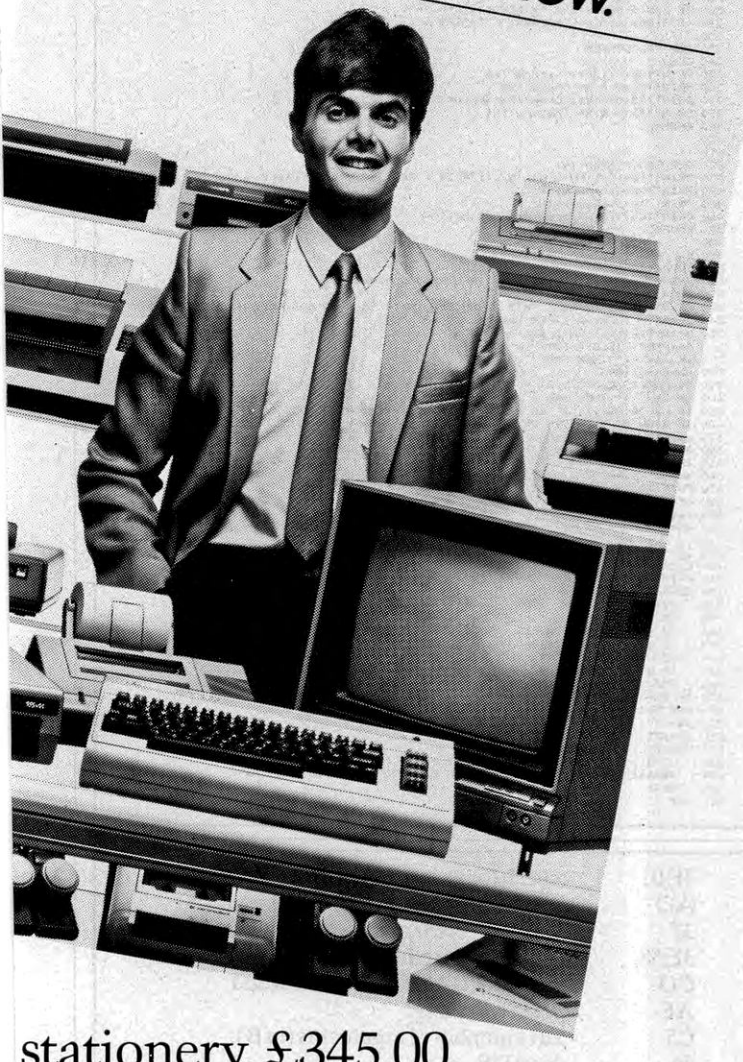

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BBC PROTECTED FIELDS

I enclose a listing of a routine to enable the BBC Micro to be used in a screen entry mode, that is, with protected and unprotected fields. The routine can be used in any program that requires input and subsequent update of data, for example, a database type program.

The routine is a function (FNGETFIELD) which is called with three parameters: the line number, the start character position and the length of the input field.

When the routine has been called the user is able to edit the field on the screen using the cursor keys and the DELETE key and when he is satisfied with the result the RETURN key is used to complete the entry of the data. The RETURN key causes FNGETFIELD to read the data directly from the screen using OSWORD calls. This should make the routine compatible with the Tube. The up arrow cursor key is used to step back to the previous field.

The principal advantages of using this type of screen entry are, firstly, that input of new data and update of existing data can both be handled in one routine, and secondly, the routine does not need to keep track of what is happening in the field until the user has finished.

In order to illustrate the use of FNGETFIELD the program below maintains three arrays holding a NAME, a CODE number and an AMOUNT. This program is only a demonstration of the technique.

I have used MODE 7 in the demonstration in order to make use of the multi-coloured screens, but the routine will work in any MODE.

PB Nix

```
  1 REM   /// P.B.Nix. Screen Entry Demo ///
 10 ON ERROR GOTO 240
 20 Y$=CHR$131 : REM Yellow
 30 R$=CHR$129 : REM Red
 40 W$=CHR$135 : REM White
 50 F$=CHR$136 : REM Flash
 60 DIM name$(10),code$(10),amount(10),occupied%(10)
 70 VDU15:MODE7
 80 REM Set cursor keys to return ASCI codes
 90 *FX4,1
100 FORI=1 TO 10:occupied%(I)=FALSE:NEXT
110 record=1:lastrecord=0
120 PROCSCREEN
130 REPEAT
140   %%=&A
150   IF occupied%(record)=TRUE THEN PROCDISPLAY(record):GOTO170 : REM Old rec
160   PRINTTAB(12,1)FNformat(record,3):SPC(19);Y$;F$;"NEW"; : REM New record
170   record=FNUPDATE(record)
180   IF record>10 THEN VDU7:record=10:GOTO210
190   IF record<1 THEN VDU7:record=1:GOTO210
200   IF record>lastrecord+1 THEN VDU7:record=lastrecord+1
210   UNTIL FALSE
220 *FX4,0
230 END
240 REPORT:PRINT" at line ";ERL
250 *FX4,0
260 END
270
280 DEF FNformat(N,width)
290 IF N=0 THEN=STRING$(width," ")
300 IF LEN STR$N>width =STRING$(width,"*")
310 =STRING$(width-LENSTR$N," ")+STR$N
320
330 DEF PROCSCREEN
340 CLS
350 PRINTTAB(0,1)R$;"Record";W$
360 PRINTTAB(0,4)R$;"Name";W$
370 PRINTTAB(0,6)R$;"Code";W$;SPC10;R$;"(A1-Z9)";W$
380 PRINTTAB(0,8)R$;"Amount";W$
390 ENDPROC
400
410
420 DEF PROCDISPLAY(N)
430 PRINTTAB(12,1)FNformat(N,3):SPC24 : REM Clear the flashing NEW
440 PRINTTAB(6,4)name$(N)
450 PRINTTAB(6,6)code$(N)
460 PRINTTAB(9,8)FNformat(amount(N),10)
470 ENDPROC
480
490 DEF FNUPDATE(N)
500 LOCAL A$,A
510 A=VAL(FNGETFIELD(1,12,3)) : REM Record number
520 IF A<>-1 THEN 540
530 IF N=1 THEN =N ELSE =N-1 : REM Step back to previous record if possible
540 IF A<>N THEN =A : REM New record selected
550 PRINTTAB(12,1)FNformat(record,3);
560 A$=FNGETFIELD(4,6,10) : REM Name
570 IF A$="-1" THEN 510
580 name$(N)=A$
590 A$=FNGETFIELD(6,6,2) : REM Code
600 IF A$="-1" THEN 560
610 IF LEFT$(A$,1)<"A" OR LEFT$(A$,1)>"Z" THENVDU7:GOTO590
620 IF RIGHT$(A$,1)<"1" OR RIGHT$(A$,1)>"9"THENVDU7:GOTO590
630 code$(N)=A$
640 A=VAL(FNGETFIELD(8,9,10)) : REM Amount
650 IF A=-1 THEN 590
660 amount(N)=A
670 PRINTTAB(9,8)FNformat(amount(N),10)
680 occupied%(N)=TRUE
690 lastrecord=N
700 =N+1
710
720 DEF FNGETFIELD(line,start,length)
730 LOCALB%,A$
740 PRINTTAB(start,line);
750 REPEAT
760   B%=GET
770   IF B%=136 AND POS>start:VDU8 : REM <-
780   IF B%=127 AND POS>start:VDU8,32,8 : REM DELETE
790   IF B%>31 AND B%<127 THEN VDUB%:IF POS>start+length-1 THEN VDU8
800   REM If the char is printable then print it and move the cursor
810   IF B%>31 AND B%<127 THEN VDUB%:IF POS>start+length-1 THEN VDU8
820   UNTIL B%=139 OR B%=13 : REM ^ or RETURN
830 IF B%=139 THEN="-1" : REM ^
840 REM Read back the field from the screen
850 A$=""
860 AX=135 : REM for the OSWORD call
870 FORI%=start TOstart+length-1
880   VDU31,I%,line : REM Position cursor
890   A$=A$+CHR$((USR(&FFF4)AND&FFFF)DIV&100) : REM Read & decode character
900   NEXT
910 =A$
```

STRUCTURED NEWBRAIN

In many of the more common dialects of Basic, the inability to pass arguments to subroutines makes the sensible structuring of programs very difficult. In the case of the NewBrain this problem can be partially overcome by using the routine below. It takes advantage of the facility which allows the transfer of arguments between Basic programs and machine code subroutines, and exchanges the values of successive pairs of variables in the CALL statement variable list. For example,

CALL 'xfer',
A,X,B,Y,A$,X$,C,Z

will exchange the values of the variables A and X, B and Y, A$ and X$, C and Z. Arguments can then be passed to subroutines by calling this routine immediately before and

```
XFER:  LD A,01H        3E 01   ;check for an even number of. . .
       AND B           AO      ;arguments in the CALL statement.
       SCF             37      ;set up for error number 88 if the. . .
       LD A,58H        3E 58   ;number of arguments is not even and. . .
       RET NZ          CO      ;return to BASIC if number is odd.
       XOR A           AF      ;reset carry flag.
VARS:  PUSH BC         C5      ;save number of arguments (in B).
       LD D,(HL)       56      ;load DE. . .
       DEC HL          2B      ;with address. . .
       LD E,(HL)       5E      ;of odd-numbered. . .
       DEC HL          2B      ;argument.
       LD B,(HL)       46      ;load BC. . .
       DEC HL          2B      ;with address. . .
       LD C,(HL)       4E      ;of even-numbered. . .
       DEC HL          2B      ;argument.
       PUSH HL         E5      ;save argument address pointer.
       PUSH BC         C5      ;exchange BC. . .
       POP HL          E1      ;and HL.
       LD B,6          0606    ;set up 6 bytes to be exchanged.
SWAP:  LD C,(HL)       4E      ;exchange the. . .
       LD A,(DE)       1A      ;contents of the. . .
       LD (HL),A       77      ;addresses pointed. . .
       LD A,C          79      ;to by. . .
       LD (DE),A       12      ;HL and DE.
       INC HL          23      ;increment pointer.
       INC DE          13      ;increment pointer.
       DJNZ SWAP       10 F7   ;swap 6 bytes for each argument pair.
       POP HL          E1      ;recover argument address pointer.
       POP BC          C1      ;recover number of arguments.
```

after the GOSUB statement. For example,

```
CALL 'xfer',
A,X,B,Y,A$,X$,C,Z
GOSUB nnnn
CALL 'xfer',
A,X,B,Y,A$,X$,C,Z
```

Note that variables need not exist before they appear in the CALL statement but that they still exist upon completion of the routine. The exchange of string variables does not require that they have the same lengths, and elements of arrays must be passed individually.

A final point to note is that in appendix 8 of the NewBrain Handbook it states that the number of arguments in the CALL statement is preserved in the C register. This appears to be wrong, the number of arguments actually appearing in the B register.

```
        DEC B           05      ;find number of arguments remaining. . .
        DJNZ VARS       10E4    ;if at the end of the list then. . .
        RET             C9      ;return to Basic.
```

The routine works by finding the positions of the variables and string descriptors in memory (as described in appendix 8 of the NewBrain Handbook) and simply interchanging the values of corresponding pairs. The routine relies upon there being an even number of arguments in the CALL statement; the first six lines of the routine check that this is the case, and if not, return with error number 88. No checks are made which will stop attempts to exchange numeric values and string descriptors.

John S Hartas

NEATER BBC PROGRAM LISTINGS

Most attempts to improve the clarity of program listings result in the program occupying more memory and increased execution times. Two common techniques for improving clarity are:

a) insert blank lines before and/or after REMarks or PROCedures.
b) write each statement on a single program line.

Both these methods are expensive on memory and speed of execution.

To enable clear program listings which do not prevent the use of multiple statement lines or require the insertion of blank lines, I have written the following program.

The program works well for MODE 7 but is not satisfactory for other MODEs as it stands. However, I have indicated how it could be modified for other MODEs.

```
 10 REM Lister __makes listings easy to read!
 20 oswrch=?&20E+?&20F*256:REM write character vector
 30 underscore=ASC("_"):REM ASCII value of underscore character
 40 colon=ASC(":"):REM ASCII value of colon character
 50 flash=136:REM teletext flash character
 60 newline=&FFE7:REM OSNEWL vector
 70 *KEY9?&20E=&BB:?&20F=&E|M
 80 REM define f9 to reset old vector for OSWRCH
 90 FOR I
100 P
110 [
120 OPT I%
130                 CMP #underscore         / is it an underscore
140                 BNE multiline           / check for multi-statement line
150                 JSR oswrch              / yes
160                 LDA #flash              / print flash character
170                 JMP continue
180 .multiline      CMP colon               / is it a colon
190                 BNE continue            / no, so continue listing
200                 PHA                     / save accumulator
210                 JSR newline             / print newline
220                 LDA #9                  / tab right one space character
230                 LDX #5
240 .tab            JSR oswrch              / tab right five spaces
250                 DEX
260                 BNE tab
270                 PLA                     / recover accumulator
280 .continue       JMP oswrch              / print character and return
290 ]
300 NEXT
310 *KEY10?&20E=&00:?&20F=&?C:VDU12|M
320 REM make break key install new OSWRCH vector
```

When enabled, the routine allows the insertion of the underscore (_) character into the program statement. When the program is then LISTed, the rest of the line after the underscore will flash. For example. 10 REM—this is a comment—would LIST with 'this is a comment' flashing. Similarly 10 DEF PROC demo—would LIST with 'demo' flashing.

The program also breaks multiple statement lines at colons (:) and prints each statement on a new line. For example, the program line 10 PRINT a*b: a=a*b: b=c–d—would be LISTed as

```
10 PRINT a*b
:a=a*b
:b=c–d
```

The only increase in memory requirements for these features is the byte needed for the underscore; the increase in execution time is almost nil.

The program is reasonably self-explanatory. Basically the program redirects the normal routine to write to the screen (OSWRCH) to &C00 where the machine code routine resides. The routine then checks for underscore or colons and, after taking the appropriate action, returns control to the normal OSWRCH routine. Line 70 defines f9 to reset the indirection vector for OSWRCH (&20E,&20F) to allow normal listing to be resumed. (NB the hex values given in line 70 are correct for OS 0.1 but are probably changed in OS 1.0 and should be checked by peeking &20E,&20F). Line 310 defines the BREAK key to reinstall the OSWRCH vectors for the new routine each time the BREAK key is pressed. Once the program has been RUN successfully, the program can be NEWed and the routine remain active as long as &C00 to &C21 is not overwritten by defining characters.

Once entered the routine can be *SAVEd and *LOADed as normal. Note that the BREAK and f9 keys will need to be defined manually.

If the 'flash' option is not required, lines 130-170 can be deleted, or by changing line 160 to LDA#10, an underscore encountered during LISTing causes a line feed to be issued. This will work for all MODEs.

J R Hearn

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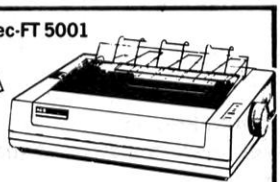

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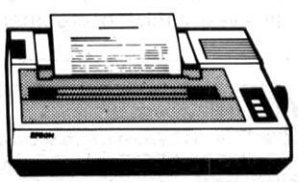

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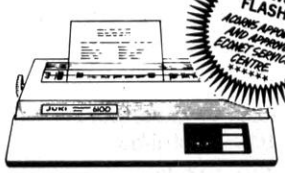

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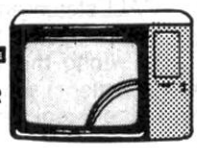

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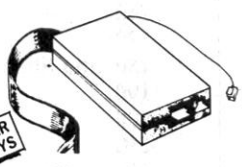

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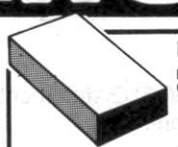

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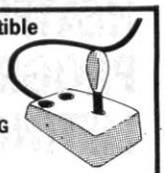

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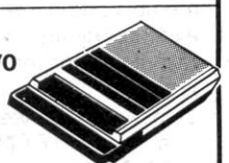

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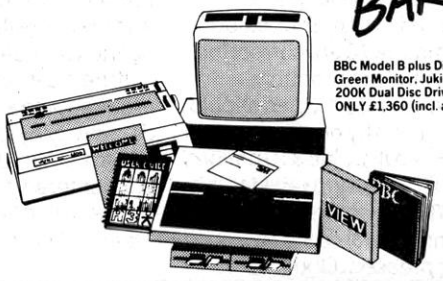

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INTERFACING THE APPLE

R C Baker presents his design for an interface unit which makes full use of the games input/output socket on the circuit board given here for the Apple II. All the components are listed, together with a program to demonstrate the interface in action.

The Apple II has a number of inputs and outputs which are dedicated to 'games' purposes. These I/O facilities are provided on a 16 pin DIL socket on the top right of the Apple's PCB and are as follows:–

Apple Reference

3 off push button (single-bit) inputs
PB0, PB1, PB2

4 off variable (analogue) inputs
GCO, GC1, GC2, GC3

4 off switch outputs
AN0, AN1, AN2, AN3

The single-bit inputs can be used with switches to provide inputs to the Apple; the analogue inputs can be used with switches to create more single-bit inputs, or with variable resistors to provide games paddles. The switch outputs are TTL signals, and change from high to low or low to high when the output memory locations are referenced. These will drive lamps, relays, etc, via a simple transistor interface.

I have devised an interface unit which tries to make the most flexible use of these inputs and outputs for games and other 'non-keyboard' software. The circuitry used in my interface is more complex than necessary, for a number of reasons, and hence a simplified circuit diagram (Fig 1) is given which is adequate for the program described below.

The interface plugs into the DIL socket on the Apple, and provides the following on its facia panel:

3 push button switches A, B, and C
4 illuminated push button switches 1, 2, 3, and 4,
1 DIN 5 pin socket for connecting three games paddles
1 DIN 6 pin socket for driving external relays, etc.

The lamps in the illuminated switches are driven from the outputs AN0-AN3.

The circuit diagram shows the layout of the interface, from the 16 pin DIL Apple socket to the front panel switches. The circuit may be battery powered (6 volt) or driven from a mains power supply as in my unit. This is shown in Fig 2. Fig 3 shows a front panel layout which can be used, although this can be varied to suit the individual, and may be dependent on the box used to contain the interface.

The switch inputs A, B, and C, are straightforward, being connected directly to the appropriate Apple inputs. The 1k resistor provides a suitable current-limiting device between the Apple's five volt supply and the input. Analogue input GC3 is used to provide the switch inputs 1, 2, 3, and 4. Each switch has a different value resistor and hence presents a different value on the analogue input. The only drawback with this is that the Apple cannot correctly interpret two or more of these switches if pressed simultaneously — this does not present a problem in the program described below.

Games paddle inputs GC0, GC1 and GC2 are taken to the 5 pin DIN socket, together with the +5 volt supply from the

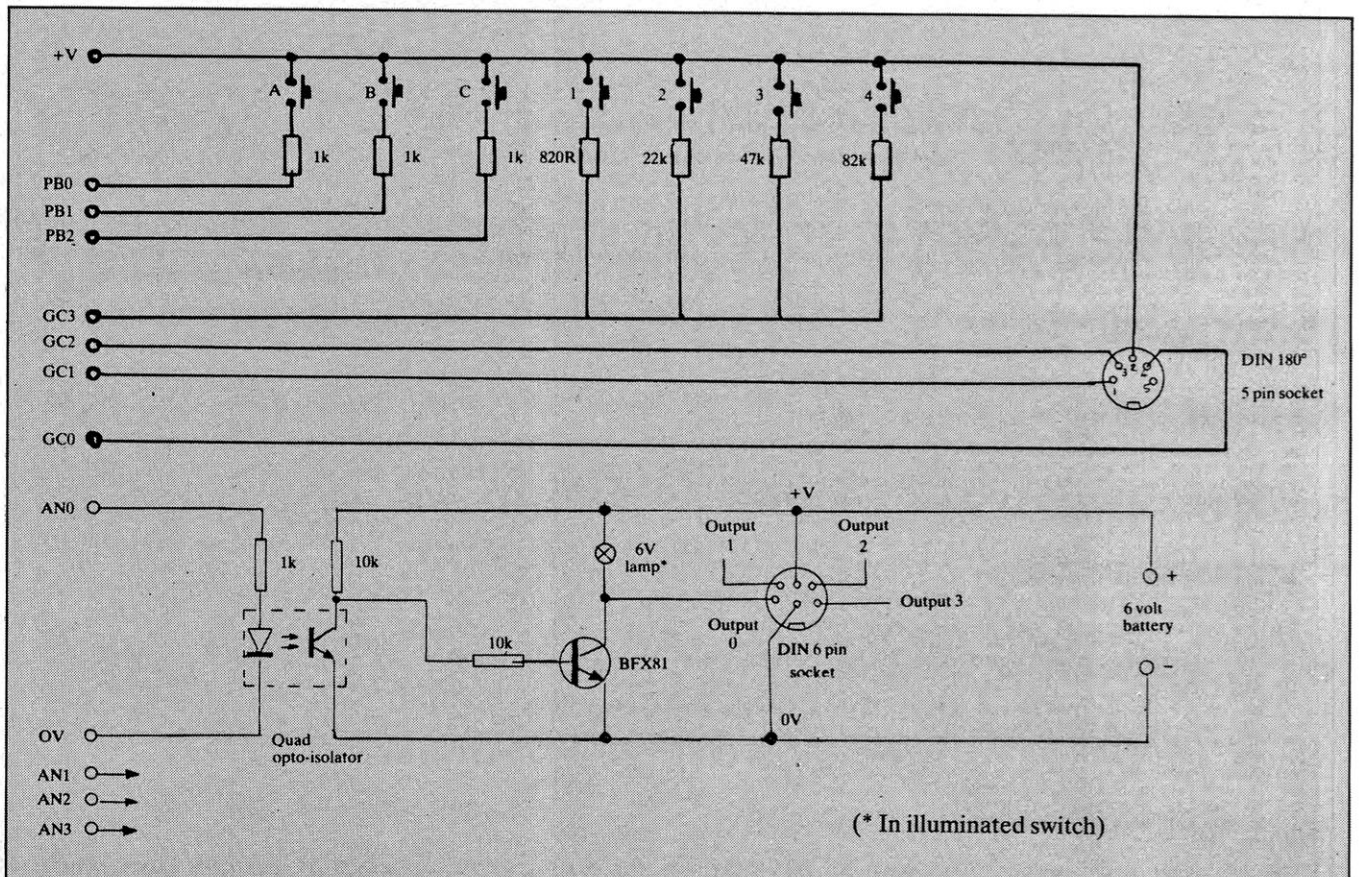

Fig 1 Circuit diagram, Apple II switch interface

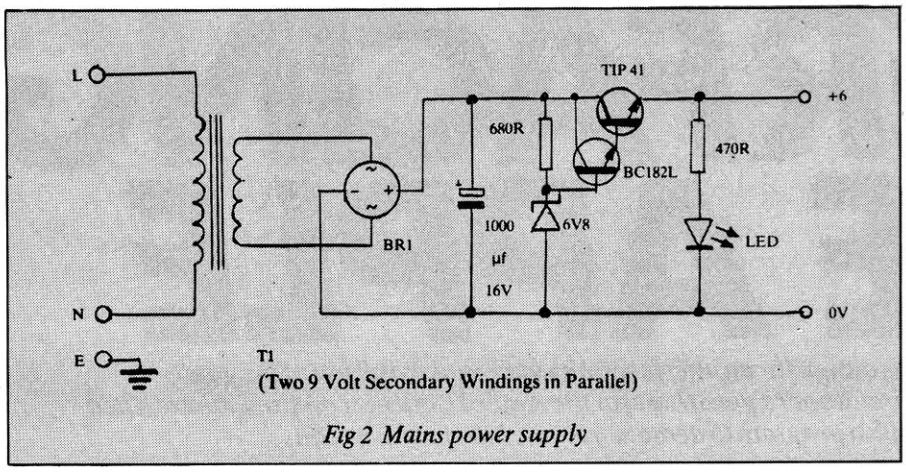

Fig 2 Mains power supply

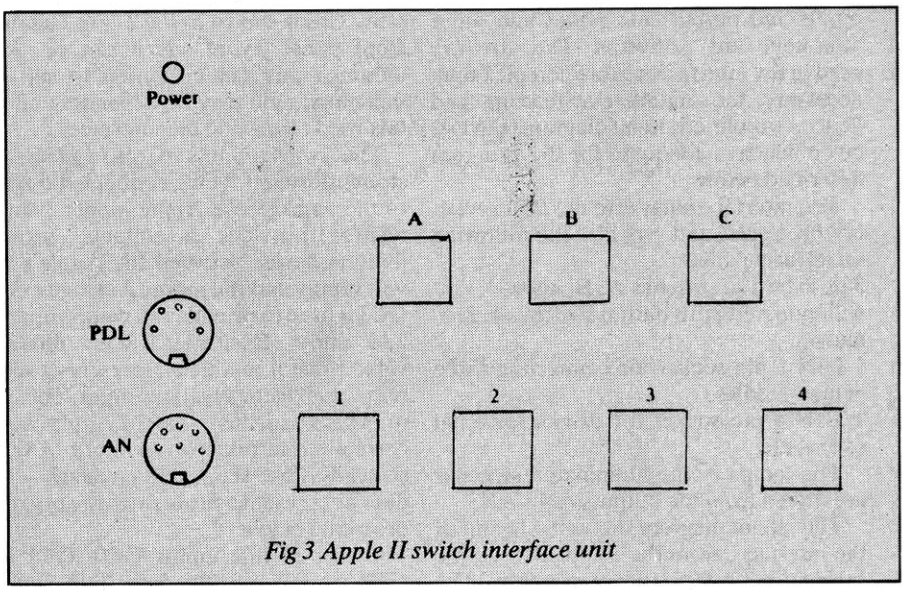

Fig 3 Apple II switch interface unit

Apple. Games paddles and/or joysticks can now be plugged in at this point. Note that the normal value of variable resistor is 150k, which gives readings from 0 to 255 depending on its setting. Larger values than 150k will have no effect (ie, 255 will be returned), whereas smaller values will reduce the upper limit (for example, a 10k variable resistor will present a maximum reading of 23 to the Apple).

The outputs from the Apple are optically isolated to prevent possible damage to the computer if a peripheral device were to short circuit or fail. A quad opto-isolator IC is used to provide this protection — for clarity only one of the outputs is shown — the others are identical, using the other channels of the opto-isolator and a driver transistor each. The transistor chosen will switch several hundred milliamps without difficulty.

The unit described here can be easily constructed by anyone who has some familiarity with electronic assembly, and there should be no difficulty in obtaining components and a suitable case. Note that the construction method and layout is not important — a small piece of veroboard will take all the components, and ribbon cable is recommended to connect from the Apple to the switch unit. A complete list of components and a recommended supplier (and his type nos) is given in Fig 4. The pin-out numbers from the DIL socket are given in Fig 5, and the memory locations which relate to the inputs and outputs are given in Fig 6.

The outputs AN0-AN3 can be toggled on and off by an instruction such as POKE xxxx, 1 where xxxx is the appropriate

```
1  REM   *     SIMON SAYS     *
2  REM   *         BY         *
3  REM   *      R.C.BAKER     *
4  REM   *       C.1983       *
5  HOME : VTAB (5): PRINT  TAB( 15)"SIMON SAYS": PRINT  TAB( 15)"===== ====="
6  VTAB (20): PRINT "YOU MUST FOLLOW SIMON'S SEQUENCE OF": PRINT : PRINT "LIGHTS AND SOUNDS TO WIN!!"
7  FOR A = 1 TO 5000: NEXT : GOSUB 10100
10  DIM X(40):        LC =  - 16290:LO =  - 16289:B1 =  - 16287:B2 =  - 16286:B3 =  - 16285
12  DEF  FN A(X) = 2 * (X - 1)
13 CL = 49264
15  FOR A = 1 TO 4: POKE LC -  FN A(A),0: NEXT
20  HOME : PRINT "SIMON SAYS USES THE APPLE SWITCH UNIT.": PRINT : PRINT "BUTTONS A, B, AND C DETERMINE THE SPEED": PRINT : PRINT "AND SEQUENCE LENGTH - A IS SLOWEST/"
21  PRINT : PRINT "SHORTEST, AND C THE FASTEST/LONGEST ": PRINT : PRINT "TO START THE GAME, PRESS EITHER A, B, OR": PRINT "C WHEN THE RED 'LENGTH?' LAMP COMES ON"
22  PRINT : PRINT "AND THEN AGAIN WHEN THE YELLOW 'SPEED?'": PRINT : PRINT "LAMP COMES ON.  THE GREEN LAMP WILL THEN": PRINT "COME ON,  WHICH MEANS THAT YOU
23  PRINT : PRINT "GOOD LUCK!"                                                                                    CAN START BY PRESSING A"
30  POKE LO - 6,0: GOSUB 250:LN = X * 10: POKE LC - 6,0
33  FOR X = 1 TO 500: NEXT
35  POKE LO - 4,0: GOSUB 250:G = X: POKE LC - 4,0
38  FOR X = 1 TO 500: NEXT
40  POKE LO,1: IF  PEEK (B1) <128 THEN 40
45 SPD = 255: POKE LC,0: FOR X = 1 TO 100: NEXT
50 SPD = 255:X =  INT ( RND (1) * LN): IF X <.5 * LN THEN 50
70  FOR A = 1 TO X
80 X(A) =  INT ( RND (1) * 5): IF X(A) <1 OR X(A) >4 THEN 80
90 A$ = A$ +  STR$ (X(A)): NEXT
100  FOR A = 1 TO  LEN (A$):SPD = SPD - G * 3
110  FOR B = 1 TO A:C =  VAL ( MID$ (A$,B,1))
120  POKE LO -  FN A(C),1: POKE 769,SPD: POKE 768,C * 20 + 100: CALL 770: POKE LC -  FN A(C),0
130  NEXT B: FOR B = 1 TO A:C =  VAL ( MID$ (A$,B,1)): POKE  - 16368,0
140  POKE CL,0: IF  PDL (3) >250 THEN 140
142  POKE CL,0:Z =  PDL (3)
144  IF Z <30 THEN Z = 4: GOTO 150
145  IF Z <60 THEN Z = 3: GOTO 150
146  IF Z <110 THEN Z = 2: GOTO 150
147 Z = 1
150  IF Z = C THEN 200
160  POKE 768,240: POKE 769,250: CALL 770: HOME : PRINT "YOU GOOFED!!!!!"
165  PRINT : PRINT "YOU GOT TO NOTE ";A;" OUT OF "; LEN (A$)
170  VTAB (20): PRINT "DO YOU WANT ANOTHER GO? (Y) ";: POKE  - 16368,0: GET Z$
180  IF Z$ <>"Y" THEN  PRINT : PRINT  CHR$ (4);"RUN HELLO"
190  CLEAR : GOTO 10
200  POKE 768,C * 20 + 100: POKE 769,SPD: POKE LO -  FN A(C),1: CALL 770: POKE LC -  FN A(C),0
210  NEXT B: FOR Z = 1 TO 1000: NEXT : NEXT A
220  FOR X = 1 TO 10: POKE 768,80: POKE 769,20: CALL 770: POKE 768,120: POKE 769,20: CALL 770: NEXT
230  HOME : PRINT "YOU DID IT!!                WELL DONE!"
240  PRINT : PRINT "THE SEQUENCE LENGTH WAS ";A - 1: GOTO 170
250  IF  PEEK (B1) >127 THEN X = 1: RETURN
260  IF  PEEK (B2) >127 THEN X = 2: RETURN
270  IF  PEEK (B3) >127 THEN X = 3: RETURN
280  GOTO 250

10100  POKE 770,173: POKE 771,48: POKE 772,192: POKE 773,136: POKE 774,208: POKE 775,5: POKE 776,206: POKE 777,1: POKE 778,3: POKE 779,240: POKE 780,9: POKE 7 ,202
10110  POKE 782,208: POKE 783,245: POKE 784,174: POKE 785,0: POKE 786,3: POKE 787,76: POKE 788,2: POKE 789,3: POKE 790,96: POKE 791,0: POKE 792,0
10120  RETURN
```

Components	Recommended supplier	Part number	
3-off Push Button Switch	RS Components	336-602	
4-off Illuminated Push Button Switch	Verospeed	63-22189L	Switch
	Verospeed	63-22199F	Pack 5 coloured inserts
	Verospeed	63-22511k	6 Volt Lamps
1-off Quad Opto-Isolator IC	Verospeed	89-21767C	
4-off BFX 85 Transistor	RS Components	294-659	
7-off 1k Resistor, 5%	RS Components	131-255	Pack 10
8-off 10k Resistor, 5%	RS Components	131-378	Pack 10
1-off 820R Resistor, 5%	RS Components	131-249	Pack 10
1-off 47k Resistor, 5%	RS Components	131-457	Pack 10
1-off 82k Resistor, 5%	RS Components	131-485	Pack 10
1-off 22k Resistor, 5%	RS Components	131-413	Pack 10
1-off 6 Pin Din Socket	RS Components	478-295	
1-off 5 Pin 180° Din Socket	RS Components	478-273	
Veroboard	RS Components	433-826	
Case with or without Battery—To Suit			
Power Supply (Optional)			
1-off Mains Transformer, 9 Volt Secondary	Verospeed	89-21550D	
1-off Bridge Rectifier 50V Lamp	Verospeed	253-25508F	
1-off Zener Diode, 6.8 V, 500mW	Verospeed	253-26015H	
1-off TIP 41 Transistor	RS Components	294-839	
1-off BC 182L Transistor	RS Components	294-277	
1-off Resistor 22k 5%	RS Components	131-413	Pack 10
1-off Resistor 470R 5%	RS Components	131-211	Pack 10
1-off LED	RS Components	586-475	
1-off Capacitor, 1000 µf 25V	RS Components	103-610	

Fig 4 Components and suppliers

memory location. The push button inputs PB0 PB2 can be 'tested' by the instruction IF PEEK (xxxx) > 127 then yyy, whereupon the branch to yyy will occur if the button is being pressed. The analogue inputs can be referenced by PDL (x) Basic command, x being 0, 1, 2, or 3. It is worth resetting the 'Analogue Clear' location −16272 before reading a game controller, by issuing the command X = PEEK (−16272). A number of game programs will be published which use the game interface unit in future issues.

Given here is a demonstration program using the Apple switch unit described above. The program is the old Simon game which tests your reflexes and short-term memory retention by asking you to memorise and mimic a random sequence of lights and sounds. Instructions are contained within the program. END

Pin	Function	Pin	Function
1	+5v from Apple power supply	9	no connection
2	PB0 Input	10	AN0 Output
3	PB1 Input	11	AB1 Output
4	PB2 Input	12	AN2 Output
5	not used by Switch Interfaced	13	AN3 Output
6	GC0 Input	14	GC3 Input
7	GC1 Input	15	GC1 Input
8	0v Ground connection	16	no connection

Fig 5 Pin-out's from Apple game I/O socket

−16296	Turns	AN0	On	When Referenced
−16295	Turns	AN0	Off	When Referenced
−16294	Turns	AN1	On	When Referenced
−16293	Turns	AN1	Off	When Referenced
−16292	Turns	AN2	On	When Referenced
−16291	Turns	AN2	Off	When Referenced
−16290	Turns	AN3	On	When Referenced
−16289	Turns	AN3	Off	When Referenced
−16287	PB0 :	If button A pressed, value will be > 127		
−16286	PB1 :	If button B pressed, value will be > 127		
−16285	PB2 :	If button C pressed, value will be > 127		
−16284	GC0 :	Value from 0 to 255		
−16283	GC1 :	Value from 0 to 255		
−16282	GC2 :	Value from 0 to 255		
−16281	GC3 :	Value from 0 to 255		
−16272	Analogue input strobe—reference time location to reset inputs GC0~GC3			

Fig 6 Memory locations associated with game I/O

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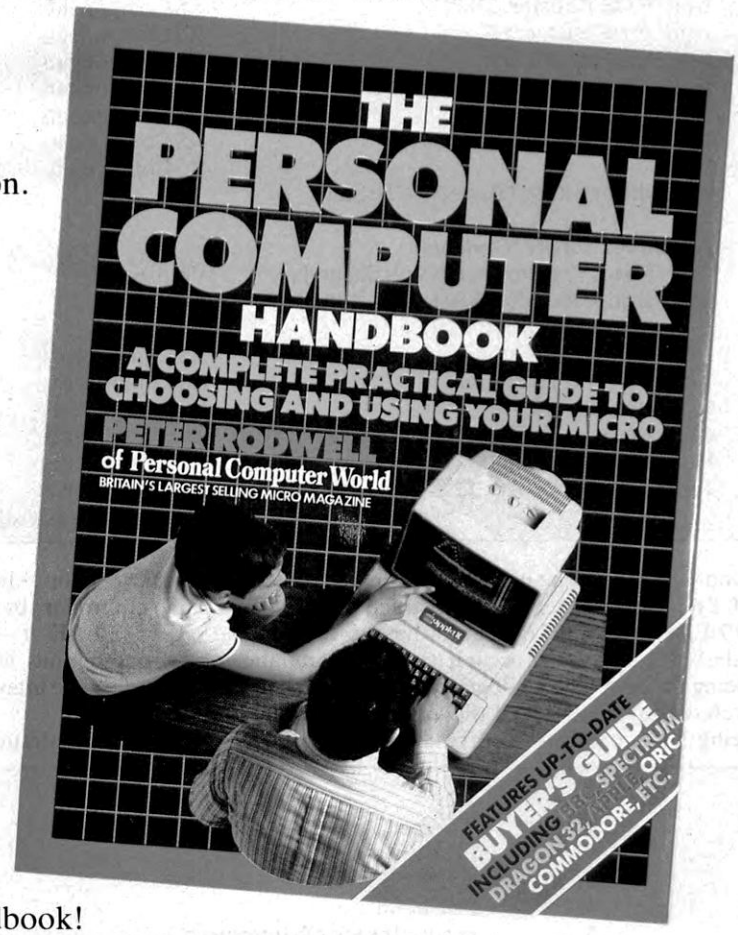



Z80: READ ONLY SECRETS

A good way to further your knowledge of machine code programming (which for many of us means learning the first principles) is to examine the instructions in a computer's read-only memory, or ROM. NewBrain enthusiast Tony Armitstead has written a disassembler for the Z80-based machine which, with the help of conversion notes, can be used to lay bare the secrets of other Z80-based micros.

The program accompanying this article is a Z80 disassembler written for the NewBrain micro. It should be easy to convert to most other Z80-based micros once you see what it does and how it does it.

The main purpose of a disassembler program is to convert machine code (possibly back) to assembler instructions. Machine code is a set of numeric instructions that the processor (Z80) can directly execute as a program. These numeric instructions usually take the form of a list of bytes in computer memory and can be very difficult to program without making numerous mistakes. To overcome this problem it is usual to use a substitute code known as the assembler language of the processor. This assembler language is far more meaningful from a programmer's point of view. For example, the hexadecimal (Hex) form of the machine code to load the Z80 C register with the value 24 (Hex) would be in two bytes 0E 24. This is represented in assembler language as LD C,24H (LD for LOAD) which is far more meaningful to us.

To convert the assembler language instructions to machine code we would use an assembler program. If, however, we have machine code instructions available, such as in the ROM of the computer, we can convert these to assembler language instructions by using a disassembler program and discover what the code does.

The assembler language of the Z80 processor consists of a set of instructions that can be split into three parts: the mnemonic; the first field; and the second field.

In the above example LD is the mnemonic, C is the first field and 24H is the second field. Some instructions only have the mnemonic, for instance RLA (Rotate Left Accumulator), and some only have the first field, for instance INC H (INCrement the H register). The missing fields can be thought of as being empty.

The disassembler works by forming these three fields and putting them together. The number of bytes of machine code needed to completely form the instruction varies for different instructions, so I have used three different methods for disassembling.

The first method — the one used most — uses a table of information which is accessed using the first byte of machine code as a key. The entries in the table give details of the mnemonic and the two fields which form the instruction. (These are usually the ones in common with the 8080 processor.)

The second method was introduced to cut down the size of the table, since some instructions can be completely decoded from one byte, for instance LD reg,reg.

The third method is really a series of *ad hoc* methods for decoding the 'odd' instructions that need several bytes to define their type, for instance SET 6,L or LD (IX+32H),72H. (This last one is decoded from the four bytes DD 36 32 72!)

Each table entry for the first method uses three bytes and the bits (binary) of these bytes are used as shown in Fig 1.

The TYPE of the field is defined as follows:

bits 654	meaning	
000	flag	eg PO
001	single data indirect	eg (34H)
010	double register indirect	eg (HL)
011	double data indirect	eg (7A3BH)
100	single register	eg A
101	single data direct	eg 5AH
110	double register direct	eg HL
111	double data direct	eg 3F5AH

The INDEX for the field gives the array subscript for FE$ (,) and the first byte of the table gives the subscript for OP$ ( ). To find the start of a table entry, I use the first byte of the machine code (m/c) as a key. If it wasn't for method two then the start of a table entry would be at TOP+1+3* (first m/c byte), ie, three bytes per entry. Method two, however, takes a chunk out of the table (162 bytes to be precise) and hence the modification to line 370.

Note that bit seven of each table byte is unused, and so the table could be recoded to use these bits for any fit purpose you want (for example, to indicate 8080 compatibility perhaps).

The program picks the information out of the table using the AND instruction in Basic, but on some micros this may not be allowed. To test this you could enter PRINT (255 AND 8). If the answer was 8 then you should have no problems. If you caused an error message to be issued then you will have to use another method (see the conversion notes later).

The second method of decoding is used solely for decoding the LD reg,reg instructions (although it could be extended to ADD reg,reg etc) which have the form:-

```
LD dst,src
 \_/\_/\_/      dst=destination
  /  |  \       src=source
10 ddd sss
```

where bits ddd and sss define which register as follows:

000=B
001=C
010=D
011=E
100=H
101=L
110=A
111=(HL)

Note that LD (HL),(HL) is replaced by HALT.

The third method/s deal with the m/c instructions that have the prefix bytes of CB,DD,ED and FD. The FD and ED prefixes indicate an index register instruction, the CB prefix indicates a bit manipulation instruction and the ED prefix indicates a mixture of instructions (interrupt and port, etc). The index register one can be dealt with by treating it as a normal instruction but replacing HL by IR or (IR + disp) where IR is an index register (IX or IV) and disp is an 8-bit displacement.

Now if you have a NewBrain then you can follow the installation notes below. If not then you can use the conversion notes to tailor the program to your micro.

Installation notes for NewBrain

Type in and check the program (especially lines 1150 to 1280). To input the mnemonics you type (IN DIRECT MODE):

```
DIM OP$(81)
FOR I=1 TO 81:PRINT "OP$(";I;";:LINPUT OP$(I):NEXT I
```

and input the mnemonics as shown in Fig 2.

To input the decoding table you type (again in direct mode):

```
RESERVE 670
FOR I=TOP+1 TO TOP+1+662: INPUT A:POKE I,A:NEXT I
```

The numbers shown in Fig 3 should then be typed in, one at a time, moving across and then down the table, ie:

Z80:READ ONLY SECRETS

? 36
?128
.
.
? 113
? 30 etc.

You can then save the program with its data by typing GOTO 1150 (this will save the program and data twice in the correct format for loading back). To test the program you should type GOTO 240 which is where the main program starts. Be careful not to type RUN as this would destroy OP$().

After (possibly) removing any typing errors and checking the data, you can save the program and data as before.

Upon subsequent loading of the program, you can type RUN as this will force the program to load its own data. After it has done this the screen should clear and you should see:

GOTO 240
START:-

You should enter the starting address in hex using upper case letters and digits for example, A9D5. You are then prompted for the end address which you should enter likewise. The disassembler listing will default to a text screen opened by the program. You can get the output to your printer by including a line such as:
20 PR=TRUE

You must, however, set up the baud rate for your printer in line number 1350 (the 600 is for the Tandy GCP-115). If you require the disassembly to pause at any stage then just press the STOP key. To continue the output press the C key, any other key will abort the disassembly and return you to the original screen.

If you wish to run the program again you could type GOTO 240 as before. However, the program has printed this statement out at the top of the screen so all you need to do is type CONTROL/NEWLINE (together) and the program will run again.

CONTROL/NEWLINE is the SEND PAGE control code which causes the computer to start reading from the top of the page as though you had typed it, and, since the first thing it reads is GOTO 240, then we have the required effect.

After stopping the disassembler you can see the output again, if you want, by typing GET#2,A. you can then use the cursor keys to see up to 20 lines off the top of the screen, as in the editor.

If you wish you can channel the output to any device by altering the definition of stream #2 in line 1350/1360.

Without the REM statements the program takes up about 5.1k but the program/data/screen together take up about 11k. The REMs can be removed as they do not provide the destination for any GOTO/GOSUBs, etc.

Conversion notes

Delete lines 240, 455, 460, 1340, 1350, 1360, 1370, 1380 as these are NewBrain specific.

Replace PRINT#2 by PRINT wherever it occurs.

All PUT statements should be replaced by your equivalent statements:-
PUT 31 and PUT#2,31 just clear the screen (CLS).
PUT 31,14 clears the screen and causes all the printed text to appear inverted. This is cancelled by the PUT 15 statement.
PUT#5,A waits for a key to be pressed and gives its key code in A. The NewBrain code for 'C' is 99 and this may need to be changed for your micro.

To read/write from/to the cassette, I have used stream number one. This means that PRINT#1/LINPUT#1 sends/receives data to/from cassette. The PUT#1/GET#1 commands will send/receive data bytes from cassette. These should be changed to the instructions specific to your machine. If you have no PUT/GET equivalents then you can PRINT/INPUT from cassette at the expense of speed.

If your micro can handle the ON BREAK command then you may only need to alter the first part of line 340 which turns the break trap off, otherwise you must delete lines 330 and 340, change line 310 to read IF PO>EN THEN END and remove the ON BREAK command in line 270. If you want to implement the pause feature then you could use an INKEY instruction at line 305, say, to see if a key is being pressed and, if so, to take appropriate action.

If you only have single dimension arrays then FE$(,) can be split into three separate arrays because the first index is always given explicitly.

The decode table is located using the NewBrain system variable TOP which is set by the RESERVE command. If you want you can put the table in any 'safe' area of RAM and replace TOP+1 with the start address of this RAM.

If your micro did not accept the AND example given above, you will need another method of picking information out of the table. You could recode the table using one byte per piece of information, ie five bytes per entry, but this would increase the table size to 1105 bytes. An alternative would be to write functions or subroutines to do the picking out of the bits.

The FIELD could be calculated using:
TE=INT(TE/16) assuming bit 7 is 0
and the index could be calculated using:
TE=TE−16*(INT(TE/16))

The variables B4,B5 and B6 in lines 550, 560, 570 are flags which indicate whether bits 4,5, and 6 are set in the FIELD. These can be calculated using similar methods.

The rest of the program is in very standard Basic and should convert to most other machines without change. You should read the NewBrain installation notes for some idea on how to set up the program and data.

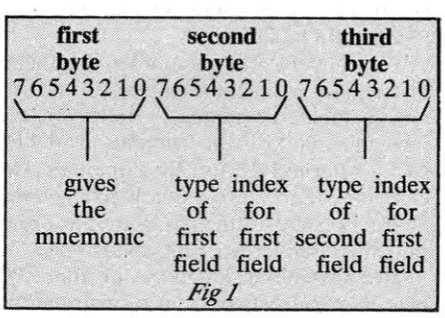

Fig 1

```
10  ?80 !
100 GOSUB 1340:GOTO 240
105 REM Dec to Hex subroutine
110 IF HX<256 THEN HX$="00":GOTO 180
120 H=INT(HX/4096)
130 HX$=CHR$(H+48-7*(H>9))
140 HX=HX-4096*H
150 H=INT(HX/256)
160 HX$=HX$+CHR$(H+48-7*(H>9))
170 HX=HX-256*H
180 H=INT(HX/16)
190 HX$=HX$+CHR$(H+48-7*(H>9))
200 HX=HX-16*H
210 HX$=HX$+CHR$(HX+48-7*(HX>9))
220 RETURN
230 HX$="":GOTO 180
235 REM Program starts here
240 PUT 31:PRINT"GOTO 240"
250 INPUT("START :")HX$:GOSUB 1070:PO=HX
    :IF ER THEN 250
260 INPUT("END :")HX$:GOSUB 1070:EN=HX :
    IF ER THEN 260
270 PUT#2,31:ON BREAK GOTO 330
280 GOSUB 350:REM Decode m/c pointed to
                  by PO
290 PRINT#2,DS$,OP$:REM DS$ is hex and
                       OP$ the mnemonic
300 PO=PO+1
310 IF PO>EN THEN 330
320 GOTO 280
330 GET#5,A:IF A=99 AND PO<EN  RESUME
340 ON BREAK GOTO 0: END
350 HX=PO:GOSUB 110:DS$=HX$+SP$
360 TE=PEEK(PO)
365 REM DI is the decoding info address
370 DI=TOP+1+3*TE+162*(TE>117)
380 HX=TE:GOSUB 230:DS$=DS$+HX$+SP$
385 REM Check for LD reg,reg
390 IF TE>63 AND TE<118 THEN 800
395 REM Check for CB,DD,ED & FD
400 IF TE=203 THEN 740
410 IF TE=221 THEN IR$="IX":GOTO 820
420 IF TE=253 THEN IR$="IY":GOTO 820
430 IF TE=237 THEN 870
440 IP=PEEK(DI)
450 OP$=OP$(IP)+SP$
455 REM Check for RST n (n=10,18,20,28)
460 IF IP>59 AND IP<64 THEN PO=PO+1:
    HX=PEEK(PO):GOSUB 230:
    OP$=OP$+"CALLING CODE:"+HX$+"H":
    RETURN
465 REM Decode 1st field
470 TE=PEEK(DI+1)
480 IF TE=128 OR TE=0 RETURN
490 GOSUB 550
495 REM Decode 2nd field
500 TE=PEEK(DI+2)
510 IF TE=0 THEN 530
520 OP$=OP$+",":GOSUB 550
525 REM Check for JR or DJNZ
530 IF IP=29 OR IP=16 THEN T=PEEK(PO):
    HX=PO+1-T*(T<128)+(T AND127)*(T>128)
    +T*(T=128):GOSUB 110:
    OP$=LEFT$(OP$,LEN(OP$)-3)+"TO "+HX$
    +"H"
540 RETURN
545 REM Sub. to decode field
550 B4=(TE AND 16)=16
560 B5=(TE AND 32)=32
570 B6=(TE AND 64)=64
580 IF B4 THEN 620
590 IF B5 THEN 700
600 IF B6 THEN OP$=OP$+FE$(1,TE AND 15):
    RETURN
610 OP$=OP$+FE$(3,TE AND 15):RETURN
620 IF NOT(B6) THEN OP$=OP$+"("
630 IF B5 THEN HX=PEEK(PO+1)+
    256*PEEK(PO+2):GOSUB 110:
    OP$=OP$+HX$+"H":PO=PO+2:GOTO650
640 HX=PEEK(PO+1):GOSUB 230:
    OP$=OP$+HX$+"H":PO=PO+1
650 IF NOT(B6) THEN OP$=OP$+")"
660 DS$=DS$+RIGHT$(HX$,2)
670 IF NOT(B5) THEN 690
680 DS$=DS$+LEFT$(HX$,2)
690 RETURN
700 IF NOT(B6) THEN OP$=OP$+"("
```

```
710 OP$=OP$+FE$(2,TE AND 15)
720 IF NOT(B6) THEN OP$=OP$+")"
730 RETURN
735 REM Decode CB....
740 PO=PO+1:TE=PEEK(PO)
750 HX=TE:GOSUB 230
760 DS$=DS$+HX$
770 IF TE<64 THEN
    OP$=OP$(CB((TE AND 248)/8+1))+SP$+
    FE$(1,(TE AND 7)+1):RETURN
780 OP$=OP$(CB((TE AND 192)/64+B))+
    STR$((TE AND 56)/8)+","+
    FE$(1,(TE AND 7)+1)
790 RETURN
795 REM Decode LD reg,reg
800 OP$="LD   "+FE$(1,(TE AND 56)/8+1)+
    ","+FE$(1,(TE AND 7)+1)
810 RETURN
815 REM Decode DD & FD
820 PO=PO+1:TE=PEEK(PO)
830 IF TE<52 OR TE>203 OR TE=57 THEN
    FE$(2,4)=IR$:GOSUB370:FE$(2,4)="HL":
    RETURN
840 IF TE=54 THEN HX=TE:GOSUB 230:
    DS$=DS$+HX$:HX=256*PEEK(PO+1)+
    PEEK(PO+2):GOSUB110:DS$=DS$+HX$:
    OP$="LD   ("+IR$+"+"+LEFT$(HX$,2)+
    "H),"+RIGHT$(HX$,2)+"H":PO=PO+2:
    RETURN
850 IF TE<203 THEN HX=PEEK(PO+1):
    GOSUB 230:FE$(2,4)=IR$+"+"+
    RIGHT$(HX$,2)+"H":FE$(1,7)="("+
    FE$(2,4)+")":GOSUB 370:DS$=DS$+
    MID$(FE$(2,4),LEN(FE$(2,4))-2,2):
    FE$(2,4)="HL":FE$(1,7)="(HL)":
    PO=PO+1:RETURN
860 IF TE=203 THEN HX=256*PEEK(PO)+
    PEEK(PO+1):GOSUB110:DS$=DS$+HX$:
    PO=PO+1:FE$(1,7)="("+IR$+"+"+
    RIGHT$(HX$,2)+"H)":GOSUB 740:
    FE$(1,7)="(HL)":RET
865 REM Decode ED.....
870 PO=PO+1:TE=PEEK(PO):HX=TE:GOSUB 230
880 DS$=DS$+HX$
890 IF TE-INT(TE/8)*8>3 OR TE>143
    THEN 1290
900 ON TE-INT(TE/8)*8+1
    GOTO 910,920,930,970
910 OP$="IN   "+FE$(1,(TE/8 AND 7)+1)+
    ",(C)":RETURN
920 OP$="OUT  (C),"+
    FE$(1,(TE AND 56)/8+1):RETURN
930 OP$="SBC  HL,":RP=(TE AND 48)/16+1
940 IF(TE AND 15)=10 THEN OP$="ADC  HL,"
950 IF RP<4 THEN OP$=OP$+FE$(2,RP+1):
    RETURN
960 OP$=OP$+"SP":RETURN
970 HX=PEEK(PO+1)+256*PEEK(PO+2):
    GOSUB 110:DS$=DS$+RIGHT$(HX$,2)+
    LEFT$(HX$,2)
980 RP=(TE AND 48)/16+1:PO=PO+2
990 IF (TE AND 15)=11 THEN 1030
1000 OP$="LD   ("+HX$+"H),"
1010 IF RP<4 THEN OP$=OP$+FE$(2,RP+1):
     RETURN
1020 OP$=OP$+"SP":RETURN
1030 OP$="LD   "
1040 IF RP<4 THEN OP$=OP$+FE$(2,RP+1)+
     ",("+HX$+"H)":RETURN
1050 OP$=OP$+"SP,("+HX$+"H)":RETURN
1060 RETURN
1070 REM Hex to Dec
1080 ER=FALSE :HX=0
1090 IF LEN(HX$)>4 THEN ER=TRUE:RETURN
1100 FOR I=LEN(HX$) TO 1 STEP -1
1110 AS=ASC(MID$(HX$,I,1))-48
1115 IF AS>22 OR AS<0 THEN ER=TRUE:
     RETURN
1120 HX=HX+16^(LEN(HX$)-I)*(AS+7*(AS>16)
)
1130 NEXT I
1140 RETURN
1145 REM To save program AND data (x 2)
1150 FOR S=1 TO 2:SAVE"DISSASEMBLER"
1160 OPEN OUT#1,1,"OP$ DATA"
1170 FOR I=1 TO 81
1180 PRINT#1,OP$(I)
1190 NEXT I
1200 CLOSE#1
1210 OPEN OUT#1,1,"INFO"
1220 FOR I=TOP+1 TO TOP+1+660 STEP 3
1230 PUT#1,PEEK(I),PEEK(I+1),PEEK(I+2)
1240 PRINT PEEK(I);
1250 NEXT I
1260 PUT#1,0,0,0
1270 CLOSE#1
1280 NEXT S:END
1285 REM To decode 'odd' ED...
1290 DI=TOP+1+604
1300 DI=DI+2:IF TE<>PEEK(DI) AND
     PEEK(DI)<>255 THEN 1300
1310 IF PEEK(DI)=255 THEN OP$=OP$(75):
     RETURN
1320 OP$=OP$(PEEK(DI+1))
1330 RETURN
1335 REM Initialise and read in data
1340 OPTION BASE 1
1350 IF PR CLOSE#2:OPEN#2,8,"600"
1360 IF NOT(PR) CLOSE#2:OPEN#2,0,1,"50":
     PUT#2,23,8
1370 CLOSE#5:OPEN#5,5
1380 OPEN#0,0,"24":PUT#0,23,"D"
1390 DIM OP$(81),FE$(3,8),CB(11)
1400 FOR I=1 TO 3
1410 FOR J=1 TO 8
1420 READ FE$(I,J)
1430 NEXT J
1440 NEXT I
1450 DATA B,C,D,E,H,L,(HL),A,AF,BC,DE,HL,
     IX,IY,AF',SP,C,N,NC,N2,P,PE,PO,Z
1460 FOR I=1 TO 11:READ CB(I):NEXT I
1470 DATA 51,56,49,54,70,71,75,72,4,45,
     69
1480 SP$=" "
1490 PUT31,14:PRINT"LOADING MNEMONICS":
     PUT15
1500 OPEN IN#1,1,")OP$ DATA"
1510 FOR I=1 TO 81
1520 LINPUT#1,OP$(I)
1530 NEXT I
1540 CLOSE#1
1550 RESERVE 670
1560 PO=TOP+1
1570 PUT31,14:
     PRINT"LOADING DECODING TABLE":
     PUT15
1580 OPEN IN#1,1,")INFO"
1590 GET#1,A,B,C
1600 IF A=0 CLOSE#1:RETURN
1610 POKE PO,A:POKE PO+1,B:POKE PO+2,C
1620 PO=PO+3
1630 GOTO 1590
```

Z80 Disassembler program for NewBrain

```
OP$( 1 )=ADC        OP$( 42 )=OUTI
OP$( 2 )=ADD        OP$( 43 )=POP
OP$( 3 )=AND        OP$( 44 )=PUSH
OP$( 4 )=BIT        OP$( 45 )=RES
OP$( 5 )=CALL       OP$( 46 )=RET
OP$( 6 )=CCF        OP$( 47 )=RETI
OP$( 7 )=CP         OP$( 48 )=RETN
OP$( 8 )=CPD        OP$( 49 )=RL
OP$( 9 )=CPDR       OP$( 50 )=RLA
OP$( 10 )=CPI       OP$( 51 )=RLC
OP$( 11 )=CPIR      OP$( 52 )=RLCA
OP$( 12 )=CPL       OP$( 53 )=RLD
OP$( 13 )=DAA       OP$( 54 )=RR
OP$( 14 )=DEC       OP$( 55 )=RRA
OP$( 15 )=DI        OP$( 56 )=RRC
OP$( 16 )=DJNZ      OP$( 57 )=RRCA
OP$( 17 )=EI        OP$( 58 )=RRD
OP$( 18 )=EX        OP$( 59 )=RST 0
OP$( 19 )=EXX       OP$( 60 )=RST 8
OP$( 20 )=HALT      OP$( 61 )=RST 10H
OP$( 21 )=IM 0      OP$( 62 )=RST 18H
OP$( 22 )=IN        OP$( 63 )=RST 20H
OP$( 23 )=INC       OP$( 64 )=RST 28H
OP$( 24 )=IND       OP$( 65 )=RST 30H
OP$( 25 )=INDR      OP$( 66 )=RST 38H
OP$( 26 )=INI       OP$( 67 )=SBC
OP$( 27 )=INIR      OP$( 68 )=SCF
OP$( 28 )=JP        OP$( 69 )=SET
OP$( 29 )=JR        OP$( 70 )=SLA
OP$( 30 )=LD        OP$( 71 )=SRA
OP$( 31 )=LDD       OP$( 72 )=SRL
OP$( 32 )=LDDR      OP$( 73 )=SUB
OP$( 33 )=LDI       OP$( 74 )=XOR
OP$( 34 )=LDIR      OP$( 75 )=DATA???
OP$( 35 )=NEG       OP$( 76 )=LD   I,A
OP$( 36 )=NOP       OP$( 77 )=LD   R,A
OP$( 37 )=OR        OP$( 78 )=IM   1
OP$( 38 )=OTDR      OP$( 79 )=LD   A,I
OP$( 39 )=OTIR      OP$( 80 )=IM   2
OP$( 40 )=OUT       OP$( 81 )=LD   A,R
OP$( 41 )=OUTD
```

Fig 2 Mnemonics

```
 36  128    0   30  226  113
 30  162   72   23  226    0
 23  193    0   14  193    0
 30   65   80   52  128    0
 18  225  103    2  228   98
 30  200   34   14  226    0
 23  194    0   14  194    0
 30   66   80   57  128    0
 16   81    0   30  227  112
 30  163   72   23  227    0
 23  195    0   14  195    0
 30   67   80   50  128    0
 29  208    0    2  228   99
 30  200   35   14  227    0
 23  196    0   14  196    0
 30   68   80   55  128    0
 29    4   80   30  228  113
 30  177  100   23  228    0
 23  197    0   14  197    0
 30   69   81   13  128    0
 29    8   81    2  228  100
 30  228   49   14  228    0
 23  198    0   14  198    0
 30   70   81   12  128    0
 29    3   81   30  232  113
 30  177   72   23  232    0
 23  164    0   14  164    0
 30   36   81   68  128    0
 29    1   81    2  228  104
 30  200   48   14  232    0
 23  200    0   14  200    0
 30   72   80    6  128    0
 20  128    0   30  164   72
 30  200   65   30  200   66
 30  200   67   30  200   68
 30  200   69   30  200   70
 30  200   36   30  200   72
  2  200   65    2  200   66
  2  200   67    2  200   68
  2  200   69    2  200   70
  2  200   36    2  200   72
  1  200   65    1  200   66
  1  200   67    1  200   68
  1  200   69    1  200   70
  1  200   36    1  200   72
 73  193    0   73  194    0
 73  195    0   73  196    0
 73  197    0   73  198    0
 73  164    0   73  200    0
 67  200   65   67  200   66
 67  200   67   67  200   68
 67  200   69   67  200   70
 67  200   36   67  200   72
  3  193    0    3  194    0
  3  195    0    3  196    0
  3  197    0    3  198    0
  3  164    0    3  200    0
 74  193    0   74  194    0
 74  195    0   74  196    0
 74  197    0   74  198    0
 74  164    0   74  200    0
 37  193    0   37  194    0
 37  195    0   37  196    0
 37  197    0   37  198    0
 37  164    0   37  200    0
  7  193    0    7  194    0
  7  195    0    7  196    0
  7  197    0    7  198    0
  7  164    0    7  200    0
 46  132    0   43  226    0
 28  132  112   28  240    0
  5  132  112   44  226    0
  2   72   80   59  128    0
 46  136    0   46  128    0
 28  136  112   75    0    0
  5  136  112    5  240    0
  1   72   80   60  128    0
 46  131    0   43  227    0
 28  131  112   40   16   72
  5  131  112   44  227    0
 73   80    0   61  128    0
 46  129    0   19  128    0
 28  129  112   22   72   16
  5    1  112   75    0    0
 67   72   80   62  128    0
 46  135    0   43  228    0
 28  135  112   18  168  100
  5  135  112   44  228    0
  3   80    0   63  128    0
 46  134    0   28  164    0
 28  134  112   18  227  100
  5  134  112   75    0    0
 74   80    0   64  128    0
 46  133    0   43  225    0
 28  133  112   15  128    0
  5  133  112   44  225    0
 37   80    0   65  128    0
 46  130    0   30  104  100
 28  130  112   17  128    0
  5  130  112   75    0    0
  7   80    0   66  128    0
 68   35   69   48   70   21
 71   76   77   47   79   77
 86   78   87   79   94   80
 95   81  103   58  111   53
160   33  161   10  162   26
163   42  168   31  169    8
170   24  171   41  176   34
177   11  178   27  179   39
184   32  185    9  186   25
187   38  255
```

Fig 3 Decoding table

Starts at TOP+1 and ends at TOP+1+662

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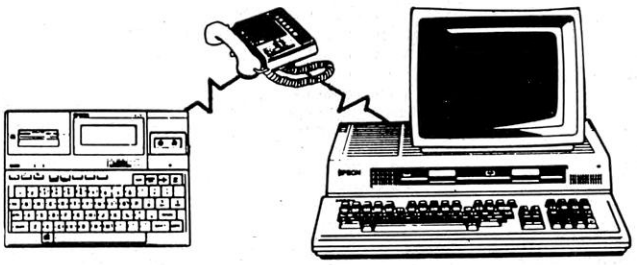

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This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. Well, in the words of *The Hitch-hikers' Guide to the Galaxy*, don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which 'the computer's output is displayed'. This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *PCW*.

For those completely new to computing, let's start with the question: what is a microcomputer? We can think of a micro as a general-purpose device as opposed to a typewriter which can only be used for typing, a calculator to perform calculations, a filing-cabinet to file information and so on. A micro can do all those things and more.

If it is to be of any use, a general-purpose device needs some way of having a function assigned to it. We do this by giving the computer a set of logical instructions called a **program**. The general term for computer programs is **software**. Every other part of a microcomputer system is known as **hardware**. 'If you can touch it, it's hardware.'

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a code known as a **computer language**. There are literally hundreds of different languages around, the most popular of these being **Basic**. Basic is an acronym of **B**eginners' **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. Although originally intended only as a simple introductory language, Basic is now a powerful and widely-used language in its own right.

Other languages you're likely to come across in *PCW* include **Forth, Pascal, C** and **Comal**. These are known as **high-level** languages because they approach the sophistication of a human language. You'll also see references to the **low-level** languages, **assembly language** and **machine code**. We'll look at high and low-level languages in a moment.

The heart of a micro, the workhorse, is the **processor** or **Central Processing Unit (CPU)**. The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor around, the Z80, 6502 and 8088 being the three most common. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

Being electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It is possible to program computers in binary notation, otherwise known as **machine code** (or machine language) programming.

Machine code is called a low-level language because it operates at a level close to that 'understood' by the processor. (Languages like Basic are known as high-level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.)

Between high-level languages and machine code is a low-level language known as **assembly language** or, colloquially, **assembler**. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

Since there is no binary equivalent of a comma or the letter 'a', for example, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange, **ASCII**. This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

There are two types of program to do this translation for us. The first of these is a **compiler** which translates our whole program permanently into machine code. When we compile a program, the original high-level language version is called the **source code** while the compiled copy is called the **object code**. Compiled programs are fast to run but hard to edit. (If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code.) For this reason there is a second translation program: an **interpreter**. An interpreter waits until we actually run (use) the program, then translates one line at a time into machine code — leaving the program in its original high-level language. This makes it slower to run than a compiled program, but easier to edit.

There are two strange-sounding Basic words you're likely to come across: **POKE** and **PEEK**. When you program in a high-level language, you are normally unable to choose which part of the machine's memory the processor will use to store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'POKE' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above POKE with 'PEEK 10000', the computer would respond by displaying the value 56. (POKEing and PEEKing is normally done to increase program speed. It's a compromise between Basic and machine code.)

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of memory. There are two types of memory known as **R**ead **O**nly **M**emory **(ROM)** and the badly-named **R**andom **A**ccess **M**emory **(RAM)**. ROM is so-called because the processor can **'read'** (get things out of) its contents, but is unable to **'write** to' (put things in) it.

ROM is used to store **firmware**, which consists of software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and data (information). The second important difference is that RAM needs a constant power-supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8-bit binary number. 8 bits make one byte and 1024 bytes make one **kilobyte** or **1k**. 32k, for example means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 ... 1024 being the nearest binary multiple to 1000.

There are numerous forms of **permanent** or **backup** storage, but by far the most common are the **floppy disk** and **cassette**.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive**. Disk drives comprise a high-speed motor to rotate the disk and a read/write head to record and 'playback' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small blocks by spoke-like divisions called **sectors**.

There are two methods for dividing the disk into sectors. One method is called **hard-sectoring**, where holes punched in the disk mark the sectors, and the other is **soft-sectoring** where the sectors are marked magnetically. (The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers do seem to have begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible with each others.')

Since the computer needs some way of tracking the whereabouts of everything on the disk, we have a program called a **Disk Operating System**, more usually known simply as the **Operating System (DOS** or **OS)**. The operating system does all the 'house-keeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available (each with its own advantages and disadvantages). The two most popular OSs are **CP/M** (Control Program for Micros) and **MS-DOS** (MicroSoft Disk Operating System).

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and is adequate for games and the like.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of programs and data. Hard disk capacity generally starts at around 10 **Mbytes** (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Since computers need some way of communicating with the outside world, we need input and output devices. Input and output devices include all manner of things from hard disk units to light-pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a tv-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU**, **Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, etc) may all be built in to a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it makes sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. **Parallel input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with 8 wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). **Serial I/O**, in contrast, uses a single wire to transmit a series of bits one at a time with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the **RS232** (or **V24**) while the **Centronics** standard is popular for parallel interfaces.

When two computers want to communicate with each other over a distance, there are again two ways of doing it. Both methods use the public phone network. The simplest and cheapest method is to use a device known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. However an acoustic coupler is slow and not exceptionally reliable.

A more sophisticated (and correspondingly more expensive) method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from British Telecom.

So, now you know!

MICRO CHESS

CHOICE PICKINGS

Tony Harrington presents a selection of the best games from the 4th European Microcomputer Chess Tournament.

This month's Micro Chess is given over to presenting games from the 4th European Microcomputer Chess Tournament. Last month's issue, you will recall, gave a round by round commentary, but we only had space for one full length game. This issue will flesh out that commentary with all the best games.

Many of you will want to know how the commercial machines performed. If your specific interest is home computer programs, see the feature on chess in the *PCW* Games Special, band-wrapped with this edition. Several of the games by the four commercially available home computer chess programs are given in that feature.

I have concentrated on presenting wins, though there are a few draws, where they had particular significance or interest.

I must apologise in advance for the inconsistencies in the style of these games scores. All the participating programmers seemed to have their own way of recording the score. I have attempted to smooth out some of the wider differences, so you will not find pieces designated at all.

The most common approach, as is usual with computer chess, is to note the square of the piece to move and the square it moves to. Captures are sometimes indicated by 'x' and sometimes not. The same, unfortunately, is sometimes true of checks. Pawn moves are sometimes indicated in full (that is, e2-e4) and sometimes simply by the destination square (that is, e4).

Round 1
Colossus vs Mephisto III

1	b1c3	d7d5	16	e1e2	g7g5
2	e2e3	g8f6	17	f4h3	f6g4
3	d2d4	c8g4	18	f2f3	d4d3
4	f1e2	g4e2	19	e2e1	e7c5+
5	g1e2	b8c6	20	g1h1	g4f2+
6	e1g1	e7e6	21	h3xf2	c5xf2
7	c1d2	f8e7	22	e1f1	f2c5
8	a1c1	h7h6	23	f3f4	g5xf4
9	f1e1	e8g8	24	d2xf4	f7f5
10	e2f4	e6e5	25	f4xh6	f8f6
11	d4xe5	c6xe5	26	h6g5	f6g6
12	e3e4	d5d4	27	f1f5	c5d4
13	c3d5	a7a5	28	d1b3	d4xe4
14	c2c4	c7c6	29	c4c5+	g8h8
15	d5xe7+	d8xe7	30	f5f4	e4d5
31	b3xd5	c6xd5	37	d5d7	h8g8
32	g5f6+	g6xf6	38	c1b1	d3d2
33	f4xf6	e5c4	39	d7xd2	b2c4
34	f6f5	c4xb2	40	d2d3	f8f7
35	f5xd5	a5a4	41	h1g1	c4e5
36	a2a3	a8f8	42	d3d4	resigns

Score: 1-0

Round 2
Mephisto vs Caesar — A real coffee-house game, one of my favourites from the Tournament.

1	d2d4	d7d5	15	e6e7	b4xe7
2	c2c4	dxc4	16	f3e2	b8c6
3	g1f3	a7a6	17	f2f4	e7xa3
4	e2e3	b7b5	18	b2xa3	a5xb5
5	a2a4	g8f6	19	e2xb5	d8d1+
6	axb5	c8b7	20	f1f2	e5g4+
7	bxa6	a8xa6	21	f2g3	d1xa1
8	b1a3	b7xf3	22	b5xc6	g4xe3
9	d1xf3	e7e5	23	c6c5+	f8g8
10	f1xc4	f8b4+	24	c5xe3	h7h5
11	e1f1	a6a5	25	c1b2	h5h4+
12	c4b5+	e8f8	26	g3h3	h1xa1
13	dxe5	f6d7	27	b2xa1	resigns
14	e5e6	d7e5			

Score: 1-0

Round 3
Advance 3 vs Constellation — This was a good win for Constellation, though Advance 3 walked into a trap that it really should have seen.

1	e2e4	e7e5	19	d4c4	d7e6
2	g1f3	b8c6	20	c4c5	f8d8
3	f1b5	a7a6	21	c1f4	a8a7
4	b5a4	g8f6	22	b1d2	a7b7
5	e1g1	f6e4	23	b2b4	f6e7
6	d2d4	b7b5	24	c5a5	b7b5
7	a4b3	d7d5	25	a5b5	a6xb5
8	d4xe5	c8e6	26	f3e2	c7c6
9	b1d2	e4c5	27	h2h3	h7h6
10	a2a4	bxa4	28	d2f3	e7f6
11	b3xa4	c5xa4	29	f4e5	e6c4
12	a1xa4	e6d7	30	e2b2	d8e8
13	c2c3	f8e7	31	e5f6	e8e1+
14	d2b1	e8g8	32	f3e1	c8e6
15	d1xd5	c6xe5	33	f6d4	e6e1+
16	a4d4	d5xf3+	34	g1h2	e1e4
17	d5xf3	d8c8	35	b2a1	c4d5
18	fle1	e7f6	36	a1f1	e4f4+
37	h2g1	f4d2	41	g1f1	f3h1+
38	g2g3	f7f6	42	f1e2	d5c4+
39	f1b1	d2e2	43	e2d2	h1xa1
40	b1a1	e2f3	44	resigns	

Score: 0-1

Round 4
Chess 2001 vs Advance 3 — One of the better end games, played reasonably well by Advance 3.

1	e2e4	e7e5	27	c2xd3	h7h6
2	d2d4	e5xd4	28	g5e3	a7d7
3	d1xd4	b8c6	29	d8xd7	f8xd7
4	d4e3	g8f6	30	d3d4	d7b6
5	c1d2	f6g4	31	e4d6	g8f8
6	e3f4	d7d5	32	d6xf7	f8e8
7	e4xd5	d8xd5	33	f7e5	a6b7
8	f1c4	d5e5	34	e5d3	b2c3
9	f4xe5	c6xe5	35	d3c5	b7c8
10	c4b5	c7c6	36	c5e4	c3b2
11	b5a4	b7b5	37	e4d6	e8d8
12	a4b3	f8c5	38	h2h4	h6h5
13	g1h3	0-0	39	b3d1	d8d7
14	b1c3	c5d4	40	d6xc8	d7c8
15	0-0	(a7a5)	41	d1xh5	b6xa4
16	a2a4	b5b4	42	h5e8	a4c3
17	c3d1	c8a6	43	e8xc6	c3e2+
18	f1e1	f8d8	44	g1h2	b2xd4
19	d2g5	d8e8	45	c6f3	d4xe3
20	e1e4	e5g6	46	F2xe3	e2c3
21	d1c3	e8xe4	47	f3g4	c8d8
22	c3xe4	d4xb2	48	g4e6	a5a4
23	a1d1	a8a7	49	h2g3	b4b3
24	d1d8	g6f8	50	g3f3	b3b2
25	h3f4	g4e5	51	e6f5	a4a3
26	f4d3	e5xd3	52	h4h5	a3a2

Score: 0-1

Round 6
Constellation vs White Knight Mk. 11 — With a lot of help from White Knight, Constellation achieves a very nice mate — almost a brilliancy prize for this kind of Tournament.

1	e2e4	b8c6	6	0-0	c6c5
2	d2d4	e7e6	7	c1e3	c5xd4
3	f1b5	a7a6	8	e3xd4	g8f6
4	b5xc6	d7xc6	9	b1c3	0-0
5	g1f3	f8e7	10	d1c1	c7c5

11	d4e5	c8d7	19	e5xd7	b6xb2
12	f1d1	a8c8	20	g3e5	e7f6
13	e5g3	f8e8	21	e5xf6	e8g8
14	f3e5	g8f8	22	d7f8	c8xf8
15	c1f4	f8g8	23	f6g7+	g8xg7
16	d1xd7	f6xd7	24	f7f8	g7g8
17	f4xf7+	g8h8	25	f8g6	g8g7
18	a1d1	d8b6	26	d1d8	(checkmate)

Round 7
Chess 2001 vs Constellation

1	e4	c5	26	d8xf8+	g8xf8
2	b1c3	b8c6	27	g3h3	h6
3	f4	d6	28	h3c8	f8e7
4	g1f3	e5	29	h4	c6b6
5	f1b5	exf4	30	c8g4	c7e6
6	d4	cxd	31	g4e4	b6b5
7	d1xd4	c8d7	32	c4	b5b6
8	b5xc6	bxc6	33	g4	a5
9	c1xf4	c5	34	h5	b6c7
10	d4d2	d7c6	35	f3e1	f6
11	0-0-0	g8f6	36	e1f3	c7d7
12	h1e1	f8e7	37	exf	e7xf6
13	f4d6	0-0	38	d5e6+	f6e7
14	d2f4	d8e8	39	b3	d7d1+
15	d6c7	a8c8	40	b1b2	d1e2
16	c1b1	c6b7	41	b2a3	a4
17	f4g3	e8c6	42	f3e5	axb
18	c7d6	e7xd6	43	axb	e7d6
19	d1xd6	c6c7	44	e5d3	e2d2
20	e4e5	f6e8	45	f5e5	d6e7
21	c3d5	b7xe5	46	e5d5	d2a5+
22	d6xd5	c8d8	47	a3b2	a5d2+
23	e1d1	d8xd5	48	b2b1	d2d1+
24	d1xd5	c7c6	49	b1b2	d1d2+
25	d5d8	e8c7	50	b2a1	Here black lost on time.

Round 8
Mephisto vs Chess 2001

1	d4	d5	32	Rb1	R8c7
2	c4	c6	33	Kf1	Nf6
3	c4xd5	c6xd5	34	Kg2	Nd7
4	Nc3	Nc6	35	Bb2	e5
5	Nf3	Nf6	36	dxe5	Rg6
6	Bf4	Bf5	37	Kf1	Nxe5
7	e3	e6	38	f4	Nf3
8	Bb5	Qa5	39	Rd1	Rg1+
9	Qa4	Qxa4	40	Ke2	Rxd1
10	Bxa4	Bb4	41	Kxd1	Ng1
11	0-0	Bxc3	42	Ke1	Nxh3
12	bxc3	0-0	43	Kf1	d4
13	Bb5	Rac8	44	Kg2	dxc3
14	Bd6	Rfd8	45	Bc1	Nxf4
15	Ba3	Rc7	46	exf4	c2
16	h3	Na5	47	Rb2	Rc6
17	Bc5	b6	48	Kg3	h5
18	Bb4	Nc4	49	f5	Kh8
19	a4	a5	50	Kh4	g6
20	Ba3	Be4	51	fxg6	fxg6
21	Rfd1	Bxf3	52	Rb5	Kg7
22	gxf3	Rdc8	53	Kg3	Kf7
23	Ba6	Ra8	54	f3	Kf6
24	Bxc4	Rxc4	55	Kh3	Kg7
25	Bb2	Rb8	56	Kg2	Kf7
26	Ra2	Re8	57	Kg3	Ke6
27	Rb1	Rc6	58	Kh4	Kf6
28	Kf1	Rec8	59	Kh3	Ke7
29	Ke2	Kf8	60	Kg2	
30	Rg1	Ne8	**Adjudicated a draw**		
31	Ba3+	Kg8	**Score: ½-½**		

Round 9
Chess 2001 vs Caesar

1	e4e5		19	Nf3h4	
2	Nf3Nf6		20	Ng5	Bxg5
3	Ne5d6		21	Bxg5	Rde8
4	Nf3Ne4		22	h3f6	
5	d4d5		23	Bf4g5	
6	Bb5+Bd7		24	Bd6Rhg8	
7	Qe2c6		25	Re3Bf7	
8	Bd3Qe7		26	Rfe1Bg6	
9	Bf4Bg4		27	Bxg6	Rxe3
10	00Nd7		28	Rxe3	Rh8
11	Qe3000		29	Bf5b5	
12	Nbd2	Nxd2	30	Re7Rd8	
13	Nxd2	Qxe3	31	b4a6	
14	fxe3	Bb4	32	Kh2g4	
15	c3Be7		33	Bxg4	f5
16	e4h5		34	Bxf5	a5
17	exd5	cxd5	35	bxa5	b4
18	Rae1Be6		36	cxb4	Rg8

and Black resigned
Score: 1–0

And here, as promised in the December issue, the game between Chess 2001 and Artic's Spectrum.

White: Chess 2001. Black: Artic Spectrum. Bishop's Opening; Notes by John Nunn.

Chess 2001 was the highest-placed commercial entry and this was probably due to its superiority in quiet positions. It is unusual to see a computer find good positional moves but in this game Chess 2001 surprised me twice.

1	e2-e4	e7-e5
2	Bf1-c4	Nb8-c6
3	Nb1-c3	Bf8-b4

(Many of the programs in the *PCW* Tournament showed an excessive fondness for the development of the bishops at N5, followed by the exchange of bishop for knight. In this game three of the four bishops suffered such a fate, undeservedly so since normally bishops are worth slightly more than knights.)

4	a2-a3	Bb4xc3
5	d2xc3	d7-d6
6	Ng1-f3	Ng8-f6
7	Bc1-g5	0-0
8	Qd1-d3	Bc8-g4

(Here we go again! 8 . . . Bc8-e6 was better.)

9	0-0-0	Qd8-e7
10	h2-h3	Bg4xf3?

(After this exchange Black is in serious trouble. His problem is not just that he is fighting with two knights against two active bishops, but also that the knight at f6 is pinned on a permanent basis. This was his last chance to play the bishop to e6.)

11	Qd3xf3	Nc6-a5

(Unless there is a special reason for doing so, it is bad to play a knight to the edge of the board. All the pieces have less mobility at the edge of the board than elsewhere, but knights suffer particularly badly.)

11 . . . Nc6-d8 followed by . . . Nd8-e6 attempting to repel the g5 bishop was more constructive.

12	Bc4-d5	c7-c6
13	Bd5-a2	b7-b5

(Black had to provide a retreat for his knight in case of b2-b4.)

14		Bg5xf6?

(There is no reason why White should make this exchange voluntarily since there is no way Black can break the pin. 14 h3-h4 followed by h4-h5 or Rh1-h3 (heading for g3) would have been very unpleasant.)

14	. . .	g7xf6
15	Qf3-d3	

(15 Rd1-d3! followed by Qf3-h5 would have been more dangerous.)

15	. . .	Rf8-d8
16	Rh1-e1	Ra8-b8
17	Kc1-b1	Qe7-f8
18	Re1-e3	Qf8-e7

(As in the previous game pointless oscillations reduce Black's defensive chances.)

19	Re3-g3+	

(Black's doubled f-pawns are his most serious weakness and it would have been more logical to attack them immediately by 19 Re3-f3 followed by Rf3-f5 and Qd3-f3.)

19	. . .	Kg8-h8
20	Kb1-c1	

(An incomprehensible move.)

20	. . .	Na5-b7
21	b2-b4	Rd8-g8
22	Rg3xg8+	Rb8xg8
23	g2-g4	a7-a5
24	Qd3-e3!	

(White's advantage has been steadily evaporating since move 14, but now Chess 2001 starts playing much more purposefully. The queen is heading for b6 to attack the weak Black queenside pawns.)

24	. . .	Rg8-e8
25	Qe3-b6	a5xb4
26	c3xb4	Nb7-d8

(Black's pieces present an abject appearance, huddled in a little group trying to defend his many weak pawns, but the next few moves show that White has trouble finding a way to step up the pressure.)

27	Kc1-b1	Re8-g8
28	Rd1-d3	Rg8-e8
29	Ba2-b3	h7-h6
30	c2-c4!	

(The exchange of pawns is forced, but then White has a new asset in his passed a-pawn.)

30	. . .	b5xc4
31	Bb3xc4	

(In the long run White should win even against best play since Black cannot defend c6, d6 and f7 while he is fighting the advance of the a-pawn, but in the event White has no need to put this plan into action for the Black monarch decides on a suicidal single-handed advance into hostile territory, with the inevitable consequences.)

31	. . .	Kh8-g7
32	Rd3-d2	Kg7-g6
33	Kb1-a2	h6-h5
34	Rd2-d1	h5xg4
35	h3xg4	Kg6-g5

(One is reminded of a helpmate problem in which both sides cooperate to finish Black off!)

36	Qb6-e3+	Kg5xg4
37	Rd1-g1+	Kg4-h4
38	Qe3-h6	mate

That's it for this month. Next issue we will look at the Budapest World Micro Chess Championship and the New York Computer Chess Championship.

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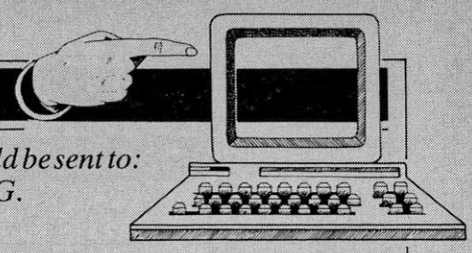

Our bi-monthly guide to microcomputing systems. Updates should be sent to: Tracy Dear, PCW, 62 Oxford Street, London W1A 2HG.

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: *MP/M Basic: Cobol: Fortran: Pascal.*	Options: 10Mb H/D £4000. ET 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: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼" F/D (320k) £895: dual 8" F/D (2 Mb). BT 1/80. (1)
Acclaim (£3650)	Country Computers 0527 29826	64k RAM: Z80: 24x80 VDU: single 5¼" F/D (140k): 5 MB H/D: RS232 port. Option: P/P	CP/M: *Basic: Cobol: Fortran: Pascal*	Various integral H/D options up to 21MB (£4450)
ACT Sirius 1 (£2395)	ACT 021 501 2284 (50)	128-512k RAM: 8088: dual 5¼" F/D (1.2M): 12", 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: Basic 86 *Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼" F/D (2.4 M) BT 2/82.(S)
Adler Alphatronic (£1895)	Adler 01-250 1717	48-64k RAM: 8085A: dual 5¼" F/D (1Mb): 12", 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	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: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£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: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	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 5¼" F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	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: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼" F/D (116k) £349.
Apple III (£2496)	As above	128-256k RAM: 6502B: dual 5¼" F/D (286k): 12", 24x80 VDU: RS232 port: P/P.	SOS: *Basic: Pascal:*	Options: single 5¼" 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): *Basic (8k ROM). Pilot: A:*	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 5¼" F/D (90k) £300: 16k RAM £65.	OS(10k ROM) Basic (8k ROM): *Pilot A: Forth: MBasic* (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: *Lisp: Forth*	High resolution graphics on bigger model: Single 5¼" F/D £297 B/ 7/80 (B)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM: 2xZ80A: 3 x 5¼" F/D (480k): 12", 24 x 80 VDU: RS232 port: P/P	DOS: (OASIS) *Ex Basic: Cobol U. A: CP/M*	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 5¼" F/D (100k) £230	MOS: Basic A: *Pascal Logo: Forth: Lisp*	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 5¼" F/D (700k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Pascal: Fortran*	Many floppy and hard disk options. 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 5¼" F/D & printer avail soon. (B)
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼" F/D (640k) £1500.
Canon CX-1 (£2500)	As above.	32k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: Basic: A: *Cobol: Pascal*	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).
Clenlo Pronto (£2825)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	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 *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)
Cleno Table Top 525 (£1750	As above	64k RAM: Z80 dual 5¼'' 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 5¼'' 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 5¼'' 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).
CommodorePET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 12'' 25x40 VDU: IEEE-488 port: Options: dual 5¼'' 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 5¼'' 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 5¼'' F/D (1Mb): IEEE-488 port: RS2332C 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 5¼'' 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 4x5¼'' 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 5¼'' 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 ints. option: dual 5¼'' 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 Micro-systems 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 Micro-systems 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 5¼'' 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 5¼'' 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 5¼'' F/D (768k and 1.5Mb) or single 5¼'' 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 5¼'' 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
Gecas 64/2 (£3305)	Grecas 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

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)
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5¼'' F/D £690.	CP/M: *Basic Cobol: Pascal Fortran AP/L:*	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).
Gemini Galaxy 2 (£1495)	As above	64k RAM: Z80A: dual 5¼'' F/D (800k): 12", 25x80 VDU: RS232 port: P/P: C int	CPM: *Basic: Cobol: Fortran: Pascal: AP/L: A*	Options: dual 5¼'' FD (800k): dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼'' F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	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): *Pascal: A M/A: Fortran*	Options: single 5¼" F/D (184k) £220; dual 5¼" 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 5¼'' F/D (1.25 Mb): 24x80 VDU: RS232 port: P/P	NewDOS 80: *CP/MZ: Basic: Cobol: Fortran Pascal*	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: *Basic: Cobol: Fortran: Pascal: Forth: PL/1: Ada*	Various hard disk options up to 26MB
Haywood 9000 Composite (£1795)	Haywood: 01-428 0111. (TBA)	64-192k RAM: Z80A: dual 5¼'' F/D (640k): RS232 port: P/P. 15'' 28x80 VDU.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	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: HiNet: *Basic: Cobol: Fortran: Pascal*	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 5¼'' F/D (540k) £1610: fusl 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: 5¼'' 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 5¼'' F/D (500k) £1693	CP/M: Basic: *Cobol Fortran: Pascal*	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 5¼'' F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	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: CBasic: *Cobol: Fortran: MicroCobol.*	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 5¼" F/D (150k): 12", 24x80 VDU: 2xS/P: P/P	CP/M: *Basic: Cobol: Fortran Pascal: A*	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: MP/M: *Basic: Cobol: Fortran: Pascal: A*	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: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	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 5¼" F/D (350k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A*	Option: Dual 8'' F/D, 10 Mb H/D (E)
LSI M-four (£2175)	As above	128-256k RAM: Z80B: 8088: dual 5¼'' or 8'' F/D 3xRS232 ports: RS422 port: P/P 12'', 24x80 VDU	MS-DOS: *CP/M-86 Basic Cobol: Fortran: Pascal: MP/M-86*	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: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	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: Basic: Pascal: W/P: *SPL: Forth: Meta*	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 5¼'' F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Millbank Sys 10 (£2395)	Millbank: 01-891 4691(6).	65k RAM: Z80: dual 5¼'' F/D (700k): 12'', 24x80 VDU: 2x RS232 ports: RS449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	12-month warranty. Mainframe 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 5¼" F/D (320k): 3xRS232 ports: P/P	Munroe Multitasking System: *CP/M: Basic: Cobol: Fortran: Pascal*	High res colour graphics. Option: single 5÷" F/D. (320k). £495

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk
G/C Graphics card
H Hardware
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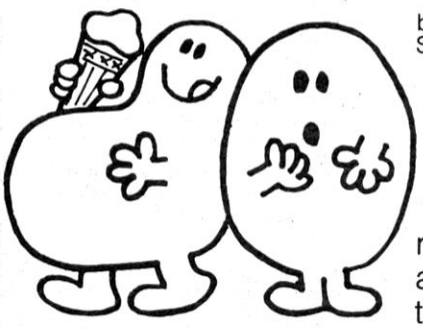
O/S Operating system
P/P Parallel port
S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

Games with a purpose

FIRST STEPS with the Mr. Men



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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 5¼" 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 5¼" F/D (700k): RS232 port: P/P.	Basic: *Pascal: A: CP/M: Cobol Fortran*	Options dual 5¼" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5¼'' F/D (326k) £699	Basic N: (24k ROM) *CP/M: Fortran: Cobol: Pascal.*	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: ½ 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 5¼'' F/D (360k): 15'', 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 5-18 Mb H/D, Multi-user.
North Star Advantage (£2195)	As above	64k RAM: Z80A: dual 5¼'' F/D (720k): 12'', 24 x 80 VDU: S/P.	GDOS: CP/M: *CBasic: MBasic: Fortran: Cobol: Pascal*	Price includes business graphics & demo software.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5¼'' F/D (768k): 12'', 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼'' 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 5¼'' F/D (640k): RS232 port; P/P	Basic: *PCOS: A*	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: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	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): *Forth*	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 5¼" F/D (200k): 5", 24x52 VDU: RS232 port: P/P	CP/M: W/P: *Cobol Fortran: Pascal* CBasic: MBasic: Wordstar: Mailmerge: Supercalc *Forth*	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5¼" F/D (400k). BT11/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 ¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8'' 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 *Micro-Cobol.*	Option: 8.4 Mb H/D £2725 (up two). BT3/80(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: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼'' F/D (140k): 12'', 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	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 5¼'' F/D (720k)	OS-9: Basic 09: *Pascal: C: A: Cobol: U FLEX O/S*	Supports 4 users, expandable to 8. Networking allows 28 users on 7 Options dual: 5¼'' 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: *Pascal C: A: Cobol: U*	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 5¼'' F/D (800k): 2xRS232 port: P/P 12'', 25x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼'' 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 *Basic: Cobol: Fortran: Pascal: A*	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 5¼'' 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 5¼" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M: Fortran: Cobol: Algol: Pascal.*	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 1pm 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)	Sinclaire 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 Chieftan (£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 daul 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 aval. 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

List of Abbreviations

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BT Bench Tested
C Cassette
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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.

ABOUT THE DEALER OF YOUR FRIENDLY IBM PERSONAL COMPUTER

It is very comforting to know that when buying an IBM Personal Computer, you are investing in a machine that carries a pedigree second to none in the computing world.

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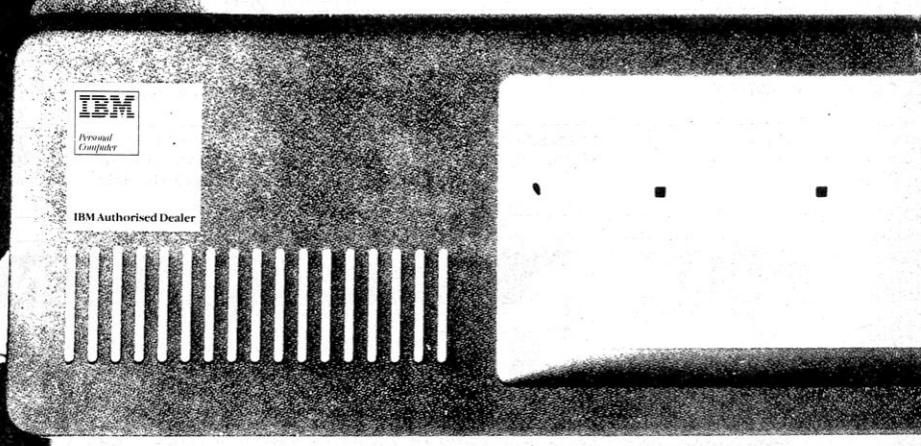

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Company .....

Address .....

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Tel. No. .....

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: *Cobol Basic*	Will run all Model II software. System with single 5¼ 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 5¼" F/D (700k):P/P: S/P: 24x80 VDU: 80 cps printer.	CP/M: *Basic: Cobol: Fortran: Pascal*	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 5¼" F/D (819k): 6Mb H/D:2xS/P: P/P	CP/M CP/Net CBasic: *Fortran: Pascal: Cobol*	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: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.
Torch (£12795)	Torch Comp. 0223 841000 (30)	64k RAM: Z80A: dual 5¼" 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 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" 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 5¼" F/D (630k): 3 S/P: 2 P/P.	CP/M: Basic: *Algol: Cobol: Pascal: Fortran: Coral: CBasic: A.*	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 5¼" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: *Basic: fortran: Cobol: Pascal: A.*	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 ports: 2xP/P: dual 5¼" F/D (700k)	OS-9: *Flex: Uniflex Basic: A: PL9: SPLM: Cobol: Fortran: Pascal*	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 5¼" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: *CP/M: Basic: Cobol: Fortran: Pascal.*	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: Basic, Fortran:* 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 5¼" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS:* CP/M: *MBasic: CBasic: Fortran.*	3 x 5¼" 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: *Cobol: Basic: Fortran: Pascal: 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).

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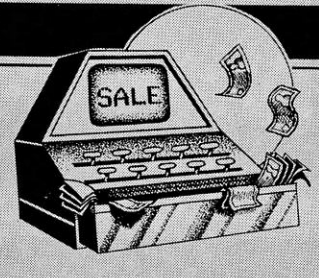

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● Sharp MZ-80A. Immaculate condition, no scratchs, books, games, graph sheets etc. Ridiculous price of £390 ono. Selling due to need of cash. Tel: (051) 546 5037 (1-6pm).

● VIC 20, 16k, C2N, S exp, joystick, intro-Basic PT1, prog ref, cartridges, £50 + software. 20 + mags, clubs, contacts, news, plenty progs. Original packaging. Possible delivery. VGC, worth £420, any offers? D. Sadler Crewkerne (0460) 73509 (after 5pm).

● Brand new unused Atari software for sale at bargain prices. Large selection of titles. Tel: (0624) 5998 (eve).

● Gemini cased twin Pertec DS/DD. 340k each disc drive, £300. Optional Gemini disc controller and CP/M, £80. Nascom 48k RAM board. Offers. Tel: Bob, 01-542 0873 (London).

● Sharp pocket computer PC-1251 and microcassette CE125. New June cost £175, will sell £125 ono. Please call Rod Crowgey (Gerrards Cross) 884262.

● PET 32k new ROM with cassette deck, toolkit, and dustcover + much literature, circuits etc. All in excellent condition, quick sale needed. Only £295. Tel: 0632 618804 (late eve).

● UK101 bust + loads of working add ons. Screen enhancement kit, several 8k ROM and RAM boards, mother and buffer boards, RAMS toolkit II, Basics Cegmon, software. Tel: Paul, Drumbo 207 (5pm).

● Video Genie EG3003, integral cassette, lower case mod. Expanded to 48k + double density controller for disk drives. Manuals, books and software, £250 ono. Tel: Ashbourne 70645.

● Apple software, very cheap. (Dbase II $300). Tel: Riyadh (Saudi Arabia) 454-3513 (ask for Russ or Martin).

● Nascom 2 32k, cased, Naspen, Zeap, Disdebug, cassette recorder, documentation, £320. Tel: 01-575 6424.

● Epson HX-20, case, microcassette, tapes, paper and sticky labels for built-in printer. VGC. Best offer over £395 or swop BBC B (OS 1.2) with disc interface. Tel: Burnham (Bucks) 4262.

● Nascom 2, 48k RAM, spare RAM A board, full documentation, unpopulated Holmes colour graphics PCB, cassette, some tapes, £250 ono. Tel: Eastleigh (Hampshire) 617214.

● TRS-80 I/III disc based Cobol compiler ANSI 1974 level 1/2 cost £129. Mint condition, offers over £100. Tel: Plymouth (0752) 59695 (after 6pm and ask for Chris).

● Aim 65 cased with 4k RAM Basic. All manuals, £250 ono. Also Casio FX502P programmable calculator + FA1 tape interface, all manuals £25. Tel: Ash Green (Kent) 0474 874291.

● Commodore PET, 2001, new ROM, integral cassette, manual, range of software, books and magazines. Good condition, £200 ono. Tel: Joe Mintz Kenton 907 4858 (after 5).

● MZ80K (48k RAM) with reset switch, 4MHz high speed board, separate video monitor output, dust cover, MZ801/0 unit, VGC, £275. Tel: Loveden (0400) 73009.

● MZ80K software. Many programs most are unused. Business and utility on both floppy disc and cassette. Please call for further details. Tel: Loveden (0400) 73009.

● Gemini GM812 IVC suitable for Nascom or Gemini systems. Offers. Atari 400/800 games. Atari Asteroids, £15. Thorn/EMI Soccer, £12. Submarine Commander, £15. Original cassette software also. Tel: Bob, 01-542 0873.

● Sharp MZ80K 48k RAM, very good condition. Reset switch, dust cover, manuals, user notes, 3 Basics, 40 + games in Basic and M-C, £300. Tel: Reading 0734 694345.

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● Wanted Atari disk drive. Exchange metal detector Teknetics 8500 (cost £499 12 months ago). Also have complete darkroom to swop WHY. Tel: 0268 285406 (eve and weekends).

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● Microprofessor MPF-I micro for machine language, learning, teaching prototyping. 4k RAM perfect

working order, Z80 based, £30. J.S. Trutwein, Flat 5, Elmslie Court, East Road, Maidenhead, Berks SL6 1PN.
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● Olivetti M20 user-club, in Germany (for English users too). Interested in best informations round the M20 soft and hardware? Write to: Klaus Nagel Weimarerstr, 45A W. Germany, 6507 Ingelheim.
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● Sharp MZ80K 36k RAM, £250 ono. Tel: Harefield (089) 582 2722.
● BBC Model B 1.2os Basic II with cables, manuals also Acornsoft program power A&F etc, boxed, £290 ono. Tel: 01-802 1280 (after 5pm).
● TRS80 Model 1, 48k, Expansion interface RS232, printer, 2 drives, Newdos + Newdos 80, comms package, games on disk and cassette, Tandy monitor, NATVG notes, Micro-80, books, £900. Tel: Gosport 20204.
● TTT2020 48k, Twin doublesided disk drives, Silentype printer, monitor, upper/lower case and Apple graphics mods, TV, Modulator, lots of software, Visicalc, Applewriter etc, £900 ono. Tel: Dave, 01-467 2600 ext. 474.
● Printer Microline 80, £90. Alecto 9ins monitor, £35. Both good working order. Wanted, Apple colour card. Tel: 01-466 5026.
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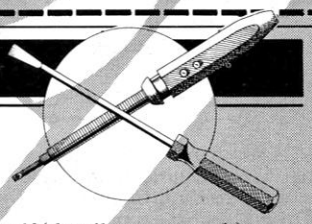
ACC NEWS



Rupert Steele gives a round-up of 1983 and some predictions for the club scene in 1984.

1983 showed a big increase in the number of computer clubs in Britain. They include general local clubs, where members can meet and exchange ideas with other owners of the same machine or with those who have common ideas on a different machine. Also, there have been a number of new local machine-specific groups, in recognition of the fact that the make of computer is what members have most in common. And of course there have been the National User Groups, which have produced very professional newsletters to share the experience of their machine.

The ACC is the national group that aims to represent computer clubs, and the hobbyist generally. We don't have the resources to act like the Gas Consumers' Council, since we are a voluntary organisation, budgeted on a shoe string (amazing what you can do with one of those) but the ACC does aim to act as the central point of the ever-growing number of clubs.

The ACC maintains a list of local clubs which is generally recognised as the most up to date in the country. The list is published twice a year in *PCW*. The number of clubs on the ACC list grew by some 200 during the year, and new clubs are starting faster than ever. Sooner or later, this growth will have to slow down, or we'll all have a club to ourselves . . .

What else does ACC do? Well, we liaise between the National User Groups for the major micros to agree the allocation of stands between groups in the 'Club Avenues' of the computer shows. We also send out news sheets to those groups (and the local clubs), so that everybody keeps in touch with the national scene.

Another growth area in 1983 was the story of the Micro User on Prestel. In conjunction with BT, Prestel and Micronet 800, the ACC was asked to set up 'Club Spot 800' on Prestel. This area, starting at page 8008, contains a mine of information, including some creative work by ACC hero David Annal. But the significant development in 1983 was that individual local clubs were at last able to put material up on the Prestel system, editing on their own micros (for instance, a BBC B with an adaptor costing about £50). Before that, only those with the resources of a full Information Provider could do much on Prestel. If you want to get in on the Prestel scene, write to Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB (Systel: 0508 30355), and he'll make sure your club can get editing.

And what do I foresee on the club scene in 1984? There'll be a whole host of new clubs appearing. Machine-specific local groups may flourish in areas strong enough in interest to support them but the more enterprising groups will collaborate with other machines' groups in the area to start more varied programmes.

Many more local clubs will appear. Some will be linked to other community groups of various types, some linked to schools or work, but many others on the traditional pattern of a computer club for an area—although for all machines and with no restrictions on membership.

To recognise the new structure of the amateur computing movement, the ACC is planning to re-organise itself (details next month) to reflect more accurately the clubs around the country. ACC will then stand for 'Association of Computer Clubs'.

Is your club on the list? Write to me if you run a computer club so that your club's details can go on the list and you can be kept in touch with developments. You may also get a mention in this column. And if your club has wound up or given up (there are a few of these), could you also let me know?

The *PCW* Show

During the *PCW* Show I talked to some of the user groups and clubs exhibiting in the Club Area. Physically, they felt the show was a bit warm (but then I'm sure that was a pretty widely felt/smelt problem), but apart from that they loved it.

Asking in the heat of the tiring last day is not the best time to get a positive view on exhibiting at the Show again, but just about everybody thought they'd be back. Here are the highlights of the groups' comments:

Forth Interest Group (FIG). I

ACC NEWS

was pleasantly surprised by not having to speak to them in Polish (whether reverse or not). Some lively demonstrations were running on the ZX81, BBC and, of course, the Jupiter machines. They felt that the visitors had a tendency to outwit them from time to time.

68 Microgroup. These Motorola fans were faring much better than last year; there was more interest in the machines, the group was going well and even the press were coming up and asking questions.

National Independent Lynx Users' Group (NILUG). Another newish group. They found the show useful, but hard work. Next year, they will attempt to share the delightful and stimulating experience with their members.

Croydon Club. As the only local club at the show this year, they were delighted with their free stand, which they felt was 'excellent value for money'. The publicity-seeking people there actually wanted better signs to direct people to the area.

The Independent Commodore Products User Group (ICPUG) were in fine form, with a computerised TV camera/matrix printer system which was taking pictures. A nice PET/video interface. Some of the Commodore stands in the main hall had been referring visitors to ICPUG for further advice.

The two BBC User Groups. BEEBUG and LASERBUG both had a good time, with lots of interest shown by all. Both groups reported a large number of new members, with advice and magazines in demand. Look out for LASERBUG's pages on Club Spot 800 (Prestel page 8008).

Tangerine User Group (TUG) were also generally pleased. They also wanted to compound the crush with a few more signs to the 'Club Avenue'. And why was the Barbican tube station closed on Sunday (were you carried away to Moorgate or Farringdon, too?). Come on London Transport, do your bit for I.T.

If you want to know more about the above groups, or the address of a user group for your micro (if there is one), write to me.

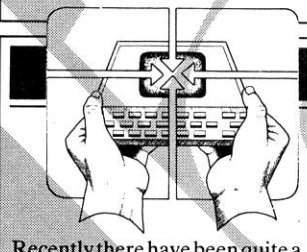
User group news

Alan Robson, of 12 Sinclair Road, Bangor, Co Down BT19 1PF, has written to mention that he's the secretary of the North Down Computer Users' Club, which meets in Bangor.

Meanwhile Eddie Wride, of 84 Wentworth Drive, Nuneaton, Warwicks, wants to start a club and is looking for members.

But what is going on in Oxford? With a University Society (see *Oxford Handbook* for address) and a flourishing local club (contact Paul Maskens, 7 Spindleberry Close, Blackbird Leys, Oxford OX4 5DU, or ring Oxford 771679), my spies tell me of a new secret society known as 'The Invariant Sub-Group' . . .

For further information contact Rupert Steele, 17 Lawrie Park Crescent, London SE26 6HH or ring 01-778 6824 evenings or weekends.



COMPUTER TOWN UK! NEWS

Margaret Spooner brings you the latest news on Computer Towns.

Recently there have been quite a number of enquiries from people wanting to set up a Computer Town. If you have enough enthusiasm to set one up you probably also have plenty of ideas about what you want to do in your CTUK! Even so the experience of longer established Computer Towns may prove helpful when you are getting yours off the ground. I talked to Jon Finegold, one of the prime movers of the Thanet Computer Town, to get some useful tips.

Like many Computer Towns, CTUK! Thanet meets in the local library. Librarians are usually co-operative about such ventures and at Thanet the library service provides handbills free of charge as one way of publicising Computer Town events. Jon also mentioned that the local press is another, source of free publicity—but this is only likely to be obtained if something new is constantly happening that the editor feels is worth a mention.

As well as holding weekly computer literacy meetings, Thanet arranges more formal meetings every six weeks or so on a particular topic—for example, 'What to do with your home computer?' and guest speakers are invited along. These meeetings are fairly sure to attract publicity. They can also provide items of interest to those members of the Computer Town who have built up a considerable knowledge about computers and would otherwise spend most of their time initiating newcomers to the mysteries of computing. This may be fine for the newcomers but provides little incentive to the experienced CTUK! members to continue giving their time. Other Computer Towns doubtless have other ways of solving the problem of how to ensure that established CTUK!ers get enough interest and stimulation out of their association with the group to remain involved. If so, let's hear about them on this page.

It is important for a Computer Town to encourage people who may feel intimidated by computers or nervous that they will not understand them easily. Jon said that you can get 'a negative effect if parents are being shown up in front of expert and knowledgeable children'. So that this does not happen, special times for children only can be arranged and conversely for adults only. It's also best not to have too many games: 'all you get when there are games around are lots of children wanting to play them,' said Jon.

Getting an adequate supply of equipment and software can be another problem. The Thanet Computer Town has built up quite a good relationship with local shops 'WH Smith has been very helpful, and now Boots is, in providing machines and software,' said Jon. If there are too few computers for the average attendance at informal literacy sessions, people soon lose any inclination to come along, defeating the purpose of CTUK!

It could be worth following Thanet's lead in this area—after all the shops may well benefit if newcomers get sufficiently hooked to go out and buy their own machines.

Fifty community computer camps where people may gain a knowledge of computers will be in operation around Britain this year. They will aim especially at providing computer literacy for disadvantaged groups.

Community computer camps are organised by the Inter-Action Trust, a charity which provides advice and training to community groups wishing to set up a computer camp. It helped organise 17 camps last summer and eventually hopes for 300-500 in the UK.

The term 'camp' is a misnomer for—unlike commercially run residential computer camps—those arranged through Inter-Action provide week-long computer literacy sessions in schools, community halls, etc, and make use of under-utilised resources in the community. The staff are drawn from university or polytechnic students and teachers during the summer holiday period; some unemployed people help out and also sixth form students. Their voluntary help is coordinated by two or three organisers. Molly Lowell, co-founder of the community computer camps, suggests that CTUK! members may be interested in helping the computer camp in their community since the aims of the two bodies coincide so closely. If you are interested in helping contact Inter-Action at 15 Wilkin Street, London NW5.

Molly adds that eventually the camps will develop a comprehensive programme of computing in the community.

The following people have written to me for guidelines with a view to starting Computer Towns:

R A Elliott
9 Irondale Close
Briar Hill
Northampton NN4 9TU

Steven Ericsson Zenith
Dragon Gate
77 St Johns Street
Hayle
Cornwall

Norman Butlin
County Technical Librarian
Central Library
Abington Street
Northampton NN1 2BA

If you live near them and are interested in joining a Computer Town, do contact them. They're sure to welcome your support. And remember, once your Computer Town is established, let us know so that your name can be added to the list of CTUK! Contacts.

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: Margaret Spooner, Computer Town UK!, PCW, 62 Oxford Street, London W1A 2HG. Remember to enclose an A4 SAE for your reply. Please don't ring PCW for information as Computer Town UK! is entirely a spare time activity.

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*For further information on Computer Town UK! see Prestel page *800803*

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Gayton Road
Harrow
Middx

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Peter J Kiff
2 Ranelagh Grove
St Peter's in Thanet
Broadstairs
Kent CT10 2TE

Peter Stone or
P Strangman
Computing and Maths Dept
The Polytechnic
Wulfruna Street
Wolverhampton WV1 1LY

J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle School
Shawfield Lane
Norden
Rochdale L12 7QR

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

E N Ryan
15 Queens Square
Eastwood
Nottingham NG16 3BJ

Philip Joy
130 Rush Green Road
Romford
Essex

Derrick Daines
18 Cuttings Avenue
Sutton-in-Ashfield
Notts

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear NE8 1TL

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne
Tyne & Wear

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
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Christopher Bates
Ashford Main Library
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Ashford
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Chilworth
Southampton SO1 7JH

Chris Cooper
110 Church Road
Hanwell
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Brian Taylor
Tonbridge Area Library
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Berks RG4 0SJ

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London SW16 4UN

B J Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
181 Woodmill Lane
Bitterne Park
Southampton SO2 4PY

Chris Woodford
31 Hopley Road
Anslow
Burton-on-Trent
Staffordshire

Mike Perry, Steve Collas or
Dave Lee
The Library
Ealing Road
Wembley
Middx HA0 4BR

Lyn Antill
1 Defoe House
Barbican
London EC2

Vernon Gifford
111 Selhurst Road
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54 Foregate Street
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18 Purbright Crescent
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Thornbury
Bradford BD3 8HG

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

NETWORK NEWS

Peter Tootill gives his summary of what's new in the telephone networking world

Interest still rising
Bulletin board System Operators ('Sysops') are still experiencing a steady rise in the interest in their systems, and the amount of traffic they get. When my own system was running part time last year, it used to get a handful of calls a week. This spring when it went on to 24 hours a day operation, the number quickly rose to half a dozen or so a day. Now 30 or 40 calls a day is the order of things, and the number still seems to be rising steadily! British Telecom must be delighted.

London local board:
This board originally ran on Bell 103 (US) frequencies from 1-7am daily, but the Sysop has been experimentally running on CCITT (UK) tones during these hours, so if you have a UK modem and can't sleep, you may well find that you can use the system. News of any permanent changes will, of course be posted on the board.

The Blandford board:
Another new board has started; this one is in Blandford Forum, Dorset. It runs TBBS software on a TRS-80 (I would have thought that **'Forum-80'** would be more appropriate!), but is open to users of any system. It is sponsored by O&J House Ltd (Blandford Computers). The board runs 24 hours a day on (0258) 54494. Facilities include messages, special interest sections, software to download and a mail order section.

Bettisfield Remote CP/M not to re-open:
Contrary to earlier reports, Bettisfield Remote CP/M system will not be restarting. The Sysop enjoyed his six months stay on a programming contract in Jamaica so much that he's decided to go back there permanently! I have also learned that wedding bells are to be heard on the wings of the warm Jamaican wind—congratulations, Jim, and all the best for your fiancee's and your future.

The number of Remote CP/M, Jamaica, will be announced as soon as we have details; once you've got the bug you don't lose it easily!

Micronet adaptors:
On the subject of Prestel/Micronet, adaptors are now available for the ZX81 and Dragon/Tandy Colour Computers. The costs, including software, but excluding the modem are around £30 for the ZX81, and £50 for the Dragon. Contact Micronet on 01-837 3699, or the designers, Microcomputer Resources, on (0727) 72917.

I hear that, at the time of writing (October), Micronet subscriptions number over 4000. While this may not be anything like as high as Micronet was forecasting 12 months ago, it is a fairly respectable number, more than many people expected (including some in Prestel itself!). With the launch of the Spectrum and Dragon adaptors, and also the hardwired two way modems, I would expect numbers to rise significantly, and it will be interesting to see what happens during the Christmas period. More subscribers will lead to a more interesting database, as more commercial organisations see that it's becoming a significant market, and one that they can't afford to ignore.

ACC/Prestel Clubspot 800:
Many computer clubs may not be aware that they can have their very own pages on Prestel. The ACC has a block of pages called ClubSpot 800, that has been made available by Micronet for use by local computer related clubs. The club simply appoints an Editor who is able to set up and edit the club's own pages and to update them as often as desired. Editor training is provided by ACC and a session is planned for early in the new year. If your club members have an interest in Micronet or Prestel, it may well be worth your while considering this. There is currently no charge apart from the usual ACC affiliation fees. Contact Andy Leeder (0508) 30355 for more details. (Many local

NETWORK NEWS

libraries have Prestel facilities, and you may be able to use these if your club doesn't have access to its own. Try talking nicely to the Librarian!)

Network jargon: X-On/X-Off protocol:
When you call a bulletin board system and read a message, it's not really good enough for the system just to keep sending the message non-stop until it reaches the end, taking no account of whether you can keep up with it or not. You may want to read the top before it scrolls off the screen, or make a note of a phone number or something. What is required is a way of telling the system to 'hang on a minute', and indeed most systems provide such a facility. You simply press the 'P' key (or sometimes the 'S' key) at your end and output will pause until you send a carriage return. Something of the same sort is needed when two computers are exchanging data. For example, transferring a file or a program from the bulletin board to your system (usually called 'down-loading'; if you send the file to the BBS, it's called 'uploading'). The receiving computer may need to pause, to save a part of the file to disk for example. One way of requesting such a pause is to send an 'X-off' character (control S, ASCII code 19 decimal, also called DC3). The system, if it supports this protocol will immediately pause until it gets an 'X-on' character (control Q. ASCII code 17 decimal, also called DC1), when it will restart. With some systems 'X-on' is not specifically required, and any character will cause transmission to restart. Most bulletin board systems support X-on/X-off protocol for transfer of ASCII files, but it is not required if you are using the XMODEM, or CP/M protocols described last month as they include their own 'handshaking' to prevent data being sent when the receiver is not ready.

UK systems run by commercial organisations, which are free at least in part:

DISTEL. Tel: (01) 679 1888. Run by Display Electronics (new and surplus electronic and computer equipt, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free. 24 hours.

REWTEL. Tel: (0277) 236628.
Run by Radio and Electronics World, the publishing side of Ambit (electronics components suppliers). Information on stock lines, some message facilities, credit card sales, the latter only for subscribers. 300 baud only at present. Cost: limited areas free, remainder £10 annual subscription. 24 hours.

MAPTEL. Tel: (0702) 552941. Run by Maplin (electronic components and microcomputers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free. 24 hours.

Subscriber commercial systems in the UK:

PRESTEL. Subscribers only: Prestel consists of a database made up of individual pages provided by many different organisations (not by Prestel itself). 1200/75 baud service at local call rates for a large percentage of potential users. 300 baud service on London telephone number only, at present. Cost: domestic subscribers £5.00 per quarter and no time charges outside peak periods, 80 per cent of pages are free. Business users: £15 per quarter and 5p/minute up to 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: tel: Freefone 2296.

MICRONET 800. An organisation providing information within the Prestel database specifically aimed at microcomputer users. Service details as Prestel. Cost: £50-£75 joining fee (covers acoustic coupler and software—for a limited range of machines at present) and £8 per quarter on top of normal Prestel charges. Information: Micronet 800, 8 Herbal Hill, London EC1R 5JB. Tel: (01) 837 3699.

Subscriber business systems in the UK:

commercial systems aimed at business users:

TELECOM GOLD. Info from: Julie Ireland, 42 Weston Street, London SE1 3QD. Tel; (01) 403 6777.

COMET. Message handling system giving user facilities for leaving and retrieving messages: costs £30 per month. Info from: John Douglas, BL Systems Limited, Grosvenor House, Prospect Hill, Redditch, Worcs. Tel: (0527) 28515.

UK networks:

CBBS North East . . . System Operators: Trevor Smith & Malcolm Piper. Tel: (0207) 543555. Hours: 2.30pm-9am daily. Tel: (0207) 32447. Hours: 7pm-midnight CCITT standards; midnight-8.30am Bell 103 (US) standards.

Mailbox-80, Stourport . . . Tel: (0384) 635336* **System Operator:** Jim Roden. Hours: 6pm-8am daily (ring back system).

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. **System Operator:** Fred Brown. International electronic mail, library for up/down loading

Forum-80 Users Group, Pet Users section shopping list system. Hours: Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. **System Operator:** Victor Saleh. Electric mail, library for downloading. Hours: Evenings & weekends.

CBBS London . . . Tel: (01) 399 2136. **System Operator:** Peter

Forum-80 Milton . . . (TRS-80 Users Group 80-Nett) Tel: (0908) 613004. **System Operators:** Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system. Hours: 24 hours daily.

Mailbox-80 Liverpool . . . Tel: (051) 428 8924. **System Operator:** Peter Tootill. Electronic mail, downloading, TRS-80 information. Hours: 24 hours daily.

ACC . . . members bulletin board. Tel: (0908) 44262. **System Operator:** Peter Whittle.

TBBS, London . . . Tel: (01) 348 9400* **System Operator:** John Newgas. Hours: Daily 9am-1am V21 (European) tones; 1-7am Bell 103 (US) tones.

Efficient Chips for Atari dealers. Tel: (0249) 657744. Message facilities, downloading, electronic shopping. Hours: 9pm-2am daily except Wed and Sun.

Southern BBS. Tel: (0243) 511077. Messages, downloading. Hours: 8pm-2am daily (ring-back system).

Note: Estelle. Tel: (0279) 443511 V21 (Datel 200); (0279) 441188 (Datel 600); (0279) 441222 (Datel 1200). For customers of STC Electronic Services. Office hours only.

The above information is correct and current, to the best of my knowledge, but I would be pleased to receive corrections and updates, either via Liverpool Mailbox, or to 7 Stockville Road, Liverpool L18 3EJ.
* Ring back system—dial the number, let phone ring once and then ring back.

American/Canadian networks

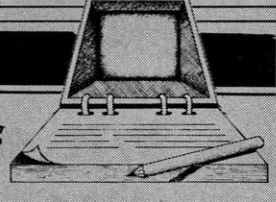
TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ system	0101.816-861 7040	
CBBS	HQ system	0101.312-545 8086	
FBBS	HQ system	0101.312-677 8514	
ABBS	Ottowa, Ontario	0101.613-725 2243	
ABBS	HQ system	0101.703-255 2192	
MABBS	Fort Walton Beach	0101.904-862 1072	
Bull-80	Alabama	0101.205-492 0373	
Conn-80	Colour Computer	0101.212-441 3755	colour graphics for TRS-80 Colour

European networks

ELFA	ABC-MONITOR Sweden	010.468 7300706	Half duplex
ABC-Banken	Halmstadt, Sweden	010.463 5110771	
ABC-MONITOR	ABC Club of Sweden	010.468 801523	Passwords required
CBBS	Gothenburg, Sweden*	010.463 1292160	75/1200 baud
		010.463 1690754	300 baud

* After receiving the tone and connecting your modem, either type: <C/R> or type: <COM C/R>. The system then asks for a password which is: 'cbbs' *in small letters*'! If you only get '>' when you dial up, the system needs resetting and you type <I> C/R.

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	(Wembley Conference Centre), Your Computer Christmas Fair. Contact: Reed Exbns, 01-643 8040	15-18 Dec
Birmingham	(NEC), Which Computer Show. Contact: Clapp & Poliak Europe Ltd, 01-747 3131	17-20 Jan
London	(Wembley Conference Centre), Microprocessor Development Show. Contact: Project Presentations Ltd, 01-242 3621	31 Jan-2 Feb
London	(Cunard Int), Peripherals Suppliers Exbn. Contact: Reed Exbns, 01-643 8040	31 Jan-2 Feb
Dublin	(Computex), International Computing Exbn. Contact: SDL Exbns Ltd, Dublin 763871	3-6 April

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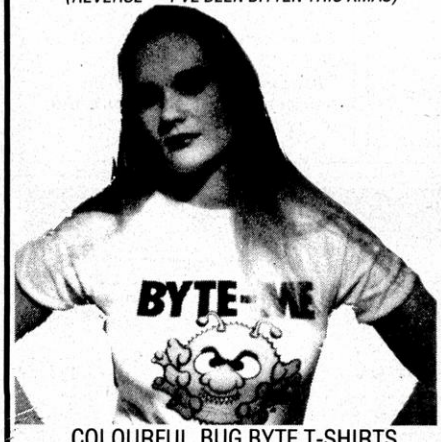

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PROGRAMS

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
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 £50 per page of published listing, plus a £100 bonus for the Program of the Month, and must be the original work of the author and not previously published. Send contributions to: Surya, PCW Programs, 62 Oxford Street, London W1A 2HG.

A collection of very different programs this month. Program of the Month is a very useful and well-presented utility program for the Sirius and Victor micros. BBC 'Logic Tree' is an entertaining program which allows the user to build up and interrogate a binary tree: this could form the basis of an 'intelligent' database or expert system. BBC 'Video Credits Generator' is one for home video producers and 'Omniopoly' is a very well written version of Monopoly — a close contender in the Program of the Month stakes. PET 'Maths Maze' is an educational program for the 4000-series machines.

This month's programs selection is completed by Tandy Pascal procedures, New Brain 3D O'S & X's and a program to play Christmas carols on the BBC and Texas micros. Oh, yes, I almost forgot BBC 'Handel'. Let's just say that it's the latest Jeff Aughton program and leave it at that, shall we?

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Program of the Month
Sirius/Victor Screen Editor

by Bengt Knorring

Last August we published a menu-creation utility for the Apple II (Apple 'Screencopy'). Sirius 'Screen Editor' is a similar idea, allowing the user to create 'pages' of text which can then be called by a Basic program. This is useful for the creation of menus, help screens and so forth.

To use the program, type in the first listing 'Program PRG1'. This should be RUN in order to create the file 'B1' before typing in the main listing. When run, note that option 3 — read help text — will only be available if you create the files depicted by the help screens immediately following the listing.

Instructions for using the program are given in these 'help' pages. These are screendumps of pages created using the Screen Editor. The program runs on either a Sirius or Victor machine with Basic86.

```
10 '***********          PROGRAM PRG1          **************
20 OPEN "O",1,"B1"
30 ON ERROR GOTO 70
40 READ Y,X,A$
50 PRINT#1,CHR$(27);"Y";CHR$(Y);CHR$(X);A$
60 GOTO 40
70 RESUME 80
80 END
90  DATA  33 , 48 ,"S C R E E N"
100  DATA  33 , 61 ,"-"
110  DATA  33 , 64 ,"I M A G E"
120  DATA  33 , 75 ,"-"
130  DATA  33 , 78 ,"E D I T O R"
140  DATA  34 , 48 ,"========================================="
150  DATA  36 , 59 ,"M A I N"
160  DATA  36 , 68 ,"-"
170  DATA  36 , 71 ,"M E·N U"
180  DATA  37 , 59 ,"--------------------"
190  DATA  40 , 48 ,"Do You want to:"
200  DATA  42 , 48 ,"1. Create a new screen image."
210  DATA  44 , 48 ,"2. Edit screen image."
220  DATA  46 , 48 ,"3. Read HELP-text."
230  DATA  48 , 48 ,"4. End program."
240  DATA  50 , 48 ,"State alternative-------)"
250  DATA  53 , 48 ,"(C) Access-Konsult 1983"
```

PROGRAMS

```
10 '*************************************************
20 '*                                               *
30 '*         SCREEN-IMAGE EDITOR                   *
40 '*         BENGT KNORRING                        *
50 '*         SWEDEN                                *
60 '*                                               *
70 '*************************************************
80 '
90 '
100 '    **********          INITIALIZE
110 WIDTH 255:WIDTH LPRINT 255
120 DIM SC$(23),A$(23),F%(23),S%(23)
130 CL$=CHR$(27)+"E"
140 REV$=CHR$(27)+"p"
150 REF$=CHR$(27)+"q"
160 ES$=CHR$(27)
170 IFL%=-1
180 DATA 32,127,8,9,13,5,7,17,19,6,1
190 FOR X%=1 TO 11
200 READ A%
210 SUB$=SUB$+CHR$(A%)
220 NEXT X%
230 EC$="CDBA"+CHR$(64)+"K"
240 DEF FNC$(Y,X)=CHR$(27)+"Y"+CHR$(Y+31)+CHR$(X+31)
250 FOR Y%=1 TO 23
260     SC$(Y%)=SPACE$(80)
270     F%(Y%)=80
280     S%(Y%)=0
290 NEXT Y%
300 '    **********          WRITE MENU
310 PRINT CL$;
320 OPEN "I",1,"B1"
330 WHILE NOT EOF(1)
340     LINE INPUT#1,A$
350     PRINT A$;
360     A=VAL(MID$(A$,5,2))
370     A$(A)=A$
380     IF INSTR(1,A$,")")=0 THEN 410
390     TY%=ASC(MID$(A$,3,1))-31
400     TX%=ASC(MID$(A$,4,1))-34+LEN(A$)
410 WEND
420 CLOSE#1
430 PRINT FNC$(TY%,TX%);
440 A$=INPUT$(1)
450 IF A$("1" OR A$)"4" THEN 440
460 PRINT A$;
470 ALT=VAL(A$)
480 PRINT REV$;A$(ALT);REF$
490 FOR  X=1 TO 3000
500 NEXT X
510 ON ALT GOTO 790,930,520,740
520 PRINT CL$
530 GOSUB 4290
540 GOTO 310
550 '    **********          ACCEPT STRING FROM KEYBOARD
560 IN$=SPACE$(30)
570 FL%=0
580 N%=0
590 N%=N%+1+(N%=30)
600 I%=ASC(INPUT$(1))
610 IF I%)127 THEN 600
620 IF I%)95 THEN I%=I%-32
630 I$=CHR$(I%)
640 IF I$()CHR$(13) THEN 670
650 IN$=LEFT$(IN$,N%-1)
660 RETURN
670 IF I$()CHR$(24) THEN 700
680 FL%=1
690 GOTO 660
700 IF I$=CHR$(8) THEN N%=N%-1-(N%=1)
710 PRINT I$;
720 MID$(IN$,N%)=I$
730 IF I$=CHR$(8) THEN 600 ELSE 590
740 PRINT CL$;FNC$(10,10);"SLUT"
750 RESET
760 WIDTH 79
770 END
780 '    **********          ACCEPT FILE NAME
790 PRINT CL$;FNC$(14,10)"ALT-X = BACK TO MENU"
800 PRINT FNC$(10,10);"NAME OF IMAGE TO BE CREATED----------)";
810 GOSUB 550
820 FIN$=IN$
830 IF FL%=1 THEN 310
840 PRINT FNC$(12,10);"ON WHICH DISC-DRIVE DO YOU WANT IT STORED (A or  B)
";
850 PRINT FNC$(12,64);
860 GOSUB 550
870 IF FL%=1 THEN 310
880 DI$=IN$
890 IF DI$("A" OR DI$)"B" THEN 840
900 FIN$=LEFT$(DI$,1)+":"+FIN$
910 GOTO 1250
920 '    **********          READ FILE?
930 PRINT CL$;FNC$(14,10)"ALT-X = BACK TO MENU"
940 PRINT FNC$(10,10);"NAME OF IMAGE TO BE EDITED----------)
950 PRINT FNC$(10,52);
960 GOSUB 550
970 IF FL%=1 THEN 310
980 FIN$=IN$
990 PRINT FNC$(12,10);"ON WHICH DISC-DRIVE IS THIS IMAGE STORED  (A or  B)
 "
1000 PRINT FNC$(12,62);
1010 GOSUB 550
1020 IF FL%=1 THEN 310
1030 DI$=IN$
1040 IF DI$("A" OR DI$)"B" THEN 990
1050 FIN$=LEFT$(DI$,1)+":"+FIN$
1060 ON ERROR GOTO 4220
1070 OPEN "I",1,FIN$
```


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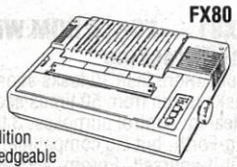

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PROGRAMS

```
1080 '  **********          WRITE CONTENTS OF FILE TO SCREEN
1090 PRINT CL$;
1100 WHILE NOT EOF(1)
1110    LINE INPUT#1,A$
1120    IF LEN(A$)(5 THEN 1200
1130    PRINT A$;
1140    Y%=ASC(MID$(A$,3,1))-31
1150    X%=ASC(MID$(A$,4,1))-31
1160    IF F%(Y%))X% THEN F%(Y%)=X%
1170    S%(Y%)=X%+LEN(A$)-5
1180    A$=MID$(A$,5)
1190    MID$(SC$(Y%),X%)=A$
1200 WEND
1210 CLOSE#1
1220 ON ERROR GOTO 0
1230 GOTO 1260
1240 '  **********          ACCEPT CHARACTER
1250 PRINT CL$
1260 X%=1
1270 Y%=1
1280 PRINT FNC$(Y%,X%);
1290 WHILE ASC(I$)-246
1300    I$=INPUT$(1)
1310    I%=ASC(I$)
1320    IF I%(240 THEN 1360
1330    ON I%-240 GOSUB 2070,3280,3150,3490,3400,2070,2430
1340    IF I%=246 THEN 1430
1350    GOTO 1300
1360    IF I$=CHR$(24) THEN 1710
1370    IF I$()ES$ THEN 1420
1380    I$=INPUT$(1)
1390    I%=INSTR(1,EC$,I$)
1400    ON I% GOSUB 2700,2750,2800,2850,3570,3840
1410    GOTO 1300
1420    GOSUB 1890
1430 WEND
1440 IF ALT=1 THEN 1540
1450 PRINT CL$;FNC$(10,10);"Do You want to save the old image as back-up
 ";                                                              (Y/N)
1460 I$=INPUT$(1)
1470 PRINT I$;
1480 IF INSTR(1,"Nn",I$)()0  THEN 1550
1490 IF INSTR(1,"Yy",I$)()0 THEN 1520
1500 GOTO 1450
1510 ON ERROR GOTO 4220
1520 NAME FIN$ AS FIN$+".BAK"
1530 ON ERROR GOTO 0
1540 PRINT FNC$(12,10);";FIN$:" IS NOW BEING STORED"
1550 OPEN "O",1,FIN$
1560 FOR Y%=1 TO 23
1570    IF F%(Y%)=80 THEN 1680
1580    Q%=INSTR(F%(Y%),SC$(Y%),"  ")
1590    IF Q%=0 OR Q%)S%(Y%) THEN 1670
1600    PRINT#1,FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),Q%-F%(Y%))
1610    F%(Y%)=Q%
1620    WHILE MID$(SC$(Y%),F%(Y%),1)=" "
1630          F%(Y%)=F%(Y%)+1
1640    IF F%(Y%))S%(Y%) THEN 1680
1650    WEND
1660    GOTO 1580
1670    PRINT#1,FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1)
1680 NEXT Y%
1690 CLOSE 1
1700 GOTO 250
1710 PRINT CL$;FNC$(10,10)"Do You want to finish editing (Y/N):";
1720 I$=INPUT$(1)
1730 PRINT I$;
1740 IF INSTR(1,"Yy",I$)()0 THEN 250
1750 IF INSTR(1,"Nn",I$)()0 THEN GOSUB 1770:GOTO 1260
1760 GOTO 1710
1770 PRINT CL$
1780 FOR Y%=1 TO 23
1790    IF F%(Y%)=80 THEN 1810
1800    PRINT FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1);
1810 NEXT Y%
1820 IF H%=0 THEN 1870
1830 Y%=HY%
1840 X%=HX%
1850 PRINT FNC$(Y%,X%);
1860 H%=0
1870 RETURN
1880 '  **********          ANALYZE CHARACTER
1890 I%=ASC(I$)
1900 IF I%)32 AND I%(127 THEN GOSUB 1920 ELSE GOSUB 2090
1910 RETURN
1920 '  **********          CHARACTER TO BE WRITTEN
1930 IF IFL%=1 THEN GOSUB 2940
1940 IF ER%=0 THEN 1960
1950 GOTO 2070
1960 PRINT I$;
1970 MID$(SC$(Y%),X%)=I$
1980 IF F%(Y%))X% THEN F%(Y%)=X%
1990 IF S%(Y%)(X% THEN S%(Y%)=X%
2000 X%=X%+1
2010 IF X%(80 THEN 2060
2020 X%=1
2030 Y%=Y%+1
2040 IF Y%(23 THEN 2060
2050 Y%=1
2060 PRINT FNC$(Y%,X%);
2070 RETURN
2080 '  **********          ANALYZE CONTROL-CHARACTER
2090 SB%=INSTR(1,SUB$,CHR$(I%))
2100 IF SB%=0 THEN RETURN
2110 ON SB% GOTO 2170,3030,3930,3970,4160,2900,3770,4020,2120,2480,2580
2120 HY%=Y%
2130 HX%=X%
2140 GOSUB 4290
2150 H%=1
```

```
2160 GOTO 1770
2170 '   **********          SPACE SPECIAL-ROUTINE CHR$(32)
2180 IF IFL%=1 THEN GOSUB 2940
2190 IF ER%=0 THEN 2210
2200 GOTO 2420
2210 PRINT" ";
2220 MID$(SC$(Y%),X%)=" "
2230 IF SC$(Y%)<>SPACE$(80) THEN 2270
2240 S%(Y%)=0
2250 F%(Y%)=80
2260 GOTO 2350
2270 F%(Y%)=1
2280 WHILE MID$(SC$(Y%),F%(Y%),1)=" "
2290    F%(Y%)=F%(Y%)+1
2300 WEND
2310 S%(Y%)=80
2320 WHILE MID$(SC$(Y%),S%(Y%),1)=" "
2330    S%(Y%)=S%(Y%)-1
2340 WEND
2350 X%=X%+1
2360 IF X%<80 THEN 2410
2370 X%=1
2380 Y%=Y%+1
2390 IF Y%<23 THEN 2410
2400 Y%=1
2410 PRINT FNC$(Y%,X%);
2420 RETURN
2430 '   **********          CURSOR HOME F7
2440 X%=1
2450 Y%=1
2460 PRINT FNC$(Y%,X%);
2470 RETURN
2480 '**********          MOVE CURSOR TO NEXT WORD ALT-F
2490 WHILE MID$(SC$(Y%),X%,1)<>" " AND X%<80
2500    X%=X%+1
2510 WEND
2520 WHILE MID$(SC$(Y%),X%,1)=" " AND X%<80
2530    X%=X%+1
2540 WEND
2550 IF X%=80 THEN 2640
2560 PRINT FNC$(Y%,X%);
2570 RETURN
2580 '**********          MOVE CURSOR TO PREVIOUS SPACE  ALT-A
2590 X%=X%-1-(X%=1)
2600 WHILE MID$(SC$(Y%),X%,1)<>" " AND X%>1
2610    X%=X%-1
2620 WEND
2630 IF X%=1 THEN 2680
2640 WHILE MID$(SC$(Y%),X%,1)=" " AND X%>1
2650    X%=X%-1
2660 WEND
2670 X%=X%+1
2680 PRINT FNC$(Y%,X%);
2690 RETURN
2700 '   **********          CURSOR RIGHT ESC-C
2710 IF X%=80 THEN 2740
2720 X%=X%+1
2730 PRINT FNC$(Y%,X%);
2740 RETURN
2750 '   **********          CURSOR LEFT ESC-D
2760 IF X%=1 THEN 2790
2770 X%=X%-1
2780 PRINT FNC$(Y%,X%);
2790 RETURN
2800 '   **********          CURSOR DOWN ESC-B
2810 IF Y%=23 THEN 2840
2820 Y%=Y%+1
2830 PRINT FNC$(Y%,X%);
2840 RETURN
2850 '   **********          CURSOR UP ESC-A
2860 IF Y%=1 THEN 2890
2870 Y%=Y%-1
2880 PRINT FNC$(Y%,X%);
2890 RETURN
2900 IFL%=-IFL%
2910 PRINT ES$;"3";
2920 IF IFL%=1 THEN PRINT ES$;"2";
2930 RETURN
2940 '   **********          TOGGLE CHARACTER INSERTION ALT-E
2950 IF F%(Y%)=80 OR S%(Y%)=80 THEN 3010
2960 ER%=0
2970 MID$(SC$(Y%),X%)=" "+MID$(SC$(Y%),X%,S%(Y%)-X%+1)
2980 S%(Y%)=S%(Y%)+1
2990 PRINT FNC$(Y%,X%);MID$(SC$(Y%),X%,S%(Y%)-X%+1);
3000 PRINT FNC$(Y%,X%);
3010 IF S%(Y%)=80 THEN ER%=1
3020 RETURN
3030 '   **********          DELETE CHARACTER CHR$(127)
3040 IF F%(Y%)=80 THEN 3140
3050 MID$(SC$(Y%),X%)=MID$(SC$(Y%),X%+1,S%(Y%)-X%+1)+" "
3060 S%(Y%)=S%(Y%)-1
3070 IF S%(Y%)>F%(Y%) THEN 3120
3080 S%(Y%)=0
3090 F%(Y%)=80
3100 PRINT FNC$(Y%,1);ES$;"K";
3110 GOTO 3130
3120 PRINT FNC$(Y%,X%);MID$(SC$(Y%),X%,S%(Y%)-X%+2);
3130 PRINT FNC$(Y%,X%);
3140 RETURN
3150 '   **********          LINE UP F3
3160 IF F%(Y%-1)<>80 OR S%(Y%-1)<>0 OR Y%=1 THEN 3270
3170 IF F%(Y%)=80 THEN 3270
3180 TX%=X%:TY%=Y%
3190 SC$(Y%-1)=SC$(Y%)
3200 F%(Y%-1)=F%(Y%):F%(Y%)=80
3210 S%(Y%-1)=S%(Y%):S%(Y%)=0
3220 SC$(Y%)=SPACE$(80)
3230 PRINT FNC$(Y%,1);CHR$(27)"K";
3240 Y%=Y%-1
```


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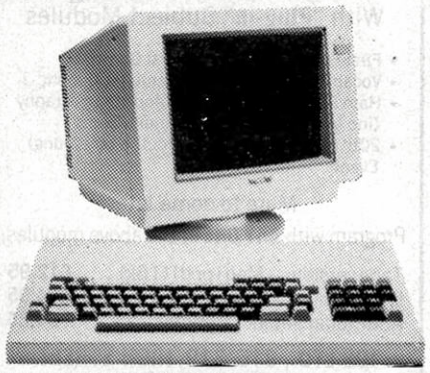

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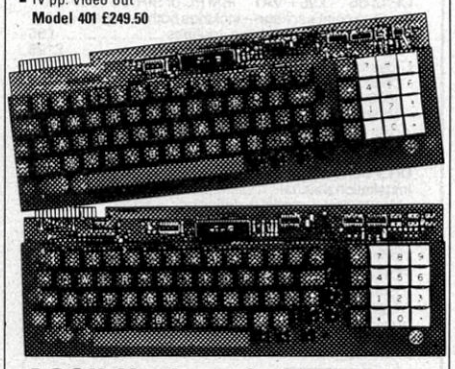

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PROGRAMS

```
3250 PRINT FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1);
3260 PRINT FNC$(Y%,X%);
3270 RETURN
3280 '  **********          LINE DOWN F2
3290 IF Y%=23 THEN 3390
3300 IF F%(Y%+1)<>80 OR F%(Y%)=80 THEN 3390
3310 SC$(Y%+1)=SC$(Y%)
3320 F%(Y%+1)=F%(Y%):F%(Y%)=80
3330 S%(Y%+1)=S%(Y%):S%(Y%)=0
3340 SC$(Y%)=SPACE$(80)
3350 PRINT FNC$(Y%,1);CHR$(27);"K";
3360 Y%=Y%+1
3370 PRINT FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1);
3380 PRINT FNC$(Y%,X%);
3390 RETURN
3400 '  **********          LINE RIGHT F5
3410 IF S%(Y%)=80 OR S%(Y%)=0 THEN 3480
3420 IF (S%(Y%)=79 AND Y%=23) THEN 3480
3430 MID$(SC$(Y%),F%(Y%))=" "+MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1)
3440 F%(Y%)=F%(Y%)+1
3450 S%(Y%)=S%(Y%)+1
3460 PRINT FNC$(Y%,F%(Y%)-1);" ";MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1);
3470 PRINT FNC$(Y%,X%);
3480 RETURN
3490 '  **********          LINE LEFT F4
3500 IF F%(Y%)=1 OR F%(Y%)=80 THEN 3560
3510 MID$(SC$(Y%),F%(Y%)-1)=MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1)+" "
3520 F%(Y%)=F%(Y%)-1
3530 S%(Y%)=S%(Y%)-1
3540 PRINT FNC$(Y%,F%(Y%));MID$(SC$(Y%),F%(Y%),S%(Y%)-F%(Y%)+1);" ";
3550 PRINT FNC$(Y%,X%);
3560 RETURN
3570 '  **********          INSERT LINE ESC-(64)
3580 IF Y%=23 THEN 3760
3590 GY%=Y%
3600 GX%=X%
3610 X%=1
3620 IF F%(Y%+1)=80 THEN 3680
3630 Y%=Y%+1
3640 IF Y%<23 THEN 3620
3650 Y%=GY%
3660 X%=GX%
3670 GOTO 3750
3680 TY%=Y%
3690 FOR Y1%=TY% TO GY% STEP -1
3700 Y%=Y1%
3710 GOSUB 3280
3720 NEXT Y1%
3730 Y%=GY%
3740 X%=GX%
3750 PRINT FNC$(Y%,X%);
3760 RETURN
3770 '  **********          BLANK LINE ALT-G
3780 PRINT FNC$(Y%,1);ES$"K";
3790 SC$(Y%)=SPACE$(80)
3800 F%(Y%)=80
3810 S%(Y%)=0
3820 PRINT FNC$(Y%,X%);
3830 RETURN
3840 '  **********          ERASE REST OF LINE ESC-K
3850 PRINT CHR$(27);"K";
3860 MID$(SC$(Y%),X%)=SPACE$(80)
3870 IF X%=1 OR F%(Y%)<X% THEN S%(Y%)=0:F%(Y%)=80:GOTO 3920 ELSE S%(Y%)=X%
3880 IF MID$(SC$(Y%),S%(Y%),1)=" " AND S%(Y%)>1 THEN S%(Y%)=S%(Y%)-1:GOTO
3890 IF MID$(SC$(Y%),F%(Y%),1)=" " THEN F%(Y%)=F%(Y%)+1:GOTO 3890    3880
3900 IF F%(Y%)=81 THEN F%(Y%)=80
3910 IF LEFT$(SC$(Y%),1)=" " AND S%(Y%)=1 THEN S%(Y%)=0
3920 RETURN
3930 '  **********          TAB LEFT CHR$(8)
3940 IF X%>1 THEN IF X% MOD 8 =1 THEN X%=X%-8 ELSE X%=X%-X% MOD 8+1
3950 PRINT FNC$(Y%,X%);
3960 RETURN
3970 '  **********          TAB RIGHT CHR$(9)
3980 IF X%>72 THEN 4010
3990 X%=(X%-X% MOD 8)+9
4000 PRINT FNC$(Y%,X%);
4010 RETURN
4020 '  **********          WRITE IMAGE TO PRINTER ALT-Q
4030 LPRINT CHR$(29);TAB(55) "SCREEN-IMAGE.........";CHR$(34);FIN$;CHR$
4040 LPRINT ES$;"8";ES$;"F48"                                        (34)
4050 LPRINT TAB(27);
4060 FOR I%=0 TO 79:LPRINT USING"#";I% MOD 10;:NEXT I%:LPRINT
4070 LPRINT TAB(26);STRING$(82,"-")
4080 FOR J%=1 TO 23
4090 LPRINT TAB(23);:LPRINT USING"##";J%;
4100 LPRINT TAB(26);"I";SC$(J%);"I";:LPRINT USING" ##";J%
4110 NEXT J%
4120 LPRINT TAB(26);STRING$(82,"-")
4130 LPRINT TAB(27);
4140 FOR I%=0 TO 79:LPRINT USING"#";I% MOD 10;:NEXT I%:LPRINT CHR$(12)
4150 RETURN
4160 '  **********          CARRIAGE RETURN CHR$(13)
4170 IF Y%<23 THEN Y%=Y%+1
4180 X%=1
4190 PRINT FNC$(Y%,X%);
4200 RETURN
4210 END
4220 IF ERL=1070 THEN 4250
4230 IF ERL=1520 AND ERR=53 THEN RESUME 1530
4240 IF ERL=1520 AND ERR=58 THEN KILL FIN$+".BAK":RESUME 1510
4250 IF ERL=1070 THEN PRINT FNC$(12,10):REV$:"CANNOT FIND IMAGE ":FIN$REF$:"
":FOR DELAY=1 TO 2000:NEXT DELAY:PRINT FNC$(12,10):SPACE$(60):RESUME 9
40
4260 PRINT"ERL";ERL
4270 RESUME 4280
4280 END
4290 '  **********          WRITE HELP-PAGES ALT-S
4300 HL%=0
4310 PRINT ES$"x5";
```

PROGRAMS

```
4320 OPEN "I",1,"HLP"+CHR$(HL%+48)
4330 N%=0
4340     WHILE NOT EOF(1)
4350     N%=N%+1
4360     LINE INPUT#1,A$(N%)
4370 WEND
4380 CLOSE#1
4390 IF FL%=0 THEN 4550
4400 I$=INPUT$(1)
4410 V%=ASC(I$)-48
4420 IF V%<0 OR V%>6 THEN 4460
4430 HL%=V%
4440 FL%=0
4450 GOTO 4320
4460 IF INSTR(1,"Nn",I$)<>0 THEN 4550
4470 IF INSTR(1,"Ff",I$)=0 THEN 4510
4480 FL%=0
4490 HL%=(HL%+5) MOD 7
4500 GOTO 4320
4510 IF I$<>CHR$(24) THEN 4400
4520 FL%=0
4530 PRINT ES$"y5";
4540 RETURN
4550 PRINT CL$
4560 FOR X%=1 TO N%
4570     PRINT A$(X%);
4580 NEXT X%
4590 PRINT FNC$(24,2)"'N' NEXT PAGE, 'F' LAST, 0-6 ANY PAGE, ALT-X RETURN
     TO EDITING";
4600 FL%=1
4610 HL%=HL%+1
4620 IF HL%>6 THEN HL%=0
4630 GOTO 4320
```

```
                    SCREEN-IMAGE.........."B:HLPO"
01234567890123456789012345678901234567890123456789012345678901234567890123456789
-------------------------------------------------------------------------------
                                                                    HLPO

                  SCREEN-IMAGE-EDITOR
                  ===================

   This program lets You create screen-images. The screen-image is stored
   on disk and read in by the program using it.

   This means that Yoy can easily change a menu without having to change
   the program using it.

   The text in the image is stored on disk in such a way that the least
   possible text is stored. Only the parts of every line thet contains
   text is stored. Lines without text are not stored. Every piece of
   text begins with the proper ESCAPE-sequence needed to put it on the
   right place on the screen, CHR$(27);"Y";CHR$(row+31);CHR$(column+31).
   Using such an image in a program is very easy. See next HELP-page
   an example.
-------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

```
                    SCREEN-IMAGE.........."B:HLP1"
01234567890123456789012345678901234567890123456789012345678901234567890123456789
-------------------------------------------------------------------------------
                                                                    HLP1

        Example:
        --------
        To read a screen-image from disk and write its contents on screen
        You need the following lines in Your program.

        100 PRINT CHR$(27)"E"          'Clear screen.
        110 OPEN "I",1,"IM"            '"IM" is the name of the stored image.
        120 WHILE NOT EOF(1)
        130     LINE INPUT#1,A$
        140     PRINT A$;
        150 WEND

        If Your program uses more than one image You can make this part
        of the program as a sub-routine, called with the name of the image
        as argument.

        SCREEN-IMAGE-EDITOR has several commands to manipulate the text on
        the screen. See following HELP-pages for explanation.
-------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

```
                    SCREEN-IMAGE.........."B:HLP2"
01234567890123456789012345678901234567890123456789012345678901234567890123456789
-------------------------------------------------------------------------------
                                                                    HLP2

                    COMMANDS FOR SCREEN-EDITING
                    ===========================

COMMAND                 ACTION
-------                 ------
FUNCTION KEY 7          Moves cursor to home position.

FUNCTION KEY 3          Moves line with cursor up one line. If the line
                        above is'nt empty, this command is disabled.

FUNCTION KEY 2          Moves line with cursor down one line. If the line
                        below is'nt empty, this command is disabled.

FUNCTION KEY 5          Moves line with cursor one character-position to
                        the right. If the rightmost position is'nt empty,
                        theis command is disabled.


                        See next HELP-page for more information.
-------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

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PROGRAMS

```
                         SCREEN-IMAGE.........."B:HLP3"

01234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
ICOMMAND              ACTION                                 HLP3          I
I-------              ------                                               I
IFUNCTION KEY 4       Moves line with cursor one character-position to     I
I                     the left. If the leftmost position is'nt empty, this I
I                     command is disabled.                                 I
I                                                                          I
IFUNCTION KEY 6       Finishes editing and writes the image to disk. If    I
I                     You were editing an earlier created image, You are   I
I                     prompted to save the old version as back-up. After   I
I                     saving the program returns to the main menu.         I
I                                                                          I
ICURSOR KEYS          Moves cursor as indicated by keys.                   I
I                                                                          I
ILINE INS MODE        Moves line with cursor and the lines below one       I
I                     line down to create an empty line. If all lines      I
I                     from cursor and down contains text, this command     I
I                     is disabled.                                         I
I                                                                          I
I                                                                          I
I                                                                          I
I                     See next HELP-page for more information.             I
I                                                                          I
I                                                                          I
--------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

```
                         SCREEN-IMAGE.........."B:HLP4"

01234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
ICOMMAND              ACTION                                 HLP4          I
I-------              ------                                               I
ILINE DEL EOL         Erases line from cursor position to end of line.     I
I                                                                          I
IALT-E                Toggles character insertion mode. If cursor is       I
I                     blinking, You are in character insertion mode.       I
I                     The character typed will be inserted at cursor       I
I                     position and the rest of the line moved one          I
I                     position to the right. If the rightmost position     I
I                     contains a character, this command is disabled.      I
I                                                                          I
IALT-G                Erases entire line with cursor.                      I
I                                                                          I
IALT-Q                Writes image to printer. The program is configured   I
I                     for Microline 82A, but can easily be modified for    I
I                     other printers. The image is written with 16.5       I
I                     chrs/inch and 8 lines /inch.                         I
I                                                                          I
I                                                                          I
I                                                                          I
I                     See next HELP-page for more information!             I
I                                                                          I
I                                                                          I
--------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

```
                         SCREEN-IMAGE.........."B:HLP5"

01234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
ICOMMAND              ACTION                                 HLP5          I
I-------              ------                                               I
IALT-S                Any time during editing, You can read these HELP-    I
I                     pages. After reading, you are returned to editing.   I
I                                                                          I
IALT-F                Moves cursor to the first character after next       I
I                     space.                                               I
I                                                                          I
IALT-A                Moves cursor to the leftmost space in the first      I
I                     group of one or more spaces to the left from         I
I                     present cursor position.                             I
I                                                                          I
IDEL CHAR             Deletes character at cursor position and moves       I
I                     the rest of the line one character position          I
I                     to the left.                                         I
I                                                                          I
I                                                                          I
I                                                                          I
I                                                                          I
I                                                                          I
I                     See next HELP-page for more information!             I
I                                                                          I
I                                                                          I
--------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

```
                         SCREEN-IMAGE.........."B:HLP6"

01234567890123456789012345678901234567890123456789012345678901234567890123456789
--------------------------------------------------------------------------------
ICOMMAND              ACTION                                 HLP6          I
I-------              ------                                               I
ITAB (Arrow right)    Moves cursor to next tab position.                   I
I                                                                          I
IDEL (Arrow left)     moves cursor to previous tab position.               I
I                                                                          I
I                                                                          I
I                                                                          I
I                                                                          I
I                                                                          I
I          This is the last HELP-page. If You have comments or             I
I          questions regarding this program, please let me know.           I
I          You can write me a letter. My name and adress:                  I
I                     Bengt Knorring                                       I
I                     Access-Konsult                                       I
I                     Box 145                                              I
I                     S-199 23  Enkoping                                   I
I                     SWEDEN                                               I
I                                                                          I
I          I hope You'll find the program useful!                          I
I                                                                          I
I                                                                          I
I                                                                          I
--------------------------------------------------------------------------------
01234567890123456789012345678901234567890123456789012345678901234567890123456789
```

BBC Logic Tree

by Robert Armstrong

'Logic Tree' is a program for either model BBC. Presented loosely in the form of a simple game, it allows the user to gradually build up a binary tree (refer to a Basic textbook if you are unfamiliar with the concept). It is likely to prove a useful teaching aid in that it demonstrates how a tree is formed and the way in which it is used.

To use the program for the first time, you will need to input a subject. This can be anything you like, but it is best to stick to concrete nouns when using the program with young children. You then enter examples, supplying answers to the computer's questions as you go. The tree will carry out a search following each additional branch and request further details if the search fails.

The syntax requires attributes rather than properties of objects, since the questions asked are based on 'Can the object . . .?' rather than 'Is the object . . .?', but this is easily changed if required. Once a tree is complete, it may be saved on disk for future use. Function key 0 prints the array holding the data so that you are able to see how the tree is structured.

```
10REM TREE STRUCTURE GAME
20    ********************
30
40MODE7
50PROCinit
60REPEAT
70PROCsearch_tree
80PROCend_of_tree
90PROCanother_go
100UNTILFALSE
110     DEFPROCinit
120     ***********
130
140ON ERROR GOTO2760
150REM disable escape
160*FX220,0
170REM this shows how the tree is built up (after leaving prog use f0)
180*KEY0F.I=1TO10:P.TREE$(I,1);"  ";TREE$(I,2);"  ";TREE$(I,3):N.!M
190DIM TREE$(100,3)
200REM lower case
210*FX202,48
220REM set VDU7 duration (FX213 sets pitch)
230*FX214,1
240REM assign colours eg r=RED
250r=129
260g=130
270y=131
280m=133
290b=134
300num=1
310newnum=1
320type$="TREE GAME"
330PROCheader
340PROCinstruct
350CLS
360PRINT
370PROCprint(b,"Shall I load the file you saved last time?")
380PROCyes_no
390CLS
400PROCoff
410IF ans PROCload_datafile ELSE PROCfirst_data
420PROCoff
430PROCdelay(60)
440PRINT'''CHR$g;"Here we go....."
450PROCdelay(200)
460PROCon
470PROCheader
480ENDPROC
490     DEFPROCfirst_data
500     ****************
510
520PRINT
530PROCprint(0,"OK. I will ask you some questions to start a new tree.")
540PROCdelay(200)
550PRINT'''CHR$g;"Here we go....."
560PROCdelay(200)
570CLS
580PROCon
590PRINT
600PROCprint(b,"What tree do your objects belong to?")
610PRINT
620PROCtext_col(y)
630INPUT"They are from the tree of "type$
640IF RIGHT$(type$,1)="s" type$=LEFT$(type$,LEN(type$)-1)
650PRINT
660PROCprint(b,"What shall I ask you first about the "+type$+"?")
670PRINT
680PROCprint(y,"Ask me if the "+type$+" can ")
690INPUT""TREE$(1,1)
700PRINT
710PROCprint(b,"If the "+type$+" could "+TREE$(1,num)+" what type of
        might it be?")
720PRINT
730PROCtext_col(y)
740INPUT"It might be "TREE$(1,2)
750PRINT
760PROCprint(b,"If the "+type$+" could not "+TREE$(1,num)+" what type of
```

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Surrey KT12 3PL


```
"+type$+" might it be?")
770PRINT
780PROCtext_col(y)
790INPUT"It might be "TREE$(1,3)
800next=2
810ENDPROC
820      DEFPROCsearch_tree
830      ******************
840
850CLS
860pos=-1
870REPEAT
880pos=pos+1
890num=newnum
900PROCtext_col(b)
910PRINTTAB(0,pos)"Does the ";type$;" you are thinking of
"'TREE$(num,1);"?";
920PROCyes_no
930IF ans reply=2 ELSE reply=3
940newnum=ASC(TREE$(num,reply))-48
950PRINTTAB(0,pos);SPC38
960PRINTTAB(0,pos);CHR$m;TREE$(num,1);
970IF reply=2 PRINTTAB(25)CHR$g"yes";SPC12 ELSE PRINTTAB(30)CHR$r"no";SPC8
980UNTIL newnum>next
990ENDPROC
1000      DEFPROCend_of_tree
1010      ******************
1020
1030PROCprint(0,CHR$11+"Are you thinking of "+TREE$(num,reply)+"?")
1040PROCyes_no
1050IF ans PRINTCHR$g"yes":PROCi_won ELSE PRINTCHR$r"no":PROCupdate_tree
1060newnum=1
1070ENDPROC
1080      DEFPROCupdate_tree
1090      ******************
1100
1110TEMP$=TREE$(num,reply)
1120PRINT'CHR$(r)SPC14"OK, you win."
1130FORI=5 TO 2 STEP-1
1140FORJ=150TO0 STEP-25
1150SOUND17,-(I+10),J+SIN(I^I),I
1160NEXT,
1170PRINT'"What were you thinking of?"
1180PROCtext_col(y)
1190INPUT"I was thinking of "newtype$
1200PROCprint(b,"What question would  differentiate between
"+newtype$+" and "+ TREE$(num,reply)+"?"+CHR$10+CHR$13)
1210PROCtext_col(y)
1220INPUT"Does it "act$
1230IF RIGHT$(act$,1)="?" act$=LEFT$(act$,LEN(act$)-1)
1240TREE$(next,1)=act$
1250PROCprint(b,"What is the correct answer for "+newtype$+"?")
1260IF POS>36 PRINT
1270TEMP$=TREE$(num,reply)
1280TREE$(num,reply)=STR$(next)
1290PROCyes_no
1300IF ans PRINTCHR$y"yes": reply=2'ELSE PRINTCHR$y"no":reply=3
1310TREE$(next,reply)=newtype$
1320IF reply=2 reply=3 ELSE reply=2
1330TREE$(next,reply)=TEMP$
1340next=next+1
1350newnum=1
1360PROCoff
1370PROCprint(0,"I know "+STR$(next-1)+" "+type$+"s now")
1380PRINT
1390PROCdelay(100)
1400PROCon
1410ENDPROC
1420      DEFPROCyes_no
1430      ************
1440
1450*FX21,0
1460REPEAT
1470ans=GET OR &20
1480UNTIL ans=121 OR ans=110
1490IF ans=121 ans=TRUE ELSE ans=FALSE
1500IF ans THEN *FX213,250
1510IF NOT ans THEN *FX213,50
1520VDU7
1530ENDPROC
1540      DEFPROCi_won
1550      ************
1560
1570PRINT'CHR$136CHR$(g)TAB(16)"I WON!"
1580FORI=5TO 2 STEP-1
1590FORJ=1TO6
1600SOUND17,-(I+10),150*SIN(I^I),I
1610NEXT,
1620PRINT
1630ENDPROC
1640      DEFPROCanother_go
1650      *****************
1660
1670PRINT'"Do you want another go?";
1680PROCyes_no
1690IF ans ENDPROC
1700REM reset
1710*FX202,32
1720*FX220,27
1730*FX213,100
1740*FX214,6
1750CLS
1760PROCprint(b,CHR$10+"Thanks for playing.")
1770PRINT''
1780PROCprint(0,"Do you want to save the information about "+type$+"s?")
1790PROCyes_no
1800IF NOT ans VDU26,12:PRINTCHR$b"Bye":END
```

```
1810file=OPENOUT("$.TREEDAT")
1820PRINT#file,type$,next
1830FOR I=1 TO next-1
1840PRINT#file,TREE$(I,1),TREE$(I,2),TREE$(I,3)
1850NEXT
1860CLOSE#0
1870VDU26,12
1880PRINTCHR$b"Bye"
1890END
1900     DEFPROCload_datafile
1910     ********************
1920
1930file=OPENIN("$.TREEDAT")
1940INPUT#file,type$,next
1950FOR I=1TO next-1
1960INPUT#file,TREE$(I,1),TREE$(I,2),TREE$(I,3)
1970NEXT
1980CLOSE#0
1990PROCprint(0,CHR$10+"I have loaded the information from the file")
2000PROCdelay(100)
2010PRINT''
2020PROCprint(0,"I know "+STR$(next-1)+" "+type$+"s")
2030PROCdelay(100)
2040PROCon
2050ENDPROC
2060     DEFPROCdelay(t)
2070     ************
2080wait=INKEY(t)
2090ENDPROC
2100     DEFPROCoff
2110     **********
2120VDU23,1,0;0;0;0;
2130ENDPROC
2140     DEFPROCon
2150     *********
2160VDU23,1,1;0;0;0;
2170ENDPROC
2180     DEFPROCinstruct
2190     ***************
2200
2210PRINT
2220PROCprint(b,"Do you want instructions for the game?")
2230PROCyes_no
2240IF NOT ans ENDPROC
2250CLS
2260PROCoff
2270PRINT
2280PROCprint(0,"You will be asked if you want to load a file containing
information about the tree or answer questions to start a new tree.")
2290PROCdelay(600)
2300PRINT'
2310PRINT"A type of tree might be"
2320PROCdelay(50)
2330PRINTTAB(5)CHR$y"'animals'"'
2340PROCdelay(250)
2350PRINT"The first question may be"
2360PROCdelay(50)
2370PRINTTAB(5)CHR$y"'does it walk'."
2380PROCdelay(250)
2390PRINT''"I will ask questions in blue writing."
2400PROCdelay(50)
2410PROCprint(y,"Your replies will be in yellow.")
2420PROCdelay(700)
2430PRINT''CHR$g;"Here we go....."
2440PROCdelay(400)
2450PROCon
2460ENDPROC
2470     DEFPROCtext_col(c)
2480     ***************
2490REM poke colour outside text window
2500FORI=&7C78+VPOS*40 TO &7FCOSTEP&28
2510?I=c
2520NEXT
2530ENDPROC
2540     DEFPROCheader
2550     *************
2560VDU26
2570CLS
2580FORI=1TO2
2590PRINTCHR$(y)CHR$157CHR$132CHR$141SPC((34-LEN(type$))/2);type$
2600NEXT
2610REM text window to leave first col'm blank
2620VDU28,1,24,39,3
2630ENDPROC
2640     DEFPROCprint(col,A$)
2650     ************
2660
2670IF col PROCtext_col(col)
2680IF LEN(A$)<39 PRINTA$;:ENDPROC
2690P=39
2700REPEAT
2710P=P-1
2720UNTIL MID$(A$,P,1)=" "
2730PRINT LEFT$(A$,P)
2740A$=RIGHT$(A$,LEN(A$)-P)
2750GOTO2680
2760REM ERROR ROUTINE
2770     *************
2780
2790IF ERR=129 PRINTCHR$136CHR$r"
THE FILE IS NOT ON THE DISC":PROCdelay(600):RUN
2800PRINT''"OOPS @ line ";ERL
2810REPORT
2820PRINT'
2830*FX202,32
2840*FX220,27
2850END
```

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PROGRAMS

BBC Omniopoly

by Richard Smith

'Omniopoly' is so-called presumably because the author didn't want to upset Waddingtons by calling it Monopoly. The program runs on a model B or expanded model A, requiring 32k RAM.

There is very little to explain since the program is all but self-explanatory to anyone familiar with the game. The computer acts as the board and bank, and two human opponents compete against each other. The rules are standard with the sole exception being the auction rule — where a property is auctioned if not purchased by the first player to land on it — which does not apply. All the features of the game are supported, and the presentation rivals that of commercial versions.

Owners of disk-based machines will have to use cassette, setting PAGE to &EOO before typing in the program. The program must then be saved to tape rather than disk (*TAPE).

```
   10 REM OMNIOPOLY Version 1.30
   20 REM Runs on any 32K BBC
   30 REM
   40 REM (c) Copyright Richard Smith
   50 REM Aug 23 1983
   60 REM
   70 ONERRORGOTO1360
   80 DIMN%(8),A$(30),NAM$(9),LO%(40),N$(2),OPOS(2),NPOS(2),MO(2),IJ(2),GJ(2),PR
(4),PR2(3),PR$(3),P$(5),H(3),CH%(52,1),CHP(1),JC(1):NJ=1:DO=0:FORI%=0TO4:P$(I%)=
STR$I%:NEXT:P$(5)="H":A$=STRING$(100," "):B$=A$:N$=A$:*FX4,1
   90 A=RND(-TIME):FORI%=1TOTIME MOD10:A=RND(1):NEXT:LE$="ABCDEFGHIJKLMNOPRSTUVW
XYZ£346789":OK$=LE$+" 01250"
  100 FORK%=0TO1:FORI%=1TO26
  110 J%=RND(26)*2-1:IFCH%(J%,K%)=0CH%(J%,K%)=I%ELSEGOTO110
  120 NEXT:CH%(RND(26)*2,K%)=1:NEXT
  130 MODE5:VDU19,1,2;0;19,2,6;0;29,640;512;23;8202;0;0;0;5:COLOUR129:COLOUR0:RE
STORE3270:FORI%=0TO9:READNAM$(I%):NEXT:PROCBOARD:Y%=RND(2):A$=N$(Y%)+" STARTS":Y
=320:PROCTEXT
  140 ONERRORGOTO1280
  150 PROCWAIT
  160 X%=Y%:Z%=OPOS(X%):MO(X%)=INTMO(X%):PROCAT(Z%):PROCMONEY:PROCWARN:RESTORE36
10:FORI%=1TO8:READA$:MOVE-336,-32*(I%+1):A$=STR$I%+" "+A$:PROCPRINT(A$):NEXT:MOV
E-160,-320:PROCPRINT("ENTER CHOICE")
  170 PROCWAIT:B=VALA$:IFB<1ORB>8THEN170
  180 ONB GOTO190,440,450,480,510,580,770,850
  190 IFSGNMO(X%)=-1THENB60
  200 IFZ%=41THEN900ELSEIJ(X%)=0
  210 D1=RND(6):D2=RND(6):IFD1<>D2 Y%=3-X%:DO=0:GOTO230
  220 Y%=X%:DO=DO+1
  230 PROCROLL
  240 PROCWAIT
  250 NPOS(X%)=Z%:PROCNPOS
  260 IFA<>18ANDA<>11PROCMONEY
  270 IFA=17Z%=41:GOTO240ELSEIFA<>18ANDA<>11PROCMONEY
  280 IFA=10PROCCOMCHEST:GOTO880
  290 IFA=12PROCCHANCE:GOTO880
  300 ONERRORGOTO1280
  310 IFA=9ORA=15ORA=16ORA=19THEN150
  320 IFA=11MO(X%)=MO(X%)-200:PROCMONEY:GOTO150
  330 IFA=18MO(X%)=MO(X%)-100:PROCMONEY:GOTO150
  340 PROCGETDA(Z%):READD,A$,A
  350 IFN%THEN380
  360 MOVE-336,-96:PROCPRINT("DO YOU WANT TO BUY IT"):PROCGET:IFA$="N"THEN160
  370 MO(X%)=MO(X%)-A:LO%(Z%)=LO%(Z%)OR16*X%:PROCTITLEDEED(Z%):GOTO150
  380 IFLO%(Z%)AND16*X%ORLO%(Z%)AND64THEN150
  390 MOVE-64,-96:PROCPRINT("RENT")
  400 IFD=13PROCUTRENT:GOTO430ELSEIFD=14PROCSTNRENT:GOTO430
  410 FORI%=0TOK%:READA:NEXT
  420 IFK%=0PROCALL(D):IFB A=A*2
  430 A$="£"+STR$A:Y=-160:PROCTEXT:MO(3-X%)=MO(3-X%)+A:MO(X%)=MO(X%)-A:GOTO150
  440 PROCHIGH:GOTO160
  450 PROCASK:FORA%=1TO40:PROCGETDA(A%):READA:IFW=0THEN460ELSEIFA<>W THEN470
  460 IFLO%(A%)AND(X%*16)PROCPROP(A%,1):IFA$="T"PROCTITLEDEED(A%):PROCWAIT
  470 NEXT:GOTO160
  480 PROCASK:FORI%=1TO40:PROCGETDA(I%):READA:IFA>8ANDA<>13ANDA<>14THEN500
  490 IFW=0ORW=A PROCPROP(I%,0)
  500 NEXT:GOTO160
  510 PROCCLS:PROCGETPROP:PROCCLS:PROCCHECK1:IFER THEN150
  520 PROCCHECK3:IFER THEN150
  530 PROCCHECK2:A$="WHAT IS THE AGREED/SELLING PRICE":Y=224:PROCTEXT:PROCINPUTN
:LO%(A)=LO%(A)AND207OR16*(3-X%):MO(X%)=MO(X%)+B:MO(3-X%)=MO(3-X%)-B
  540 IF(LO%(A)AND64)=0THEN570
  550 PROCCLS:X%=3-X%:A$=N$(X%)+"/DO YOU WANT TO LIFT/THE MORTGAGE NOW":Y=320:PR
OCTEXT:PROCGET:IFA$="Y"PROCCLS:FL%=0:GOTO840
  560 PROCGETDA(A):READB,A$,B:A$="YOU STILL HAVE TO PAY/INTEREST OF £"+STR$(B*.0
5):MO(X%)=MO(X%)-B*.05:Y=192:PROCTEXT:PROCWAIT
  570 PROCTITLEDEED(A):PROCWAIT:GOTO160
  580 FORI%=1TO3:H(I%)=0:NEXT:PROCCLS:A$="DO YOU WANT TO SELL/BUILDINGS":Y=320:P
ROCTEXT:PROCGET:B$=A$
  590 PROCCLS:PROCGETCOL(B):PROCCLS:PROCALL(A):IFB<>X%A$="YOU DO NOT HAVE THE/EN
TIRE GROUP/OR PART OF THE GROUP/IS MORTGAGED":Y=320:PROCTEXT:GOTO150ELSEA$="EXIS
TING BUILDINGS/AND PROPERTY NAME":Y=320:PROCTEXT
  600 G%=0:PR(3)=-1:J%=0:FORI%=1TO40:PROCGETDA(I%):READW:IFW=A B=LO%(I%)AND7:J%=
J%+1:PR(J%)=B:PR2(J%)=I%:READA$,R%,R%,R%,R%,R%,R%,R%,R%:PROCSPACES(1):PROCNORTH:
PR$(J%)=N$:MOVE-320,256-32*J%:PROCPRINT(P$(PR(J%))+" "+N$)
  610 NEXT:ONERRORGOTO1350
  620 IFB$="Y"THEN670ELSEA$="HOUSES COST £"+STR$R%+" EACH":Y=96:PROCTEXT
  630 A$="HOW MANY HOUSES DO/YOU WANT TO BUILD ON":Y=32:PROCTEXT
  640 FORI%=1TOJ%
  650 PROCGETHOUSES:H(I%)=B:IFPR(I%)+B>5MOVE-128,-192:PROCPRINT("TOO MANY"):PROC
WAIT:GOTO650
  660 GOTO710
  670 R%=-R%/2:A$="HOUSES ARE WORTH £"+STR$-R%:Y=96:PROCTEXT
  680 A$="HOW MANY HOUSES DO/YOU WANT REMOVED FROM":Y=32:PROCTEXT
  690 FORI%=1TOJ%
  700 PROCGETHOUSES:H(I%)=B:IFPR(I%)-B<0MOVE-128,-192:PROCPRINT("TOO MANY"):PROC
WAIT:GOTO700
  710 NEXT
  720 L%=5:H%=0:FORI%=1TOJ%:A=PR(I%)+SGNR%*H(I%):IFA<L%L%=A
  730 IFA>H%H%=A
  740 NEXT:IFH%-L%>1A$="BUILDINGS ARE NOT/DISTRIBUTED EVENLY":Y=-192:PROCTEXT:PR
OCWAIT:GCOL0,1:PROCHBAR(-320,-64,-256):GCOL0,0:ONSGNR%+2GOTO690,0,640
  750 FORI%=1TOJ%:LO%(PR2(I%))=LO%(PR2(I%))AND248OR(PR(I%)+SGNR%*H(I%)):MO(X%)=M
O(X%)-R%*H(I%):NEXT:ONERRORGOTO1280
  760 GOTO160
  770 FL%=1:PROCCLS:A$="DO YOU WANT TO LIFT/A MORTGAGE":Y=320:PROCTEXT:PROCGET:B
$=A$
```

PROGRAMS

```
  780 PROCGETPROP:PROCCLS:PROCCHECK1:IFER PROCWAIT:GOTO780
  790 IFB$="Y"THEN830
  800 PROCCHECK2:IFER PROCWAIT:GOTO780
  810 PROCCHECK3:IFER PROCWAIT:GOTO780
  820 LOX(A)=LOX(A)OR64:PROCGETDA(A):READB,A$,B:MO(X%)=MO(X%)+B/2:PROCTITLEDEED(
A):PROCWAIT:GOTO780
  830 PROCCHECK4:IFER PROCWAIT:GOTO780
  840 LOX(A)=LOX(A)AND191:PROCGETDA(A):READB,A$,B:MO(X%)=MO(X%)-.55*B:PROCTITLED
EED(A):PROCWAIT:IFFL%THEN780ELSEGOTO160
  850 PROCCLS:A$="ARE YOU SURE YOU/WANT TO END/ /YOU WILL LOSE/IF YOU DO":Y=320:
PROCTEXT:PROCGET:IFA$="N"THEN160
  860 PROCCLS:A$=N$(3-X%)+"/ /IS THE WINNER":Y=320:PROCTEXT:PROCWAIT:MODE7:*FX4,
0
  870 END
  880 IFMV THEN240ELSEONERRORGOTO1280
  890 PROCWAIT:PROCAT(Z%):PROCMONEY:GOTO150
  900 DO=0:IJ(X%)=IJ(X%)+1:GCOL0,1:PROCHBAR(352,-64,-356):GCOL0,0:N$="YOU ARE IN
JAIL":PROCCENTRE:MOVEX,-64:PROCPRINT(N$):RESTORE3620:A=3:B=2:IFGJ(X%)A=5:B=3
  910 FORI%=1TOA:READA$:MOVE-320,-32*(I%+3):PROCPRINT(A$):NEXT:MOVE-160,-32*(I%+
4):PROCPRINT("ENTER CHOICE")
  920 PROCWAIT:A=VAL(A$):IFA<10RA>B THEN920
  930 ONA GOTO940,960,1010
  940 MO(X%)=MO(X%)-50
  950 Y%=3-X%:IJ(X%)=0:OPOS(X%)=11:Z%=11:GOTO210
  960 D1=RND(6):D2=RND(6):PROCROLL:IFD1=D2 Y%=X%:DO=1:GOTO990
  970 Y%=3-X%:IFIJ(X%)=3A$="YOU MUST PAY £50":Y=192:PROCTEXT:MO(X%)=MO(X%)-50:GO
TO1000
  980 GOTO150
  990 Y%=X%
 1000 OPOS(X%)=11:Z%=11+D1+D2:IJ(X%)=0:GOTO240
 1010 GJ(X%)=GJ(X%)-1:IFJC(0)=X%J%=0ELSEJ%=1:JC(J%)=0:I%=CHP(J%):IFI%=0I%=52
 1020 CH%(I%,J%)=1
 1030 GOTO950
 1040 DEFPROCGETPROP:PROCGETCOL(10):PROCCLS:W=A:IFA=9W=14ELSE1FA=10W=13
 1050 J%=0:FORI%=1TO40:PROCGETDA(I%):READA:IFW=A READA$:PROCSPACES(1):PROCNORTH:
J%=J%+1:N$=STR$J%+" "+N$:MOVE-320,352-J%*32:PROCPRINT(N$):PR(J%)=I%
 1060 NEXT:MOVE-320,288-32*J%:PROCPRINT("ENTER CHOICE")
 1070 PROCWAIT:A=VALA$:IFA<10RA>J%THEN1070
 1080 A=PR(A):ENDPROC
 1090 DEFPROCCHECK1:ER=0:IF(LO%(A)AND48)/16<>X%A$="YOU DO NOT OWN THIS/PROPERTY"
:Y=320:PROCTEXT:ER=1
 1100 ENDPROC
 1110 DEFPROCCHECK2:ER=0:IFLO%(A)AND64A$="THIS PROPERTY IS/MORTGAGED":Y=320:PROC
TEXT:ER=1
 1120 ENDPROC
 1130 DEFPROCCHECK3:ER=0:IFLO%(A)AND7A$="THERE ARE BUILDINGS/ON THIS SITE":Y=320
:PROCTEXT:ER=1
 1140 ENDPROC
 1150 DEFPROCCHECK4:ER=0:IF(LO%(A)AND64)=0A$="THIS PROPERTY IS/NOT MORTGAGED":Y=
320:PROCTEXT:ER=1
 1160 ENDPROC
 1170 DEFPROCINPUTN:X=-96:Y=128:PROCTYPE("£"):X=-64
 1180 MOVEX,Y:PROCINPUT:B=VALB$:IFB$<>STR$B ORB>9999THENGCOL0,1:MOVEX,Y:PROCTYPE
(B$):GCOL0,0:GOTO1180
 1190 ENDPROC
 1200 DEFPROCINPUTTEXT:MOVE-160,224:PROCINPUT:ENDPROC
 1210 DEFPROCINPUT:B$=""
 1220 PROCWAIT:IFASCA$<>13THEN1240
 1230 IFB$=""THEN1220ELSEENDPROC
 1240 IFASCA$=127ANDLENB$>0GCOL0,1:PLOT0,-32,0:PROCPRINT(RIGHT$(B$,1)):B$=LEFT$(
B$,LENB$-1):GCOL0,0:PLOT0,-32,0:GOTO1220
 1250 IFINSTR(OK$,A$)=0ORLENB$=10THEN1220
 1260 B$=B$+A$:PROCPRINT(A$):GOTO1220
 1270 DEFPROCGETHOUSES:GCOL0,1:PROCHBAR(320,-64,-256):GCOL0,0:N$=PR$(I%):PROCCEN
TRE:MOVEX,-64:PROCPRINT(N$):X=-32:Y=-128:GOTO1180
 1280 IFERR=17THEN160
 1290 MODE7:REPORT:PRINT" in line ";ERL:*FX4,0
 1300 END
 1310 IFERR<>17THEN1290
 1320 PROCUNHIGH:ONERRORGOTO1280
 1330 GOTO160
 1340 IFERR=17THEN250ELSEGOTO1290
 1350 IFERR=17THEN720ELSEGOTO1290
 1360 IFERR=17RUN ELSEGOTO1290
 1370 DEFPROCBOARD:GCOL0,1:PROCSBAR(512,512):GCOL0,2:PROCSBAR(480,480):GCOL0,1:P
ROCSBAR(360,360):GCOL0,0:PROCBOX(480,480):PROCBOX(360,360)
 1380 FORY=-360TO360STEP80:MOVE-480,Y:DRAW-360,Y:MOVEY,480:DRAWY,360:MOVE480,Y:D
RAW360,Y:MOVEY,-480:DRAWY,-360:NEXT
 1390 FORI%=1TO40:PROCGETDA(I%):READA:PROCLOC(I%):IFA<9PROCSMBOX(I%)ELSEPROCNAM(
I%)
 1400 NEXT:GA=0:FORX%=1TO2:MO(X%)=1500:PROCCLS:A$="WHAT IS THE NAME OF/PLAYER "+
STR$X%:Y=320:PROCTEXT:PROCINPUTTEXT:N$(X%)=B$:OPOS(X%)=40:Z%=1:PROCNPOS:NEXT:GA=
1:ENDPROC
 1410 DEFPROCSBAR(X,Y)MOVEX,Y:MOVEX,-Y:PLOT85,-X,-Y:MOVE-X,Y:PLOT85,X,Y:ENDPROC
 1420 DEFPROCBOX(X,Y)MOVEX,Y:DRAWX,-Y:DRAW-X,-Y:DRAW-X,Y:DRAWX,Y:ENDPROC
 1430 DEFPROCLOC(I%)S=(I%-1)MOD10*80-360:ON(I%-1)DIV10+1GOTO1440,1450,1460,1470
 1440 X=-S:Y=-360:ENDPROC
 1450 X=-360:Y=S:ENDPROC
 1460 X=S:Y=360:ENDPROC
 1470 X=360:Y=-S:ENDPROC
 1480 DEFPROCSMBOX(I%)ON(I%-1)DIV10+1GOTO1490,1500,1510,1520
 1490 MOVEX+8,Y-4:MOVEX+72,Y-4:PLOT85,X+72,Y-40:MOVEX+8,Y-40:PLOT85,X+8,Y-4:ENDP
ROC
 1500 MOVEX-8,Y-4:MOVEX-8,Y-76:PLOT85,X-40,Y-76:MOVEX-40,Y-4:PLOT85,X-8,Y-4:ENDP
ROC
 1510 MOVEX-8,Y+4:MOVEX-72,Y+4:PLOT85,X-72,Y+40:MOVEX-8,Y+40:PLOT85,X-8,Y+4:ENDP
ROC
 1520 MOVEX+8,Y+4:MOVEX+8,Y+76:PLOT85,X+40,Y+76:MOVEX+40,Y+4:PLOT85,X+8,Y+4:ENDP
ROC
 1530 DEFPROCNAM(I%)B$=NAM$(A-9):PROCLBOX(0):ENDPROC
 1540 DEFPROCLBOX(M%):IFI%=11THEN1590ELSEIFI%=31THEN1600ELSEON(I%-1)DIV10+1GOTO1
550,1560,1570,1580
 1550 MOVEX+8,Y-16-M%*32:PROCPRINT(B$):ENDPROC
 1560 MOVEX-48-32*M%,Y-12:PROCPRINT(LEFT$(B$,1)):MOVEX-48-32*M%,Y-44:PROCPRINT(R
IGHT$(B$,1)):ENDPROC
 1570 MOVEX-72,Y+40+32*M%:PROCPRINT(B$):ENDPROC
 1580 MOVEX+16+32*M%,Y+68:PROCPRINT(LEFT$(B$,1)):MOVEX+16+32*M%,Y+36:PROCPRINT(R
IGHT$(B$,1)):ENDPROC
 1590 MOVEX-72,Y-16-32*M%:PROCPRINT(B$):ENDPROC
 1600 MOVEX+12,Y+40+32*M%:PROCPRINT(B$):ENDPROC
 1610 DEFPROCGETCOL(N%)PROCCLS:RESTORE3280:FORI%=0TON%-1:READC$:MOVE-320,320-I%*
32:PROCPRINT(STR$I%+" "+C$):NEXT:MOVE-320,256-I%*32:PROCPRINT("ENTER CHOICE")
 1620 PROCWAIT:A=VALA$:IFA=0ANDA$<>"0"THENA=-1
 1630 IFA<0ORA>N%-1THEN1620ELSEA=A+1:PROCGETLCOL:ENDPROC
 1640 DEFPROCHIGH:PROCGETCOL(B):IFC=0ORC=6C=C+8
 1650 ONERRORGOTO1310
 1660 VDU19,3,C;0;:GCOL0,3:FORI%=1TO40:PROCGETDA(I%):READB:IFB=A PROCLOC(I%):PRO
CSMBOX(I%)
 1670 NEXT:PROCWAIT:PROCUNHIGH:ENDPROC
 1680 DEFPROCUNHIGH:GCOL0,0:FORI%=1TO40:PROCGETDA(I%):READB:IFA=B PROCLOC(I%):PR
OCSMBOX(I%)
 1690 NEXT:ONERRORGOTO1280
 1700 ENDPROC
 1710 DEFPROCGETDA(I%)RESTORE(2850+10*I%):ENDPROC
 1720 DEFPROCTITLEDEED(I%)PROCGETDA(I%):READA:IFA>8ANDA<>13ANDA<>14THEN1850
 1730 IFLO%(I%)AND64THEN1830
 1740 PROCTDFRAME:IFA=13ORA=14THEN1800
```

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PROGRAMS

```
1750 MOVE-160,272:PROCPRINT("TITLE DEED"):PROCSPACES(1):PROCNORTH
1760 PROCCENTRE:MOVEX,208:PROCPRINT(N$):GCOL0,0:FORI%=0TO7:READN%(I%):NEXT:N%(8
)=N%(0)/2:RESTORE3300
1770 X=-288:Y=112:PROCTYPE("RENT"):FORI%=1TO8:Y=Y-32:IFI%>6Y=Y-32
1780 READA$:PROCTYPE(A$):MOVE96,Y:PROCPRINT("£"+STR$N%(I%)):IFI%=7Y=Y-32:PROCTY
.PE("COST HOTEL  £"+STR$N%(7)):Y=Y-32:PROCTYPE("PLUS 4 HOUSES")
1790 NEXT:GOTO1850
1800 PROCSPACES(1):PROCCENTRE:MOVEX,240+24*(A-13):PROCPRINT(N$):IFA=14MOVE-112,
216:PROCPRINT("STATION"):RESTORE3310ELSERESTORE3320
1810 X=-288:Y=96:FORI%=1TO12:READA$:IFA$=""A$=" "
1820 PROCTYPE(A$):Y=Y-32:NEXT:GOTO1850
1830 C=A:PROCCLS:GCOL0,3:READA$,A:PROCSPACES(1):VDU19,3,1;0;:PROCSBAR(320,320):
GCOL0,0:PROCBOX(320,320):FORY=-1TO1STEP2:MOVE-288,288*Y:DRAW288,288*Y:DRAW288,96
*Y:DRAW-288,96*Y:DRAW-288,288*Y:NEXT:MOVE-144,208:IFC=14N$=N$+" STN"
1840 PROCPRINT("MORTGAGED"):PROCNORTH:A$=N$+"/ /"+"MORTGAGED FOR £"+STR$(A/2):Y
=48:PROCTEXT:Y=-132:X=-256:RESTORE3330:FORI%=1TO4:READN$:PROCPR:NEXT
1850 ENDPROC
1860 DEFPROCGETLCOL:LOCALI%:RESTORE3290:FORI%=1TOA:READC:NEXT:ENDPROC
1870 DEFPROCTDFRAME:PROCCLS:IFA<9PROCGETLCOL ELSEC=7
1880 VDU19,3,C;0;:GCOL0,2-(A>12):PROCSBAR(320,320):GCOL0,0:PROCBOX(320,320):IFA
<13ANDA<>2GCOL0,3:PROCHBAR(304,304,144)
1890 GCOL0,0:PROCHBOX(304,304,144)
1900 PROCGETDA(I%):READA,A$:COLOUR131:IFA=1ORA=8COLOUR2:GCOL0,2ELSECOLOUR0:GCOL
0,0
1910 ENDPROC
1920 DEFPROCSPACES(I%)B=INSTR(A$,"/",I%):IFB=0N$=A$ELSEN$=LEFT$(A$,B-1)+" "+MID
$(A$,B+1)
1930 A$=N$:ENDPROC
1940 DEFPROCCENTRE:X=-288+32*((18-LENN$)/2):ENDPROC
1950 DEFPROCNORTH:IFN$="NORTHUMBER LAND AVENUE"N$="NORTHUMBERLAND AVE"
1960 ENDPROC
1970 DEFPROCCHANCE:N$="CHANCE":CH=1:GOTO1990
1980 DEFPROCCOMCHEST:N$="COMMUNITY CHEST":CH=0
1990 MV=0:PROCWAIT:PROCCLS:VDU19,3,5-2*CH;0;:GCOL0,3:PROCSBAR(320,192):GCOL0,0:
PROCBOX(320,192):Y=128:A$=N$:PROCTEXT:Y=32
2000 IFCH%(CHP(CH)+2,CH)A=27:CH%(CHP(CH)+2,CH)=0:JC(CH)=X%ELSEA=CH%(CHP(CH)+1,C
H):CHP(CH)=CHP(CH)+2:IFCHP(CH)=52CHP(CH)=0
2010 RESTORE(3330+10*A):READA$,A1%,A2%
2020 PROCTEXT:IFA1%MO(X%)=MO(X%)+A1%:ENDPROC
2030 IFA2%=0THEN2050ELSEMV=1:IFA2%=-3Z%=OPOS(X%)+3:ENDPROC
2040 Z%=A2%:ENDPROC
2050 IFA=27THEN2090
2060 B%=0:FORI%=1TO40:IF(LO%(I%)AND48)/16<>X%THEN2080
2070 J%=LO%(I%)AND7:IFJ%<5B%=B%+J%*40ELSEB%=B%+115
2080 NEXT:A$="TOTAL COST £"+STR$B%:Y=-224:PROCTEXT:MO(X%)=MO(X%)-B%:ENDPROC
2090 GJ(X%)=GJ(X%)+1:IFJC(CH)=X%
2100 ENDPROC
2110 DEFPROCPR:PROCCENTRE:MOVEX,Y:Y=Y-32:PROCPRINT(N$):ENDPROC
2120 DEFPROCHBAR(X,Y,Y1)MOVEX,Y:MOVEX,Y1:PLOT85,-X,Y1:MOVE-X,Y:PLOT85,X,Y:ENDPR
OC
2130 DEFPROCHBOX(X,Y,Y1)MOVEX,Y:DRAWX,Y1:DRAW-X,Y1:DRAW-X,Y:DRAWX,Y:ENDPROC
2140 DEFPROCTEXT:I%=0
2150 PROCSPACES(I%+1):IFB=0N$=MID$(A$,I%+1):PROCPR:ENDPROC ELSEN$=MID$(A$,I%+1,
B-I%-1):I%=B:PROCPR:GOTO2150
2160 DEFPROCAT(L%)PROCCLS:K%=0:GCOL0,2:PROCHBAR(320,320,64):GCOL0,0:PROCHBOX(32
0,320,64):Y=256:PROCGETDA(L%):READA:IFA<9ORA=13ORA=14THEN2270
2170 ONA-8GOTO2180,2190,2200,2210,0,0,2220,2230,2240,2250,2260
2180 A$="GO":GOTO2300
2190 A$="COMMUNITY/CHEST":GOTO2300
2200 A$="INCOME/TAX/PAY £200":GOTO2300
2210 A$="CHANCE":GOTO2300
2220 A$="JAIL/JUST/VISITING":GOTO2300
2230 A$="FREE/PARKING":GOTO2300
2240 A$="GO TO/JAIL":GOTO2300
2250 A$="SUPER/TAX/PAY £100":GOTO2300
2260 A$="IN/JAIL":GOTO2300
2270 IFA<9PROCGETLCOL:VDU19,3,C;0;:GCOL0,3:PROCHBAR(312,316,224):GCOL0,0:MOVE-3
20,224:DRAW320,224:Y=192:PROCHOUSES
2280 PROCGETDA(L%):READJ%,A$,J%:IFA=14A$=A$+"/STATION"
2290 PROCTEXT:A$="£"+STR$J%
2300 PROCTEXT:IFA<9ORA=13ORA=14N%=(LO%(L%)AND63)/16:PROCSALE ELSEN%=4
2310 ENDPROC
2320 DEFPROCHOUSES:K%=LO%(L%)AND7:IFK%=0ENDPROC ELSEIFK%=5A$="HOTEL"ELSEA$=STR$
K%+" HOUSE"
2330 IFK%<5ANDK%>1A$=A$+"S"
2340 IFA=10RA=8GCOL0,2ELSEGCOL0,0
2350 PROCSPACES(1):PROCCENTRE:MOVEX,288:PROCPRINT(N$):GCOL0,0:ENDPROC
2360 DEFPROCSALE2:IFN%=0N$="FOR SALE"ELSEN$="OWNED BY "+N$(N%)
2370 ENDPROC
2380 DEFPROCSALE:PROCSALE2:PROCCENTRE:MOVEX,52:PROCPRINT(N$):ENDPROC
2390 DEFPROCNPOS:PROCCLS:B$=LEFT$(N$(X%),2):N%=OPOS(X%):G%=Z%:IFG%=416%=11:NJ=0
:DO=0:IFD1=D2 Y%=3-X%
2400 IFZ%=41ANDN%<32ST=-1ELSEST=1
2410 IFN%=G%THEN2460
2420 REPEAT:PG=0:K%=N%:N%=N%+ST:IFN%=41N%=1:PG=1
2430 GCOL0,2:I%=K%:PROCLOC(I%):PROCLBOX(X%):GCOL0,0:I%=N%:SOUND1,-7,50,1:PROCLO
C(I%):PROCLBOX(X%):IFPG ANDGA ANDNJ PROCPG
2440 *FX15,1
2450 A=INKEY25:UNTILN%=G%
2460 OPOS(X%)=Z%
2470 IFGA PROCAT(Z%)
2480 NJ=1:ENDPROC
2490 DEFPROCPG:VDU19,3,7;0;:GCOL0,3:PROCHBAR(320,320,192):GCOL0,0:PROCHBOX(320,
320,192):A$="COLLECT £200 SALARY/AS YOU PASS GO":Y=288:PROCTEXT:MO(X%)=MO(X%)+20
0:PROCWAIT:ENDPROC
2500 DEFPROCMONEY:N$=N$(X%):PROCCENTRE:Y=0:PROCTYPE(N$):N$="£"+STR$(ABS(MO(X%))
):IFSGNMO(X%)=-1N$="MINUS "+N$
2510 N$=N$+"  "+STR$GJ(X%):PROCCENTRE:Y=-32:PROCTYPE(N$):ENDPROC
2520 DEFPROCGET
2530 PROCWAIT:IFA$<>"Y"ANDA$<>"N"THEN2530
2540 ENDPROC
2550 DEFPROCTYPE(Z$)MOVEX,Y:GOTO2570
2560 DEFPROCPRINT(Z$)
2570 FORE%=1TOLENZ$:PLOTO,-32,0:F%=ASC(MID$(Z$,E%,1)):IFF%=49F%=7ELSEIFF%=50F%
=90ELSEIFF%=53F%=83ELSEIFF%=48F%=79ELSEIFF%=81F%=86:VDU23,244,7,5,5,5,7,2,3,0ELS
EIFF%=86VDU23,244,5,5,5,5,5,2,2,0
2580 IFF%=32PRINT" ";ELSEPRINTCHR$(223+INSTR(LE$,CHR$(F%)));
2590 NEXT:ENDPROC
2600 DEFPROCWAIT:*FX15,1
2610 SOUND1,-7,125,1:A$=GET$:ENDPROC
2620 DEFPROCCLS:GCOL0,1:PROCSBAR(352,356):GCOL0,0:ENDPROC
2630 DEFPROCWARN:IFSGN(MO(X%))=-1A$="YOU ARE IN DEBT/ /YOU MUST PAY THIS/BEFORE
ROLLING DICE":Y=-96:PROCTEXT:PROCWAIT:GCOL0,1:PROCHBAR(320,-96,-224):GCOL0,0
2640 ENDPROC
2650 DEFPROCPROP(I%,J%)PROCCLS:READA$:IFA=14THENA$=A$+"/STATION"
2660 K%=LO%(I%)AND7:IFA>8THEN2690
2670 IFK%=0A$=A$+"/ /NO BUILDINGS"ELSEIFK%=5A$=A$+"/ /HOTEL"ELSEA$=A$+"/ /"+STR
$K%+" HOUSE"
2680 IFK%<5ANDK%>1A$=A$+"S"
2690 IFLO%(I%)AND64A$=A$+"/ /MORTGAGED"
2700 IFJ%A$=A$+"/ /PRESS T FOR/TITLE DEED/ELSE ANY OTHER KEY"ELSEN%=(LO%(I%)AND
48)/16:PROCSALE2:A$=A$+"/ /"+N$
2710 Y=320:PROCTEXT:PROCWAIT:ENDPROC
2720 DEFPROCASK:PROCCLS:A$="DO YOU WANT JUST/ONE GROUP LISTED":Y=320:PROCTEXT:P
ROCGET:IFA$="N"W=0:ENDPROC
2730 PROCGETCOL(10):W=A:IFW=9W=14ELSEIFW=10W=13
2740 ENDPROC
```

```
 2750 DEFPROCALL(J%)B=-1:FORI%=1TO40:PROCGETDA(I%):READC:IFC<>J%THEN2780ELSEB%=(
LO%(I%)AND112)/16
 2760 IFB=-1B=B%ELSEIFB<>B%B=0
 2770 IFB<>B%B=0
 2780 NEXT:ENDPROC
 2790 DEFPROCSTNRENT:J%=-1:FORI%=6TO36STEP10:IF(LO%(I%)AND112)/16=3-X%J%=J%+1
 2800 NEXT:A=2^J%*25:ENDPROC
 2810 DEFPROCUTRENT:J%=-1:FORI%=13TO29STEP16:IF(LO%(I%)AND112)/16=3-X%J%=J%+1
 2820 NEXT:A=(4+6*J%)*(D1+D2):ENDPROC
 2830 DEFPROCROLL:PROCCLS:A$="YOU HAVE ROLLED/ /"+STR$D1+" AND "+STR$D2:IFDO=3A$
=A$+"/ /YOU HAVE THROWN/THREE DOUBLES/ /GO TO JAIL":Z%=41:NJ=0:Y%=3-X%:DO=0ELSEI
FIJ(X%)=0Z%=Z%+D1+D2:IFZ%>40Z%=Z%-40
 2840 Y=320:PROCTEXT:ONERRORGOTO1340
 2850 ENDPROC
 2860 DATA9
 2870 DATA1,OLD KENT/ROAD,60,2,10,30,90,160,250,50
 2880 DATA10
 2890 DATA1,WHITECHAPEL/ROAD,60,4,20,60,180,320,450,50
 2900 DATA11
 2910 DATA14,KINGS CROSS,200
 2920 DATA2,ANGEL/ISLINGTON,100,6,30,90,270,400,550,50
 2930 DATA12
 2940 DATA2,EUSTON/ROAD,100,6,30,90,270,400,550,50
 2950 DATA2,PENTONVILLE/ROAD,120,8,40,100,300,450,600,50
 2960 DATA15
 2970 DATA3,PALL MALL,140,10,50,150,450,625,750,100
 2980 DATA13,ELECTRIC/COMPANY,150
 2990 DATA3,WHITEHALL,140,10,50,150,450,625,750,100
 3000 DATA3,NORTHUMBER/LAND AVENUE,160,12,60,180,500,700,900,100
 3010 DATA14,MARYLEBONE,200
 3020 DATA4,BOW STREET,180,14,70,200,550,750,950,100
 3030 DATA10
 3040 DATA4,MARLBOROUGH/STREET,180,14,70,200,550,750,950,100
 3050 DATA4,VINE STREET,200,16,80,220,600,800,1000,100
 3060 DATA16
 3070 DATA5,STRAND,220,18,90,250,700,875,1050,150
 3080 DATA12
 3090 DATA5,FLEET STREET,220,18,90,250,700,875,1050,150
 3100 DATA5,TRAFALGAR/SQUARE,240,20,100,300,750,925,1100,150
 3110 DATA14,FENCHURCH ST,200
 3120 DATA6,LEICESTER/SQUARE,260,22,110,330,800,975,1150,150
 3130 DATA6,COVENTRY/STREET,260,22,110,330,800,975,1150,150
 3140 DATA13,WATER/WORKS,150
 3150 DATA6,PICCADILLY,280,22,120,360,850,1025,1200,150
 3160 DATA17
 3170 DATA7,REGENT/STREET,300,26,130,390,900,1100,1275,200
 3180 DATA7,OXFORD/STREET,300,26,130,390,900,1100,1275,200
 3190 DATA10
 3200 DATA7,BOND STREET,320,28,150,450,1000,1200,1400,200
 3210 DATA14,LIVERPOOL ST,200
 3220 DATA12
 3230 DATA8,PARK LANE,350,35,175,500,1100,1300,1500,200
 3240 DATA18
 3250 DATA8,MAYFAIR,400,50,200,600,1400,1700,2000,200
 3260 DATA19
 3270 DATAGO,CC,IT,CH,UT,SN,JA,FP,GJ,ST
 3280 DATABLACK,CYAN,MAGNETA,WHITE,RED,YELLOW,GREEN,BLUE,STATIONS,UTILITIES
 3290 DATA0,6,5,7,1,3,2,4,0,0
 3300 DATASITE ONLY,1 HOUSE,2 HOUSES,3 HOUSES,4 HOUSES,HOTEL,COST HOUSE,MORTGAGE
 3310 DATA" BRITISH RAILWAYS",,RENT £25,,IF 2 STATIONS £50,,IF 3 STATIO
NS £100,,IF 4 STATIONS £200,,,MORTGAGE £100
 3320 DATAIF ONE UTILITY,IS OWNED RENT IS 4,TIMES AMOUNT SHOWN,ON DICE,,IF BOTH
UTILITIES,ARE OWNED RENT IS,10 TIMES AMOUNT,SHOWN ON DICE,,,MORTGAGE £75
 3330 DATACARD MUST BE,TURNED THIS SIDE,UP IF PROPERTY,IS MORTGAGED
 3340 DATASPEEDING FINE £15,-15,0
 3350 DATADOCTORS FEE/PAY £50,-50,0
 3360 DATAPAY HOSPITAL £100,-100,0
 3370 DATAYOU ARE ASSESSED/FOR STREET REPAIRS/£40 PER HOUSE/£115 PER HOTEL,0,0
 3380 DATABANK PAYS YOU/DIVIDEND OF £50,50,0
 3390 DATAFROM SALE OF STOCK/YOU GET £50,50,0
 3400 DATAYOU INHERIT £100,100,0
 3410 DATAINCOME TAX REFUND/COLLECT £20,20,0
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 3450 DATAADVANCE TO/PALL MALL/IF YOU PASS GO/COLLECT £200,0,12
 3460 DATAADVANCE TO MAYFAIR,0,40
 3470 DATAADVANCE 3 SPACES,0,-3
 3480 DATAPAY INTEREST ON/A LOAN/£50,-50,0
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 3520 DATAPAY YOUR INSURANCE/PREMIUM £50,-50,0
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41
 3600 DATAGET OUT OF JAIL/FREE/ /THIS CARD MAY BE/KEPT UNTIL NEEDED,0,0
 3610 DATAROLL DICE,SHOW COLOUR GROUP,LIST OWNED PROPERTY,LIST ALL PROPERTY,SELL
PROPERTY,BUY OR SELL HOUSES,MORTGAGE PROPERTY,END GAME
 3620 DATA1 PAY £50,2 ROLL DICE AND HOPE," FOR DOUBLES",3 USE A GET OUT OF," J
AIL FREE CARD"
```

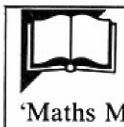

PET Maths Maze

by Daniel Lawson

'Maths Maze' is an educational program for a 4000-series Commodore PET. It is aimed at the primary school level.

The program presents the user with a maze. The child moves through the maze using the keys U)p, D)own, L)eft and R)ight, but before a move can be made, the child must solve an arithmetic problem. The program adjusts itself to the ability of the user by testing the score at the end of the maze. Less than 40% correct results in an easier maze, greater than 60% a more difficult one. Instructions are contained within the program.

```
 2 REM"MATHS MAZE 2"
 5 POKE144,88
 6 GOSUB9000
 7 POKE59468,14
 8 GOSUB8000
 10 B=0:V=0
```


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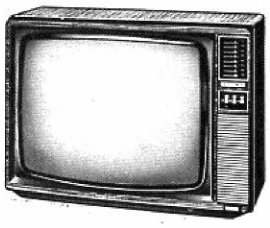

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PROGRAMS

```
 12 PRINT"■■■■■■ENTER DIRECTION YOU WISH TO GO"
 13 PRINT"■■■■■■■■■■■■■■ LEFT:Z RIGHT:X UP:P DOWN"
 15 M=33248
 20 FORA=33248TO33254
 30 POKEA,160
 40 NEXTA
 50 FORS=33254TO33054 STEP-40
 60 POKES,160
 70 NEXTS
 80 FORA=33054 TO33070
 90 POKEA,160
100 NEXTA
110 FORS=33070TO33190 STEP40
120 POKES,160
130 NEXTS
140 FORA=33062 TO33182 STEP40
150 POKEA,160
160 NEXTA
170 FORS=33254 TO33454STEP40
180 POKES,160
190 NEXTS
200 FORA=33454TO33458
210 POKEA,160
220 NEXTA
230 FORS=33458TO33338STEP-40
240 POKES,160
250 NEXTS
255 GOSUB5000
260 POKEM,77
270 GETQ$:IFQ$="" THEN270
280 IFQ$="L"THENM=M-1:M1=M+1
285 IFQ$="R" THENM=M+1:M1=M-1
286 IFQ$="D"THENM=M+40:M1=M-40
287 IFQ$="U"THENM=M-40:M1=M+40
289 IFM=33364 THEN500
290 IFPEEK(M)=32 THENM=M1
300 POKEM1,160
310 POKEM,77
320 X%=12*RND(1)+1
330 IFX%>4THENGOSUB1000
350 GOTO270
500 PER=((B-V)/B)*100:IFPER>=60THEN700
510 IFPER>=40THEN600
520 PRINT"■■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■"
530 PRINT"                                "
540 PRINT"■■OR GETTING LESS THAN 40% RIGHT YOU "
550 PRINT"■■SHALL BE RETURNED TO THE START."
560 IFVAL(Y$)>1THENPRINT"■■N A EASIER LEVEL.
":CO=VAL(Y$):CO=CO-1:Y$=STR$(CO)
570 FORO=1TO5000:NEXTO
580 GOTO10
600 PRINT"■■■■■■■■■■■■■■■■
```

PROGRAMS

```
1315 PRINT"■■■■                              "
1325 IFW=P%-L% THENRETURN
1330 PRINT"■■■■ANSWER= "P%-L%
1340 FORR=1TO500:NEXTR
1350 PRINT"■■■■                              "
1370 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1385 V=V+1
1390 RETURN
1400 PRINT"■■■■"L%"■- "P%"="
1410 GOSUB8100
1415 PRINT"■■■■                              "
1425 IFW=L%-P% THENRETURN
1430 PRINT"■■■■ANSWER= "L%-P%
1440 FORR=1TO500:NEXTR
1450 PRINT"■■■■                              "
1470 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1485 V=V+1
1490 RETURN
5000 FORA=33338TO33358
5010 POKEA,160
5020 NEXTA
5030 FORS=33348TO33228 STEP-40
5040 POKES,160
5050 NEXTS
5060 FORA=33230TO33215 STEP-1
5070 POKEA,160
5080 NEXTA
5090 FORS=33358TO33158STEP-40
5100 POKES,160
5110 NEXTS
5120 FORA=33150TO33159
5130 POKEA,160
5140 NEXTA
5150 FORS=33160TO33520 STEP40
5160 POKES,160
5170 NEXTS
5180 FORA=33520TO33505 STEP-1
5190 POKEA,160
5200 NEXTA
5210 FORS=33505TO33345STEP-40
5220 POKES,160
5230 NEXTS
5240 FORA=33360TO33364
5250 POKEA,160
5260 NEXTA
5270 RETURN
8000 PRINT"□■■■■■■■■■■■■■■■■NATHS MAZE"
8005 PRINT"■■■■■■■■■■■■■■■■
```

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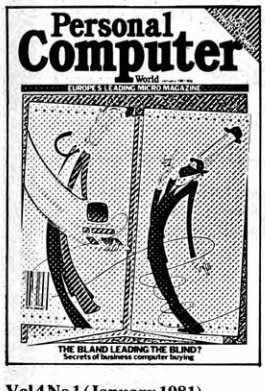

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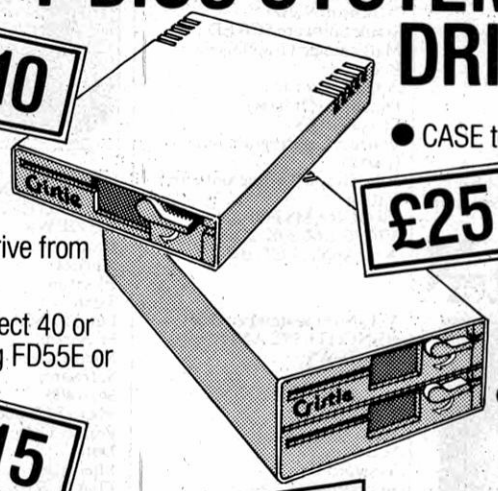

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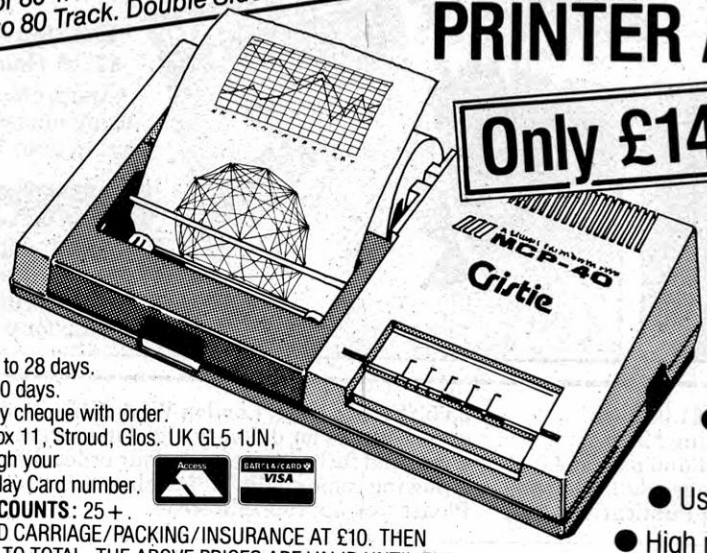

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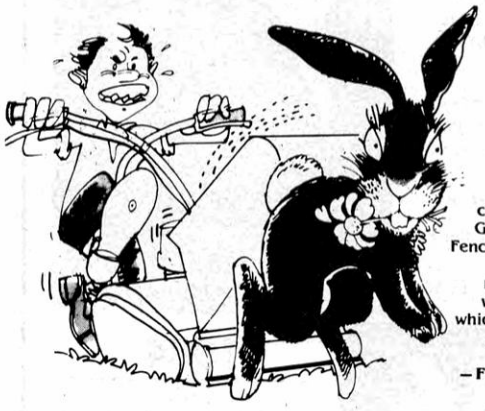

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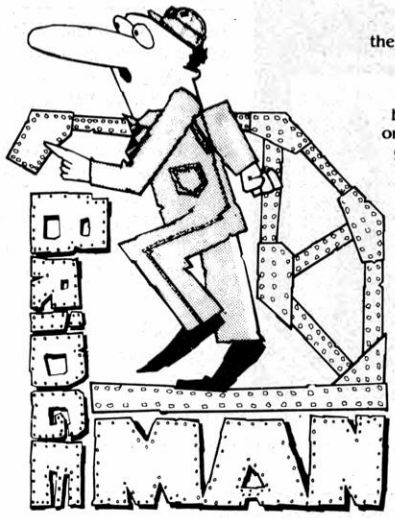

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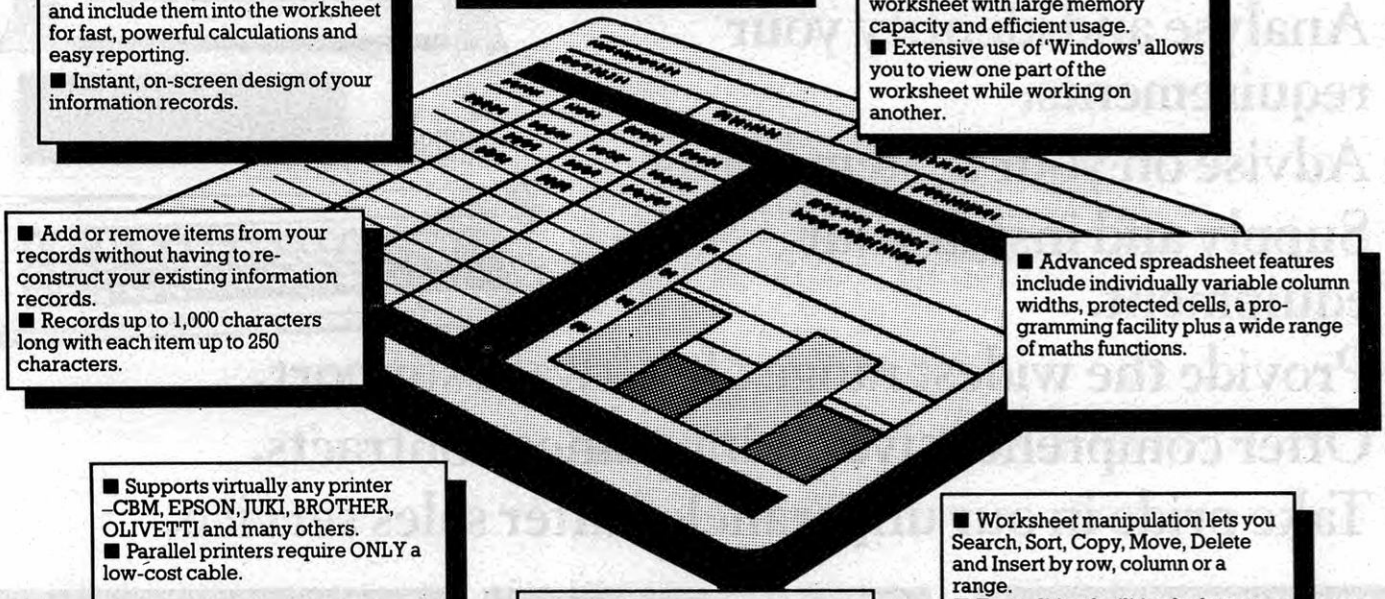

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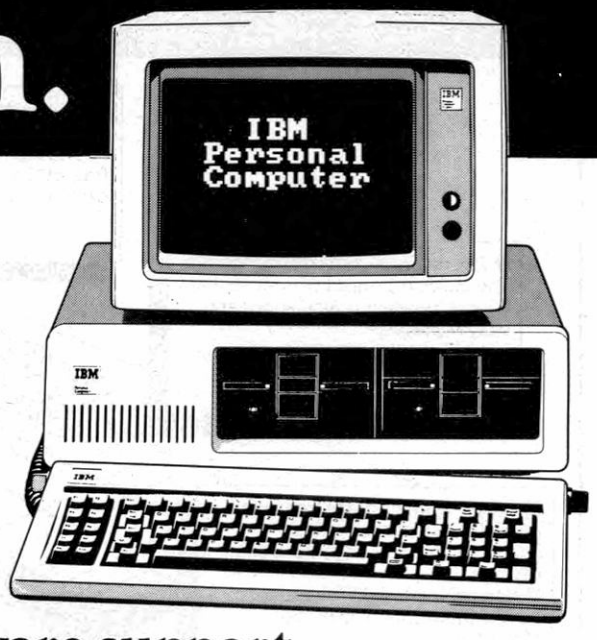

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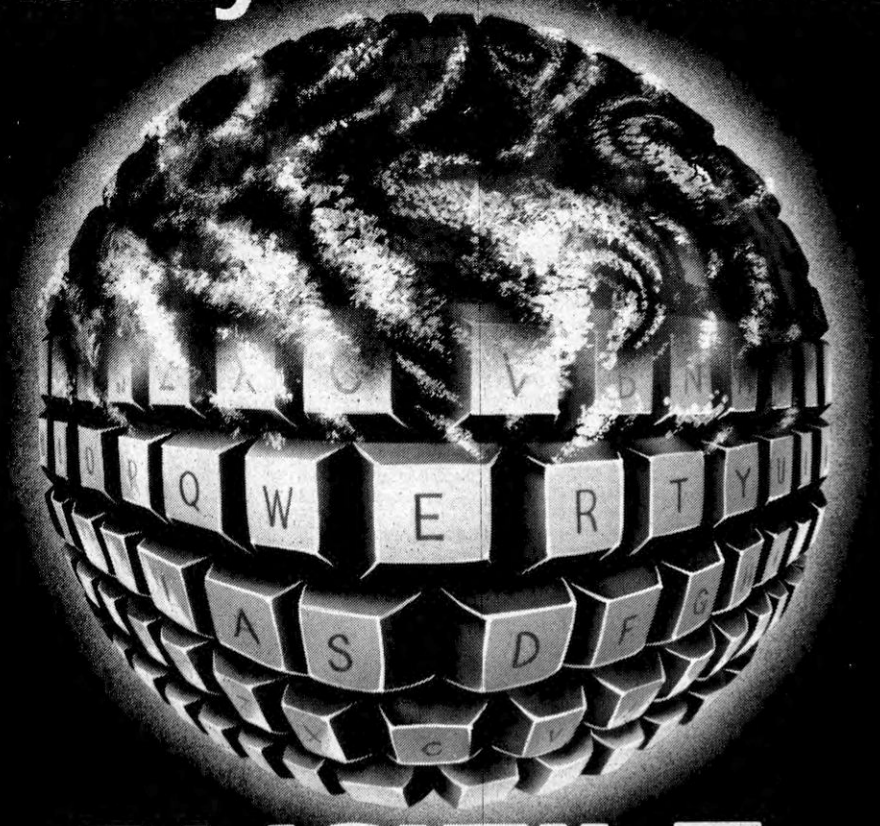

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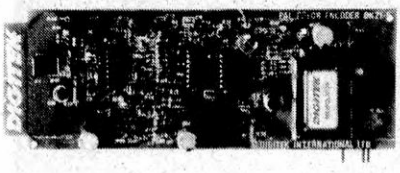

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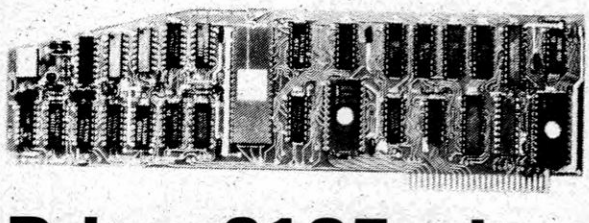

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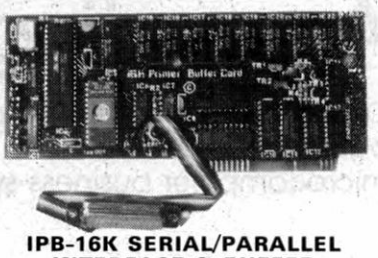

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Hardware – 32K RAM on the MTX500, 64K on the MTX512.

The MTX500 has 32K of user RAM as standard (64K on the 512), expandable to 512K plus 16K of video RAM, controlled by a separate Video Processor. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and 32 easily moveable user defined graphics characters (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 4 channel sound with hifi output plus a dedicated cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight 2-function keys and separate numeric pad.

Software

The MTX's 24K ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, MTX LOGO with screen display of the Z80 CPU registers, memory and program, which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to split the screen into a maximum of eight sections to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

The Disc Based Computers from Memotech

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- permits single disc CP/M operation

FDX – Floppy Disc System

1 or 2 5¼" Qume drives 500K unformatted, 347K formatted

HDX – Hard Disc System

5¼" Qume drive, 500K unformatted, 347K formatted, 5¼" Winchester which may be 5, 10, or 20 Mb

MTX500 £275 MTX512 £315

Disk Drives

100K disk drive	**£201.25**
200K single disk drive	**£241.50**
400K single disk drive	**£396.75**
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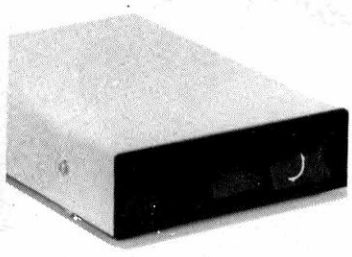

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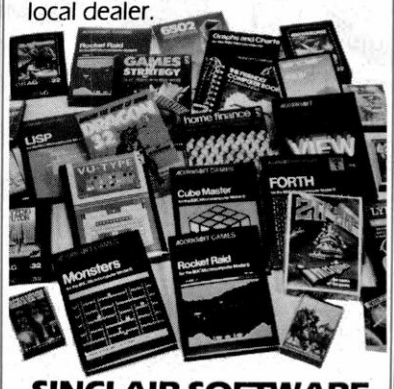

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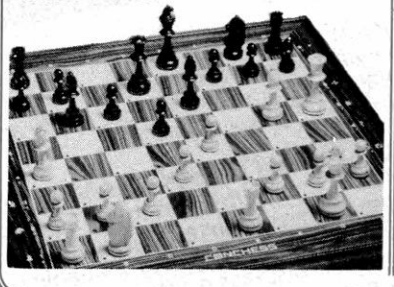

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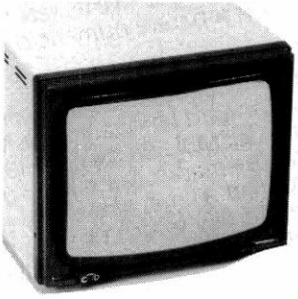

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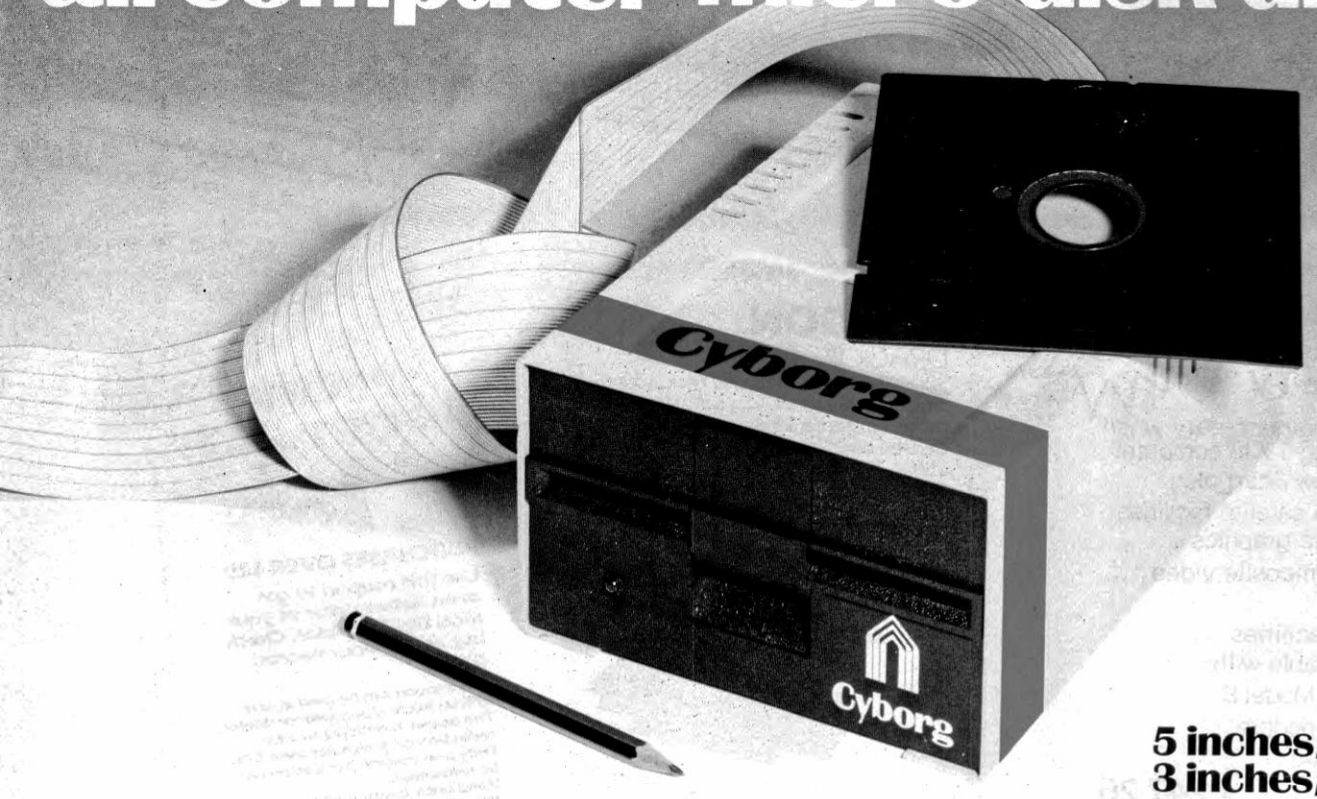

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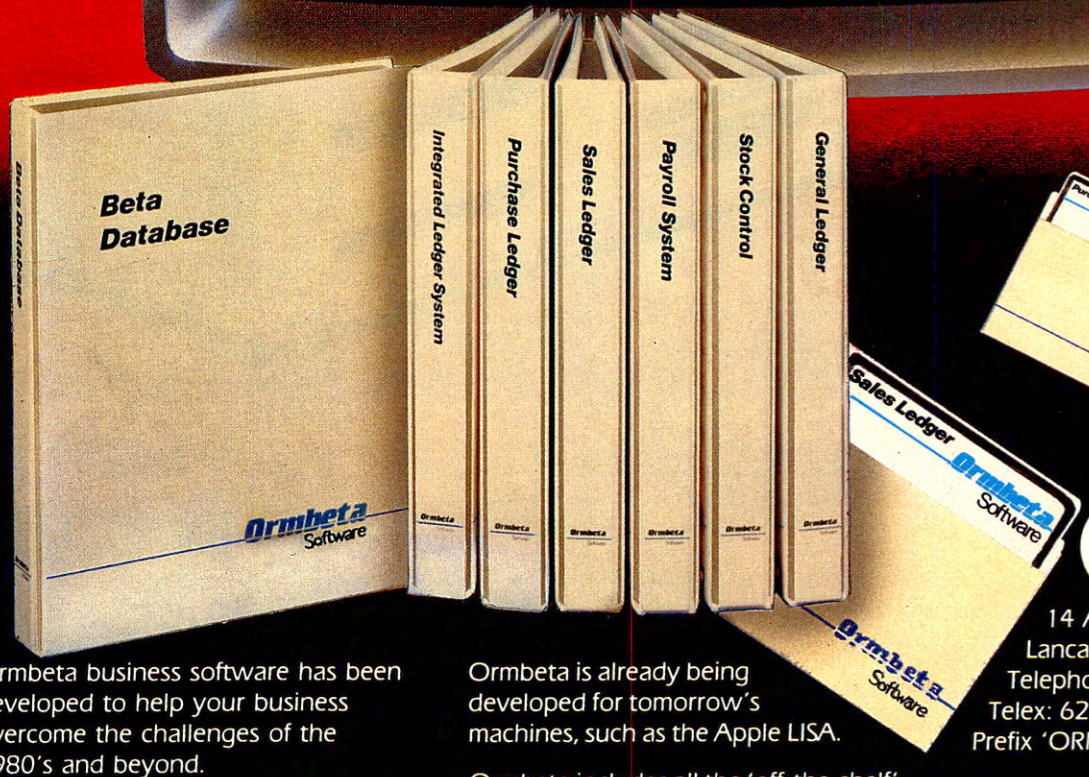





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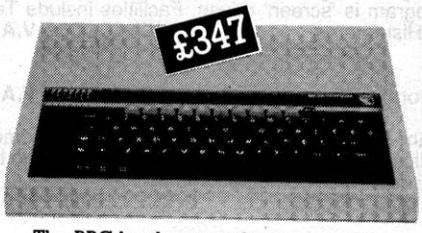

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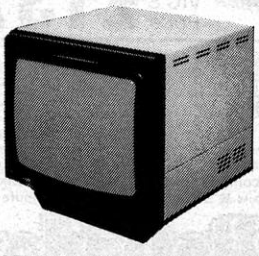

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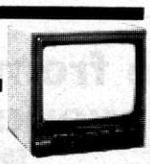

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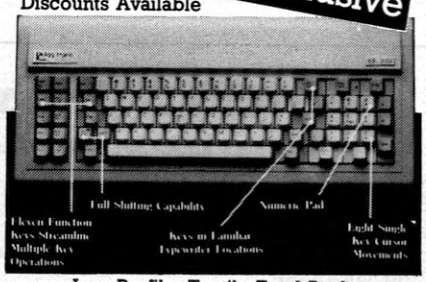

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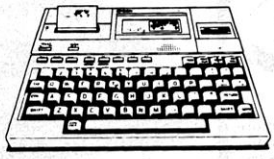

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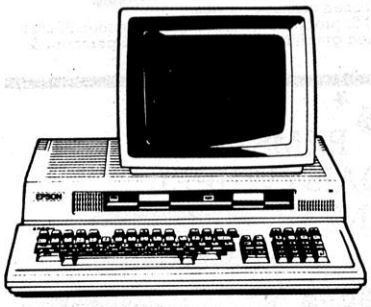

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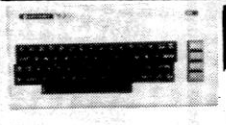

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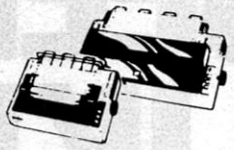

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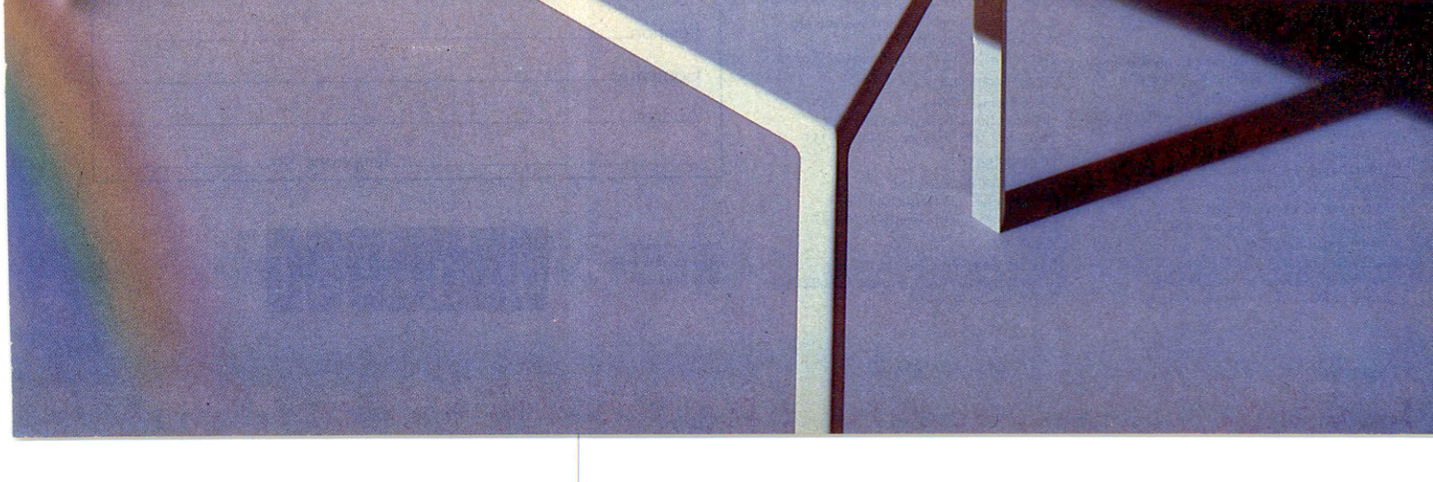

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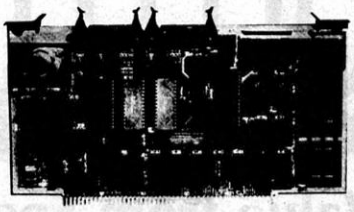

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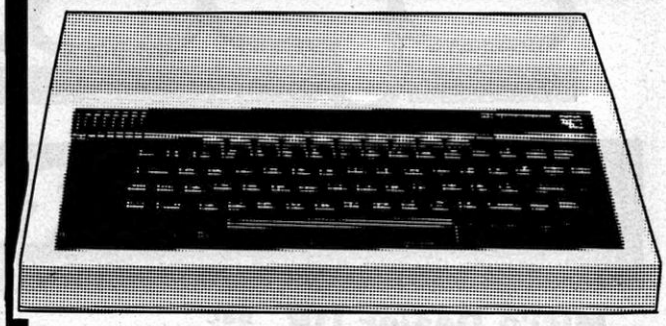

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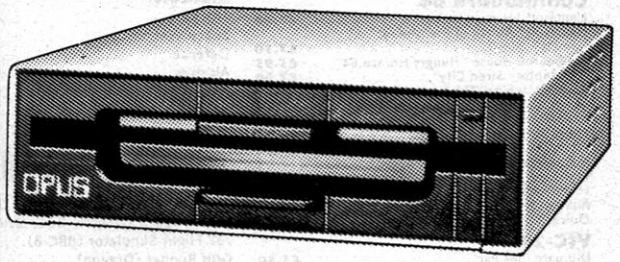

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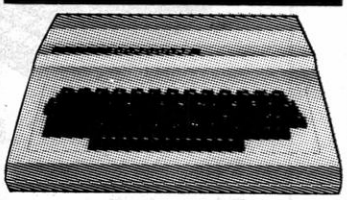

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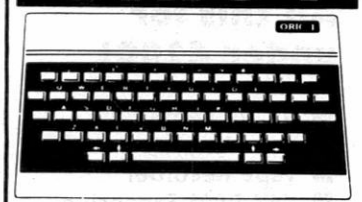

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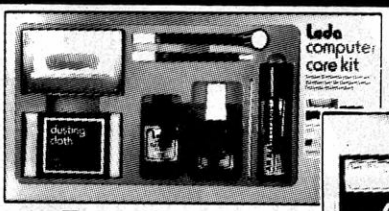

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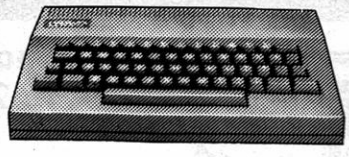

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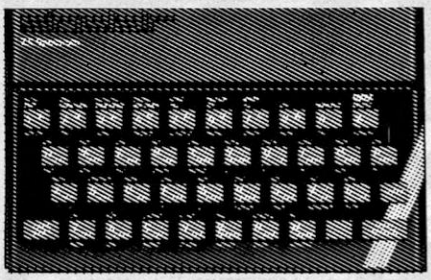

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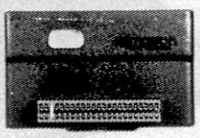

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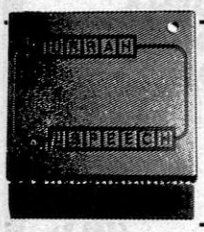

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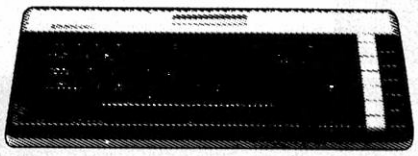

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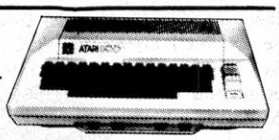

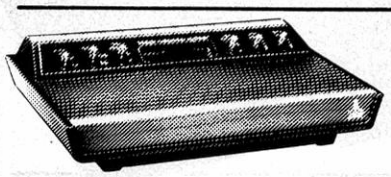

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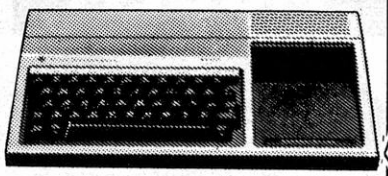

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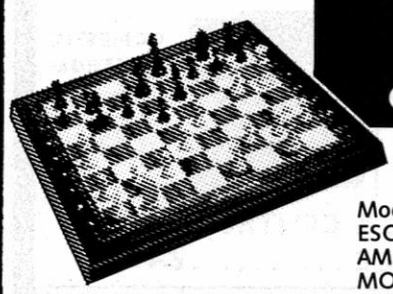

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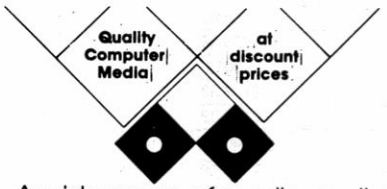

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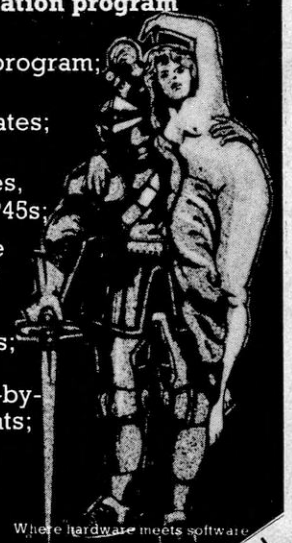

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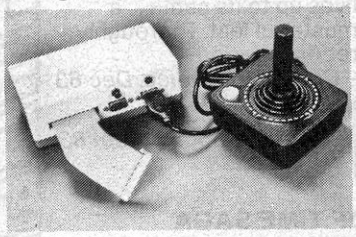

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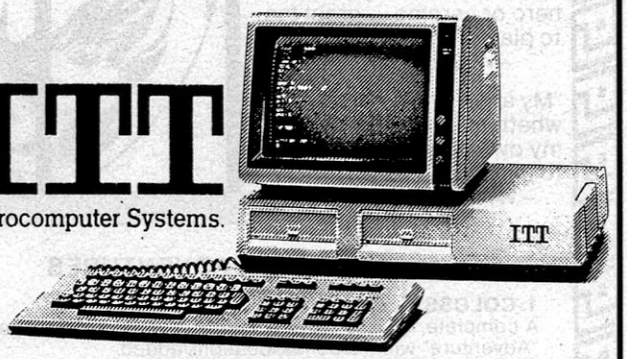

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Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."

– PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"

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Inside...

Setting new standards in educational software with Sinclair-Macmillan

Plus six other learning programs

TODAY, LEARNING IS A NEW GAME

Subsidised microcomputers are now commonplace as teaching aids for the very youngest children and the ZX Spectrum is prominent amongst those micros at use in schools.

In the relatively short time that the Spectrum has been at work in the classroom, two questions have been answered. Yes: with the right software, the micro can and does teach effectively and thoroughly (and gives teachers more time to devote to individual pupils). Yes: young children think little of working rapidly and successfully, with a screen and keyboard, on even quite complex subjects.

In this Sinclair Special we reveal a range of educational software specifically designed to make full use of these advantages. The programs produced by Sinclair in collaboration with Macmillan Education are fascinating. They deal imaginatively and most effectively with early reading skills and take a truly refreshing approach to basic science.

In the Blackboard range we've programs which bring a light-hearted clarity to the tricky matters of spelling and punctuation.

These programs are designed for use both at home and in the classroom. Each program is accompanied by full documentation which gives parents helpful advice and guidance on the educational objectives.

The programs covered on these pages represent only a fraction of the full and fast-growing list of Spectrum software. Be assured we'll keep you in touch with new developments as they happen.

David Park

David Park
Education Marketing Manager

NEW WAYS TO LEARN WITH THE ZX SPECTRUM™

Programs from Blackboard Software

The new range of educational programs from Blackboard Software makes learning an enjoyable process by involving the child in a game which teaches as it entertains.

Each program has a step-by-step example section and gives correct answers after a number of attempts. Vocabulary changes can be made, allowing each program to keep pace with the child's development. This flexibility can also be used in the classroom to cater for children of differing ability.

The instructive and colourful games which follow the successful completion of each group of sentences provide useful practice in letter recognition and increase familiarity with the Spectrum keyboard.

All programs are written for the 48K RAM Spectrum.



Alphabet Games

Three games of letter recognition (using either upper or lower case) to help children learn the alphabet and find their way round the computer keyboard.

Alphagaps — The full alphabet is displayed, along with a second, incomplete version. The child must fill in the missing letters.

Random Rats — Press the letter key that is displayed on the gun to destroy the rats which have invaded the cellar!

Invaders — Stop little green men from landing on Earth by pressing the appropriate letter.

Early Punctuation

While an animated matchstick man marches above displayed sentences the child must decide which punctuation mark is missing and where to insert it. At the touch of a key the matchstick man drops the mark into place. After successful completion of every sentence in the exercise, light relief comes in the form of a bottle-shooting game!

The Apostrophe

As each sentence is displayed, a bird appears with a worm in its beak. The keyboard is used to move the bird and drop the worm into the correct place for the apostrophe. When ten sentences have been corrected, the Grub Game is displayed. Press the correct character to change the grub into a butterfly...before it munches through a flower!

Capital Letters

A program to teach the use of capital letters. Sentences incorporating proper nouns and sentences without opening capitals are displayed. The child inserts the correction by guiding an animated figure to the appropriate letter.

For each correct answer an apple grows on a tree. After ten correct answers the child's skills in recognising letters and using the Spectrum keyboard are needed to save the apples as they fall to the ground.

Speech Marks

A comprehensive program including sentences with one or two sets of speech marks ("inverted commas") and exercises in both direct and reported speech.

Using the Spectrum keyboard, a cursor is used to guide speech marks to the correct position. The program offers three levels of difficulty, with full examples for each section. Guide Max the mouse through a maze, after the correct completion of five sentences from each section, but beware of Persian cats!

Castle Spellerous

A spelling game with ten levels of vocabulary, including words with silent first letters, double letters and other difficult words. The Princess has been captured and carried off to Castle Spellerous. Helped by ten soldiers, the child can attempt a rescue by giving the right answers. Part of a siege tower is built for each correctly spelt word. Mistakes are costly — the wicked wizard appears as a vampire bat, turning the men into frogs, butterflies and bats!

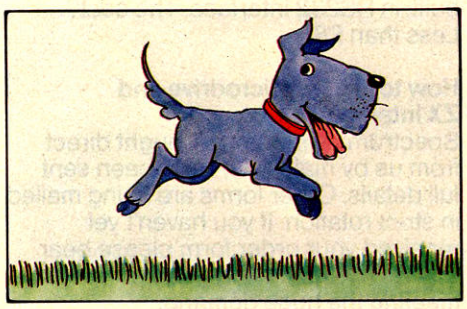
When ten words are spelt correctly the rescue begins and the wizard takes flight.

SINCLAIR + MACMILLAN: A NEW DIMENSION IN EDUCATIONAL PROGRAMS

Sinclair have joined forces with Macmillan Education to produce a completely new and different range of educational software. The results so far can be seen in these exceptional programs.

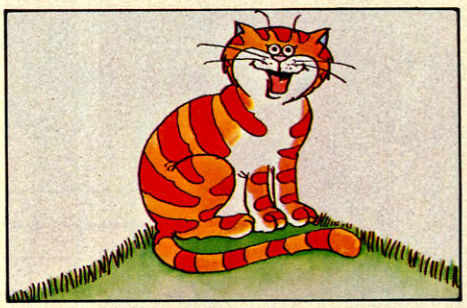
The Learn to Read series is derived from Macmillan Education's best-selling primary school reading scheme, Gay Way. It offers a unique opportunity for parents and teachers to participate in the child's first experience in reading.

Macmillan Education's Science Horizons is one of Britain's most successful school science schemes. Each program concentrates on key scientific ideas and, through simulation of real life, makes the learning process entertaining and enjoyable.



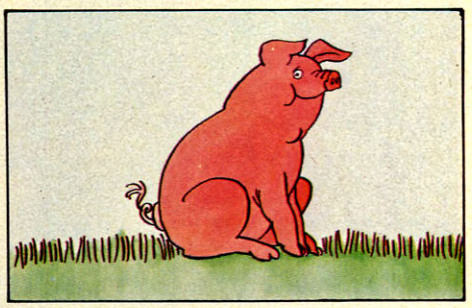
Learn to Read 1

Learn to Read 1 is designed for children who are just beginning to read. It is in four parts, each of which develops skills central to the reading process — letter recognition, sight vocabulary, early spelling and memory. The program is full of colour and fun and children will enjoy learning to read as they meet the animal characters — Ben the dog, Jip the cat and their friends.



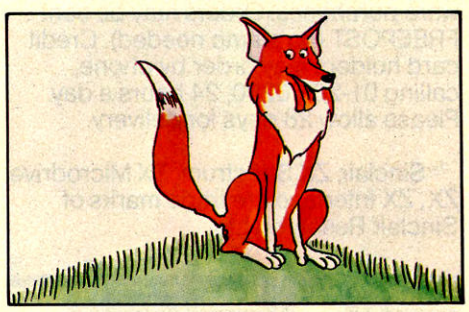
Learn to Read 2

Learn to Read 2 extends the fundamental reading skills practised in the first program, as well as encouraging logical thinking. The child's vocabulary is gradually built up as new words such as "red," "green," "car," "ship" and "bus" are introduced. In addition, Learn to Read 2 features an attractive 'reward' system enabling children to see their achievements grow.



Learn to Read 3

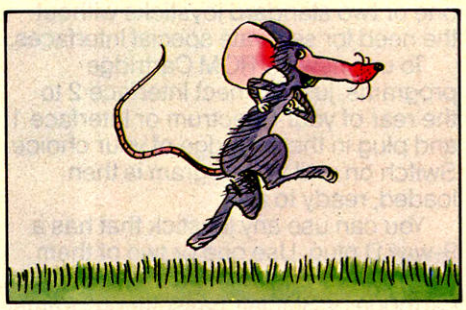
Learn to Read 3 builds on the child's progress so far, so that he or she can gain the confidence to move on through the complex reading process. Learn to Read 3 features four different activities, all of which are colourful and lively. Further vocabulary is introduced until the child is reading more than 30 words.



Learn to Read 4

Learn to Read 4 is the alphabet program in the Learn to Read series.

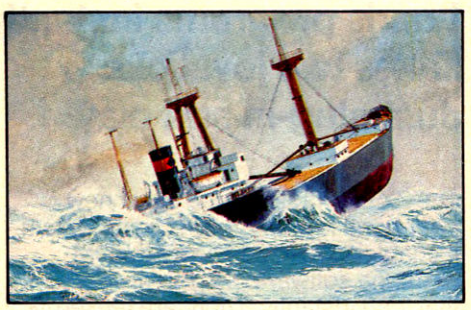
Using various stimulating activities the program gives the child plenty of practice in working with the alphabet — matching initial letters to words and pictures and spotting missing letters. These exercises build familiarity with simple sequences within the alphabet.



Learn to Read 5

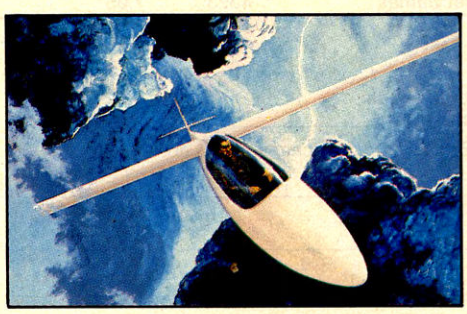
Learn to Read 5 teaches positional language — often difficult to understand and remember — by using words and phrases such as "behind" and "in front of," "inside" and "outside."

The program first demonstrates the meanings of the words using clear pictures. It then tests the child's understanding of the words in two lively games.



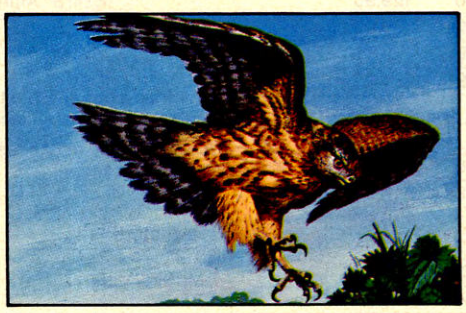
Cargo

Set sail around the world. Choose your ports of call — New York, Tokyo, Belem, Helsinki — then the real challenge begins! You must reach your destinations safely, weathering storms on the way. But first, load your cargo — using all your knowledge and skill. Poor loading can mean capsizing and sinking. Your rank, if not your life, is always at stake!



Glider

Be a glider pilot! The glider models real-life gliding conditions so that you can learn through experience. As the pilot you must consider the time of day, the amount of cloud cover and the kind of terrain below you in order to find the up-currents of air that will keep you airborne. Try to fly as far as possible and, when you are high enough, navigate your way back to your home airfield and land safely — if you can.



Survival

Discover what it is like to be an animal in the wild! Be a lion stalking your prey, escaping human hunters. Or be a hawk, mouse or even a butterfly, searching for food and avoiding predators.

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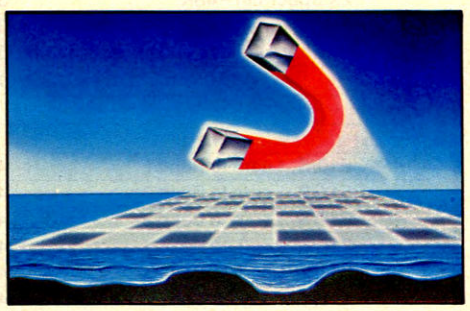

Magnets

With an army of small magnets you set out to conquer the powerful supermagnets of your opponent. You have one weapon — your forces of magnetic attraction and repulsion.

The strategy is simple: attract smaller magnets to build strength to repel the super-magnet. When cornered, just turn your poles on your enemy and see what happens!

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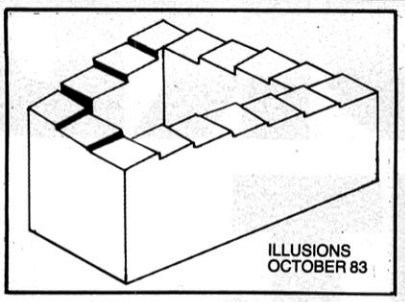

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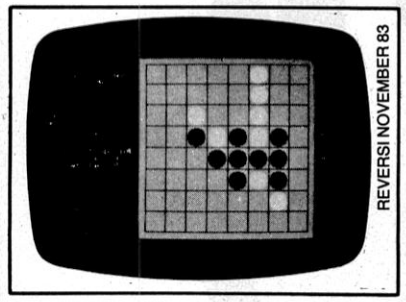

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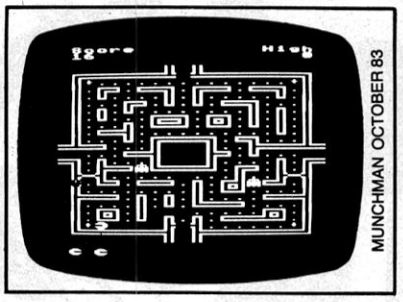

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November Issue: Program Features: **Reversi,** a challenging board game, **Lunar Escape,** and addictive arcade type game, **SNARFER,** a very useful disk recovery program, **SHAPER** for defining multiple character shapes, **RAPIDS,** another short game, **DEMOLITION,** a sizzling display with matching sound effects. Plus articles on a **Clock Display,** the **Teletext Mode** (part 2 of a series), an introduction to **Interrupt Programming,** a new **Mode 8** and The Beeb in Slow Motion. Plus **Extension ROM Board Reviews, Games Reviews, Book Reviews, M-TEC Torch Basic review.** Plus News, Hints and a new Competition.

December Issue: Program Features: **Killer Dice** game, **Galactic Invasion,** a fast moving space invasion game, **LINK,** a very useful disc utility for program development, **ASTAAD,** really excellent program for **Computer Aided Design,** the **Percussion Machine,** moving **Chequer Board** display, **Screen Freezer,** a routine to freeze your favourite game in mid-play, and a musical rendering of the **Twelve Days of Christmas** to add a seasonal flavour. Plus articles on the **Teletext Mode** (part 3) and **Fitting an External Speaker.** Plus **Disc Drive Reviews, Book Reviews,** Hints and Tips.

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BEEBUG has negotiated a deal with ACORN over the new 1.2 OPERATING SYSTEM ROM. BEEBUG members are offered the ROM at around half-price. See BEEBUG Feb. issue for details.

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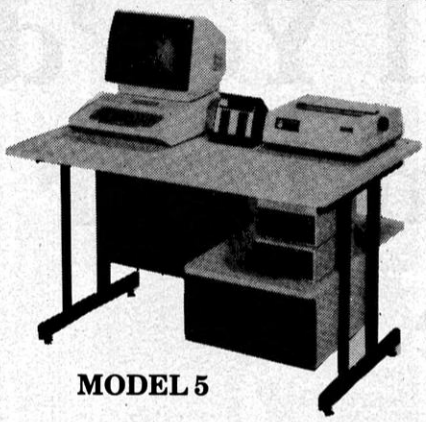

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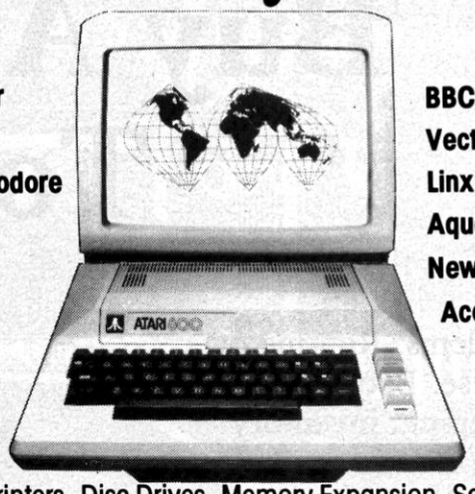

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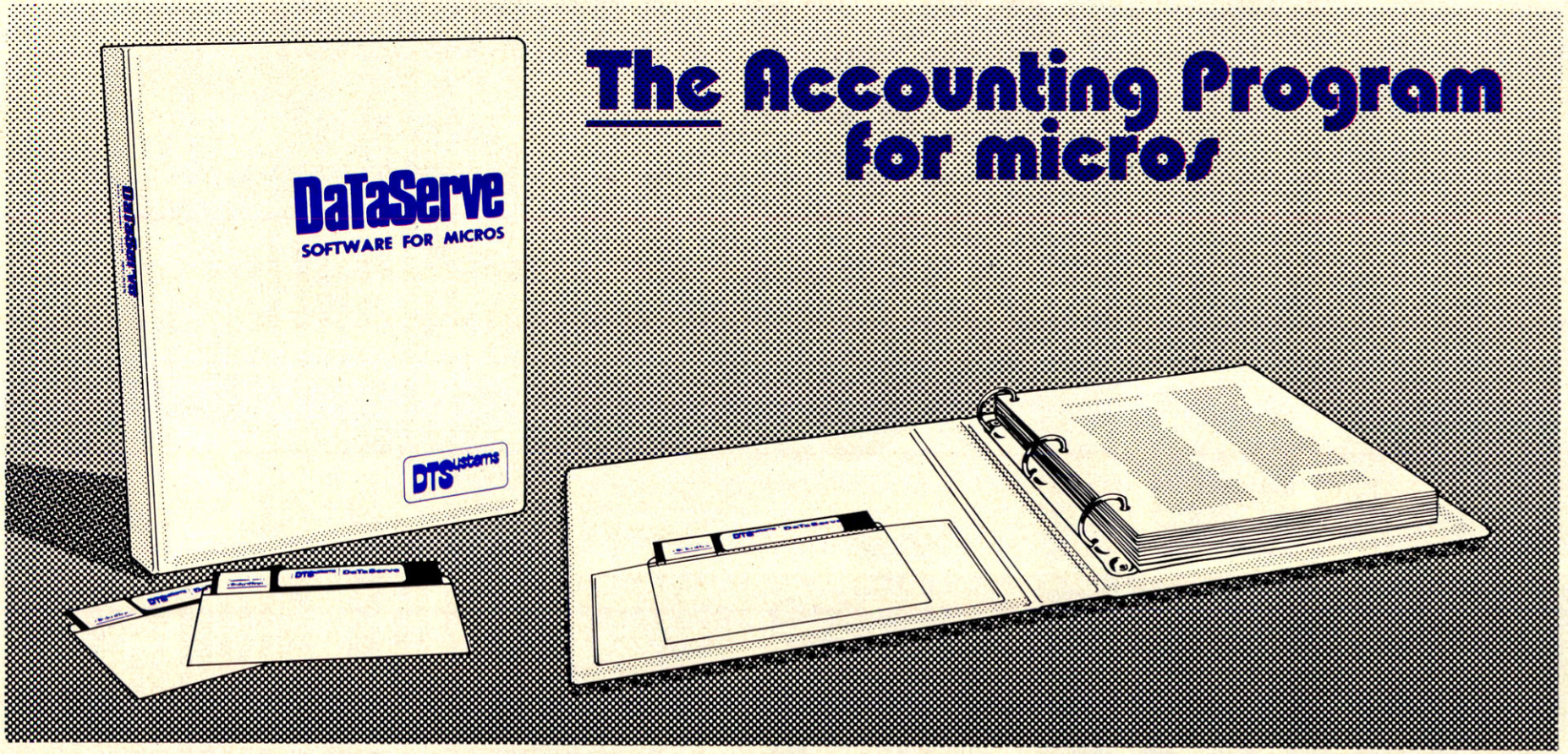

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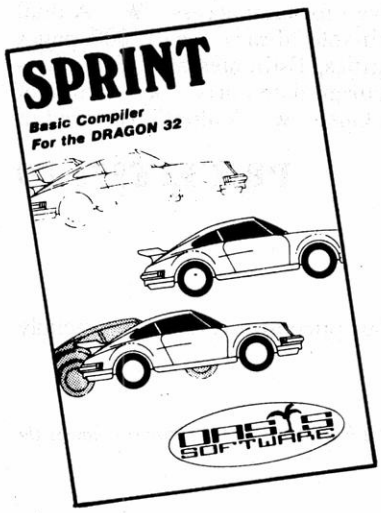

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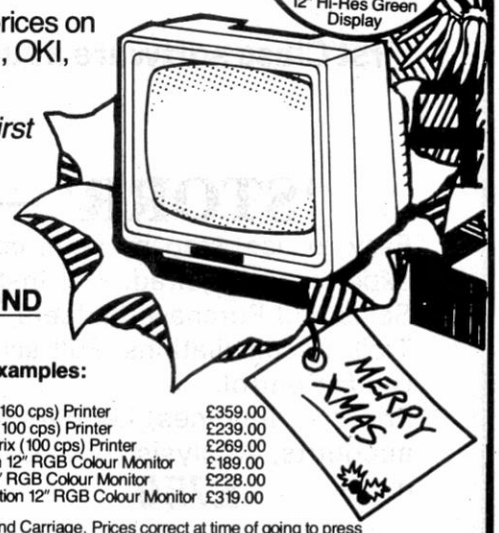

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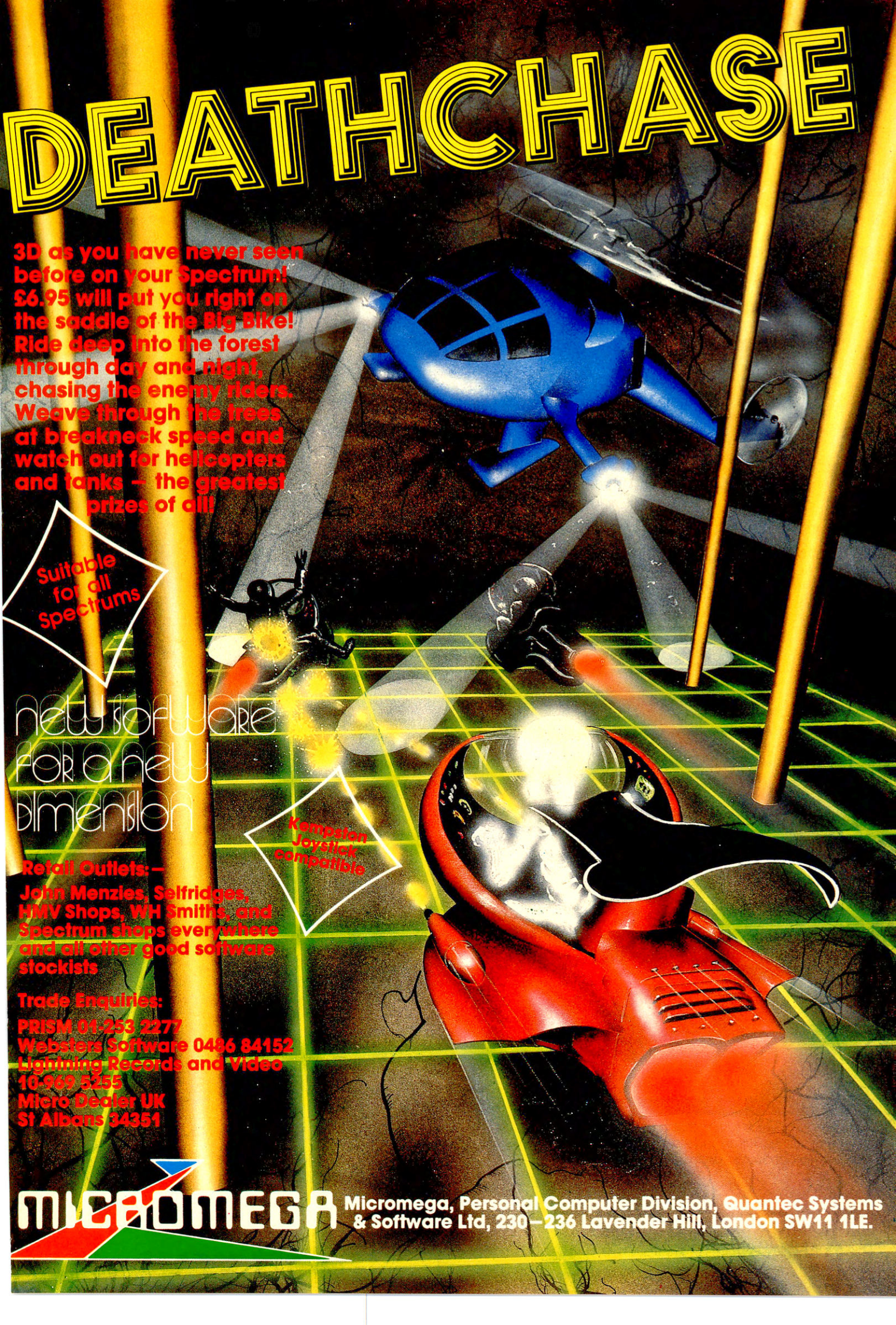
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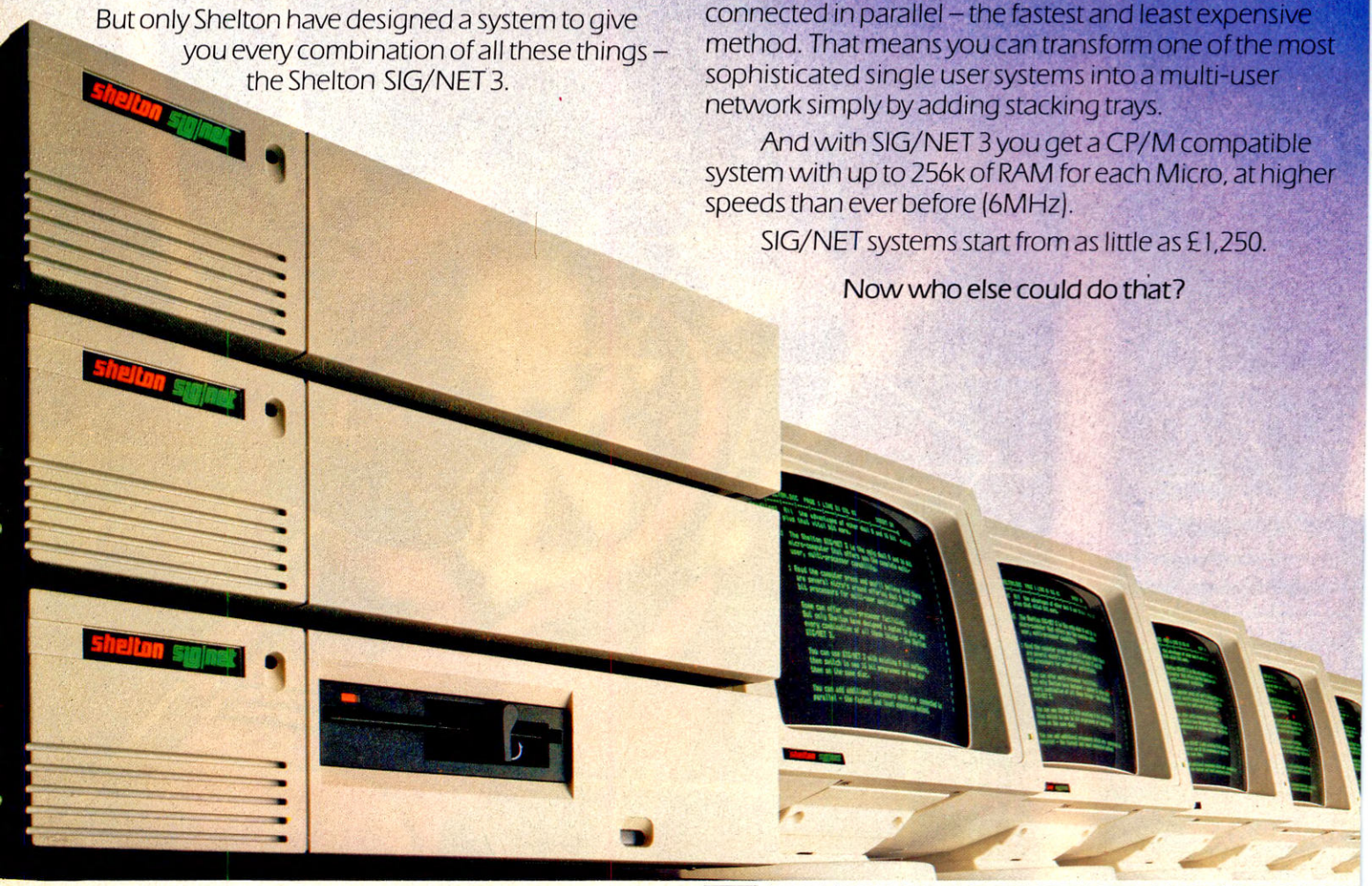

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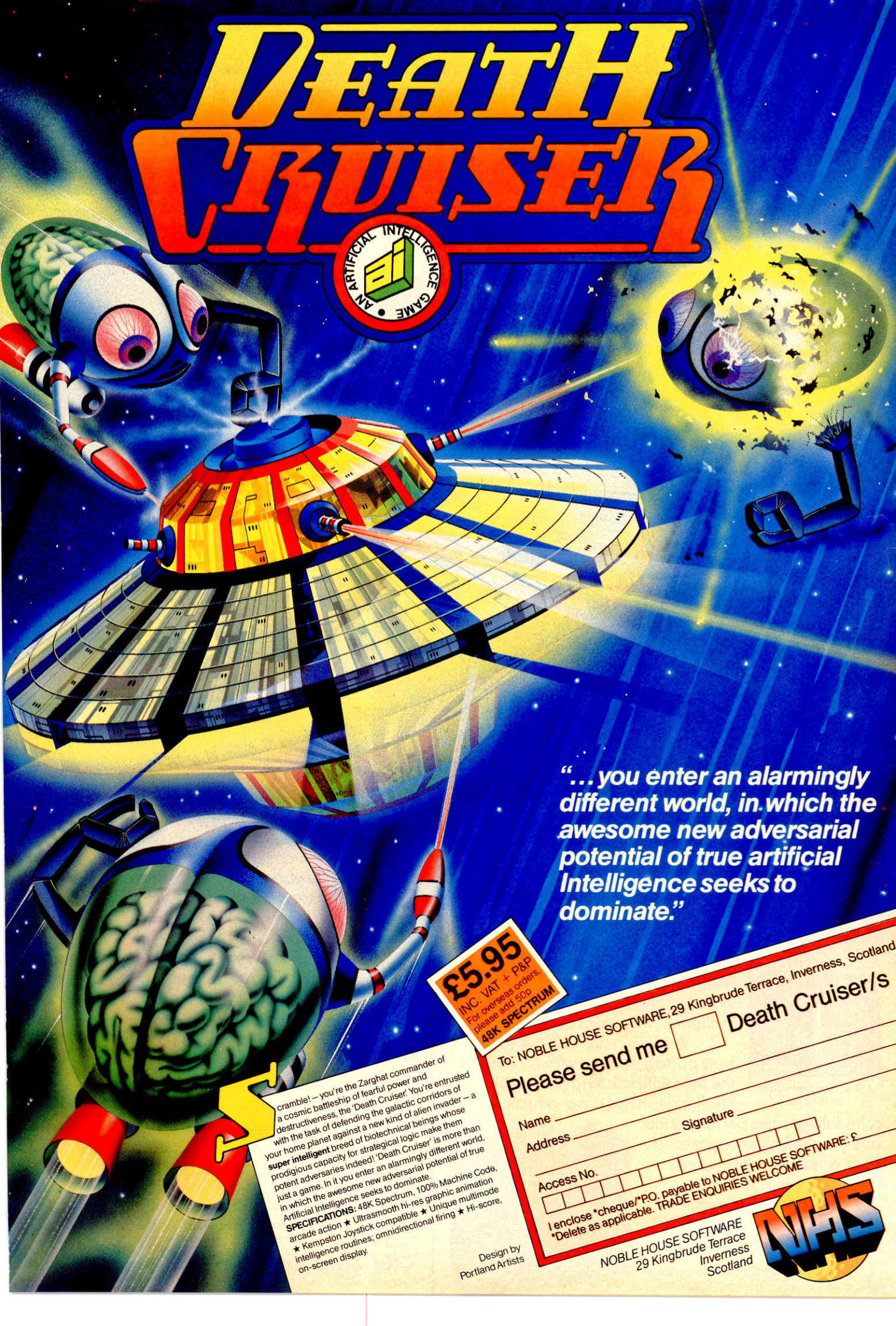
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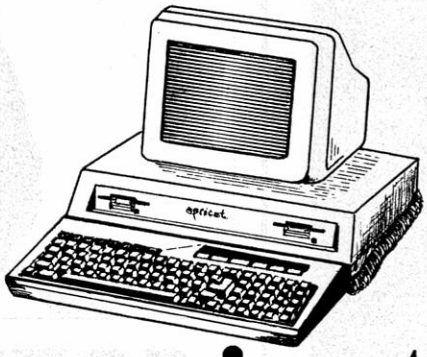

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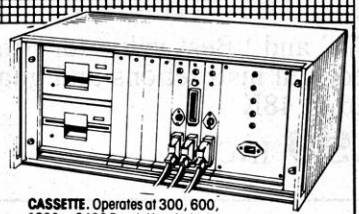

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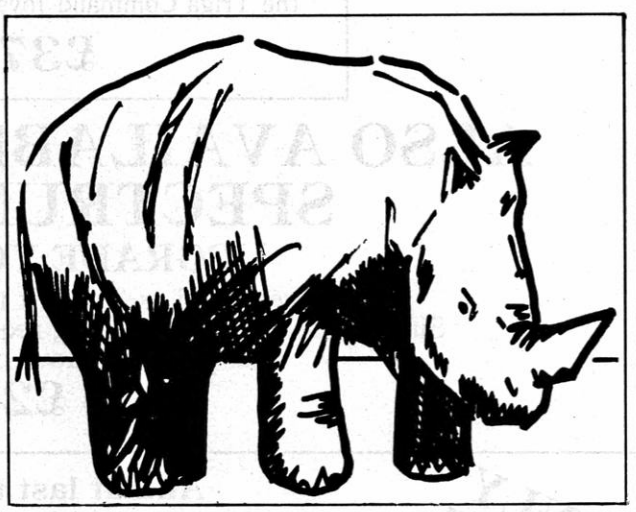

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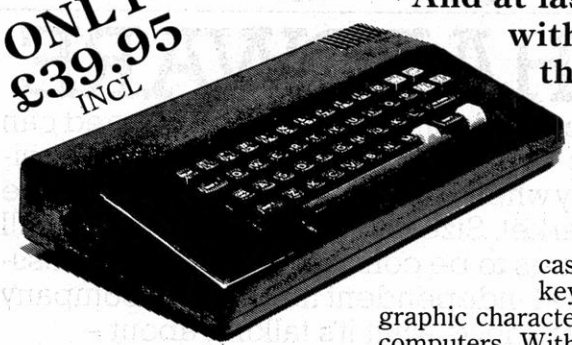

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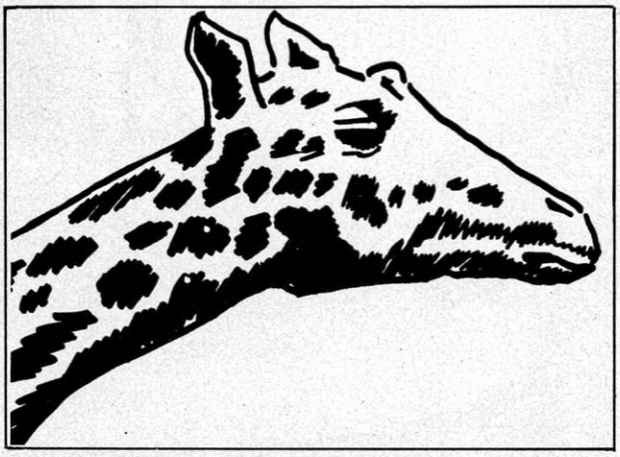

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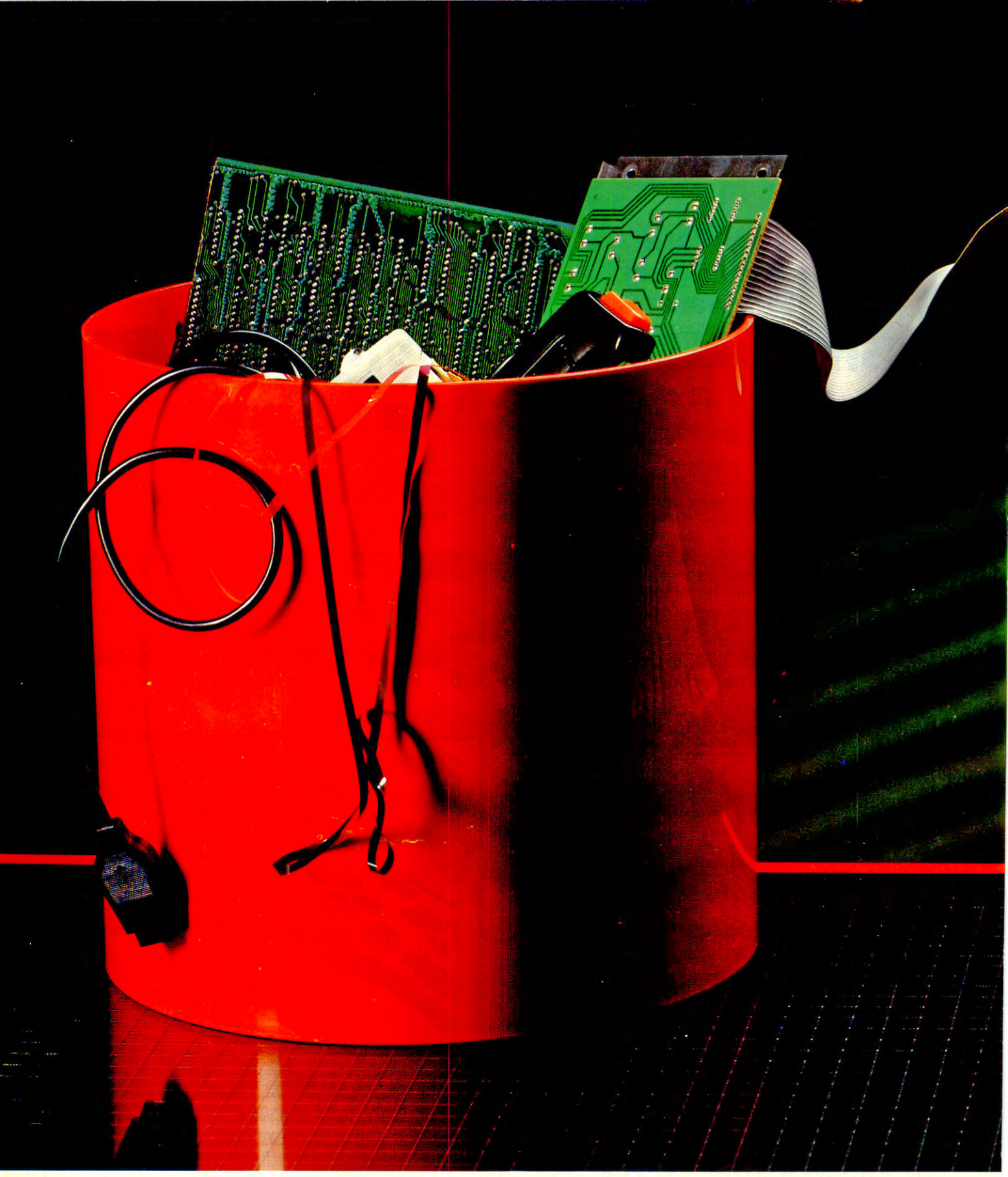

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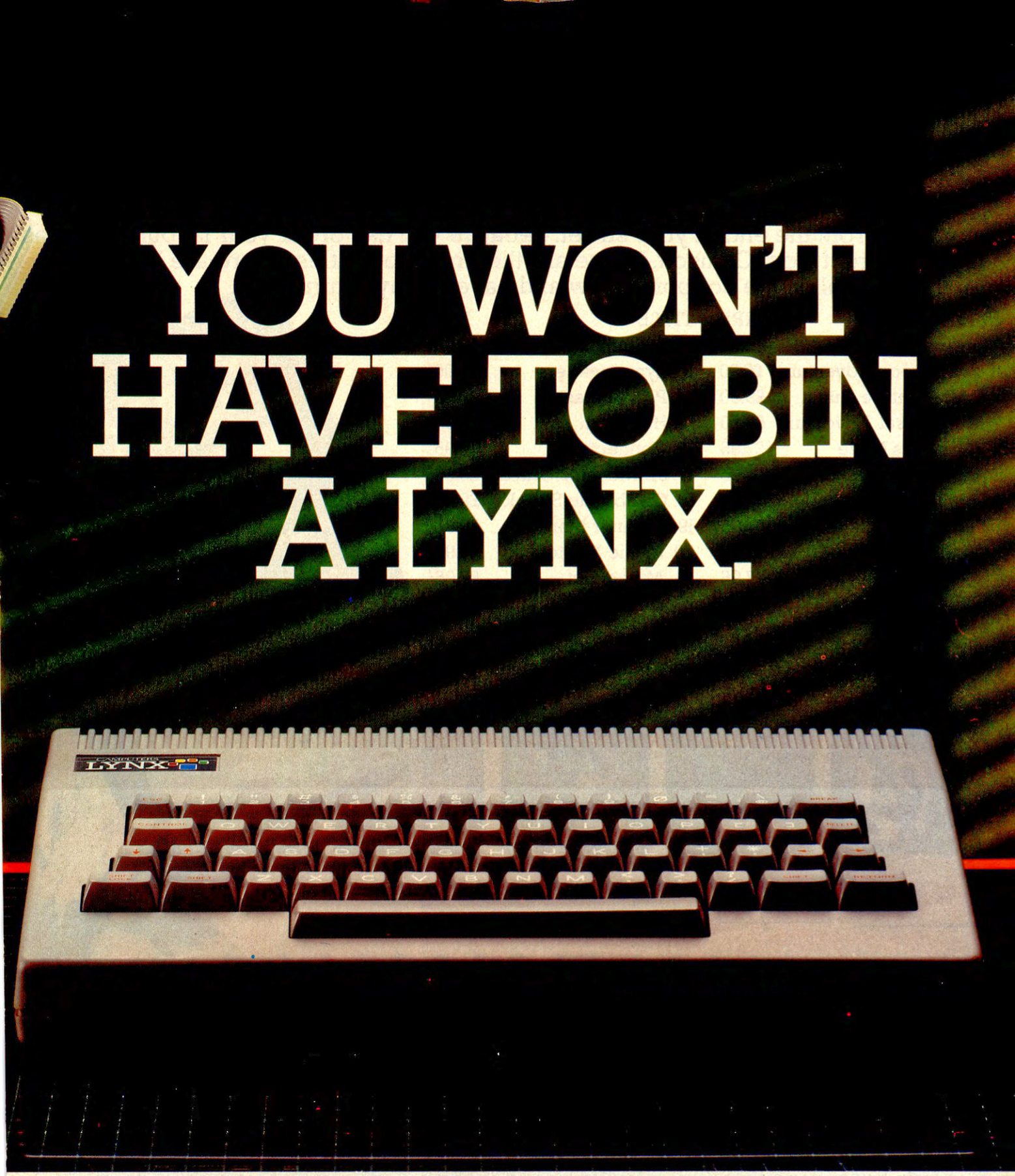

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*CP/M is the trademark of Digital Research Inc.

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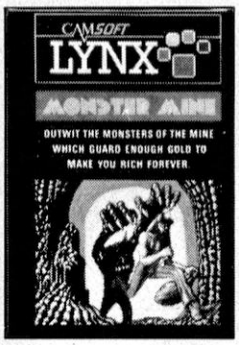

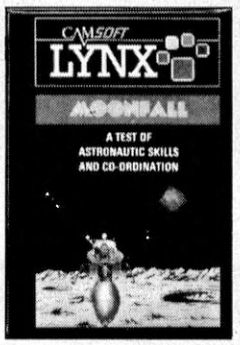



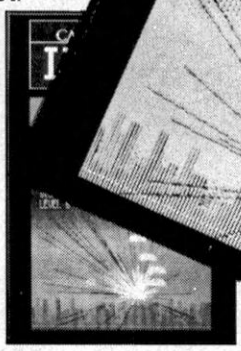

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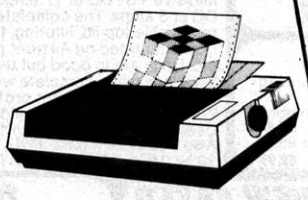

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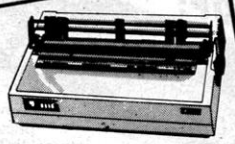

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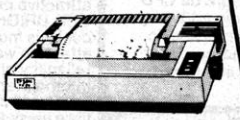

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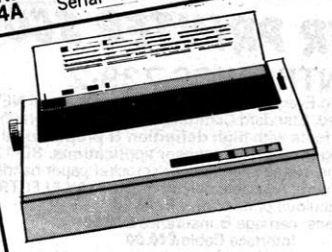

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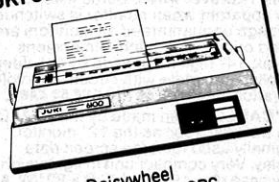

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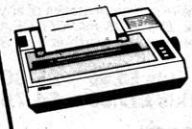

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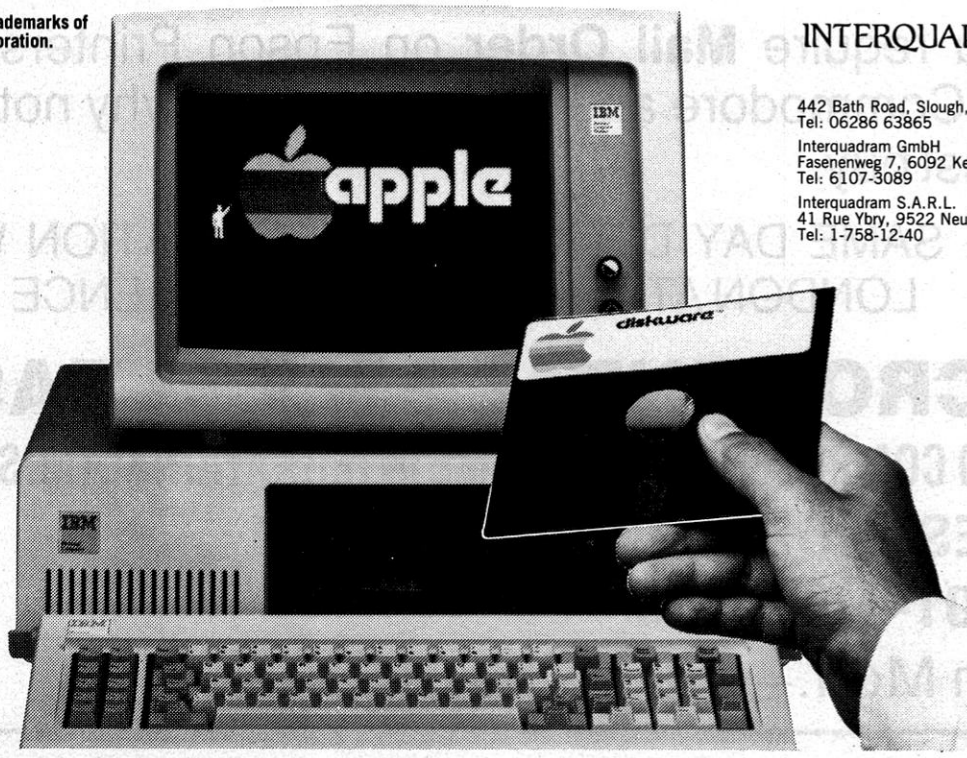

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L — Load buffer from current filing system file for transmission to modem.

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V — View current buffer contents on screen — display speed may be varied, or paused with optional dumping to printer.

T — Toggle screen mode : normally mode 7, 80 columns available in mode 3.

O — Output buffer to modem — speed may be varied to suit particular modem speeds.

M — Issue any MOS command from within COMMSTAR eg. *FX8,3 (ie set RS423 baud rate).

C — Exit menu to 'chat' mode to allow conversational access to bulletin boards.

W — Wipe buffer prior to use of other buffer commands if necessary.

E — Echo on/off — set echo on when using host terminals which do not provide an echo.

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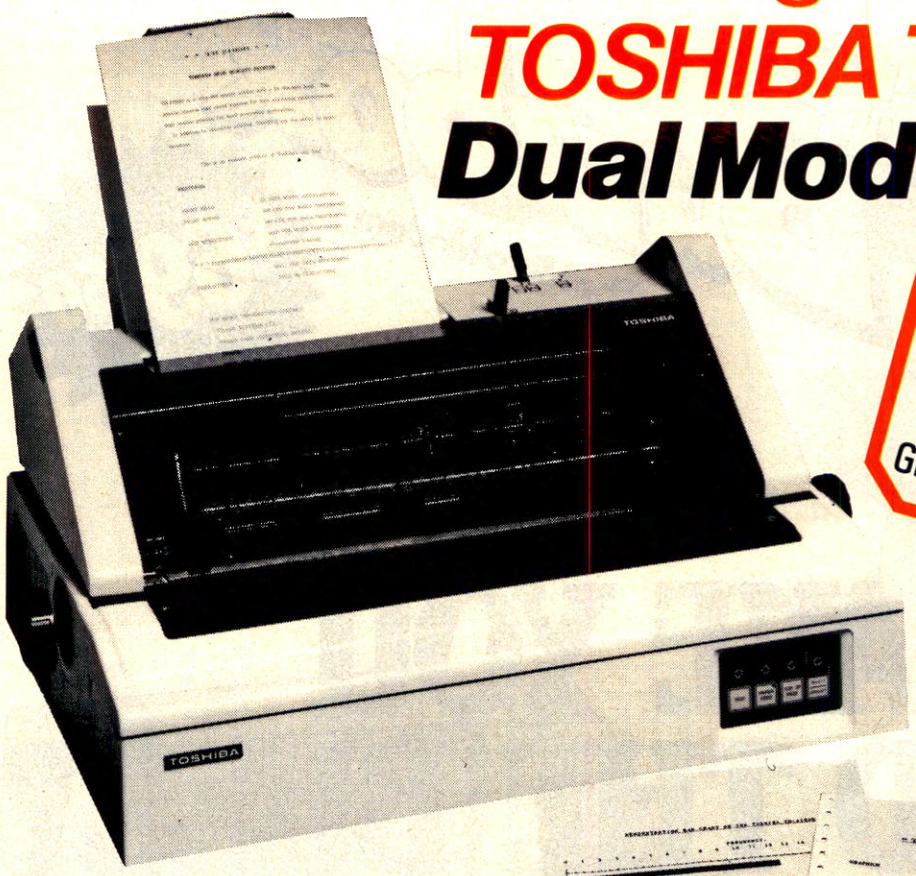

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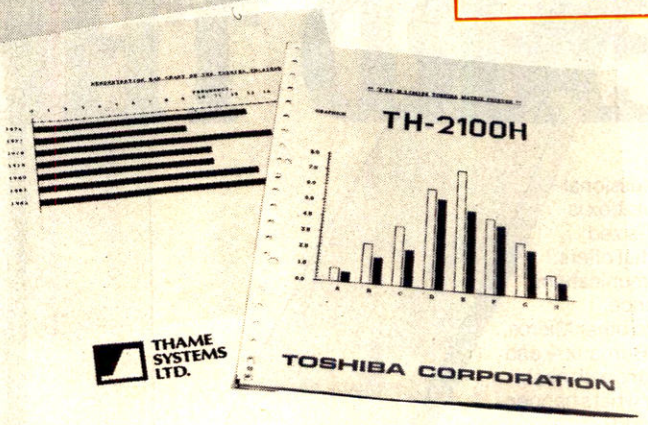

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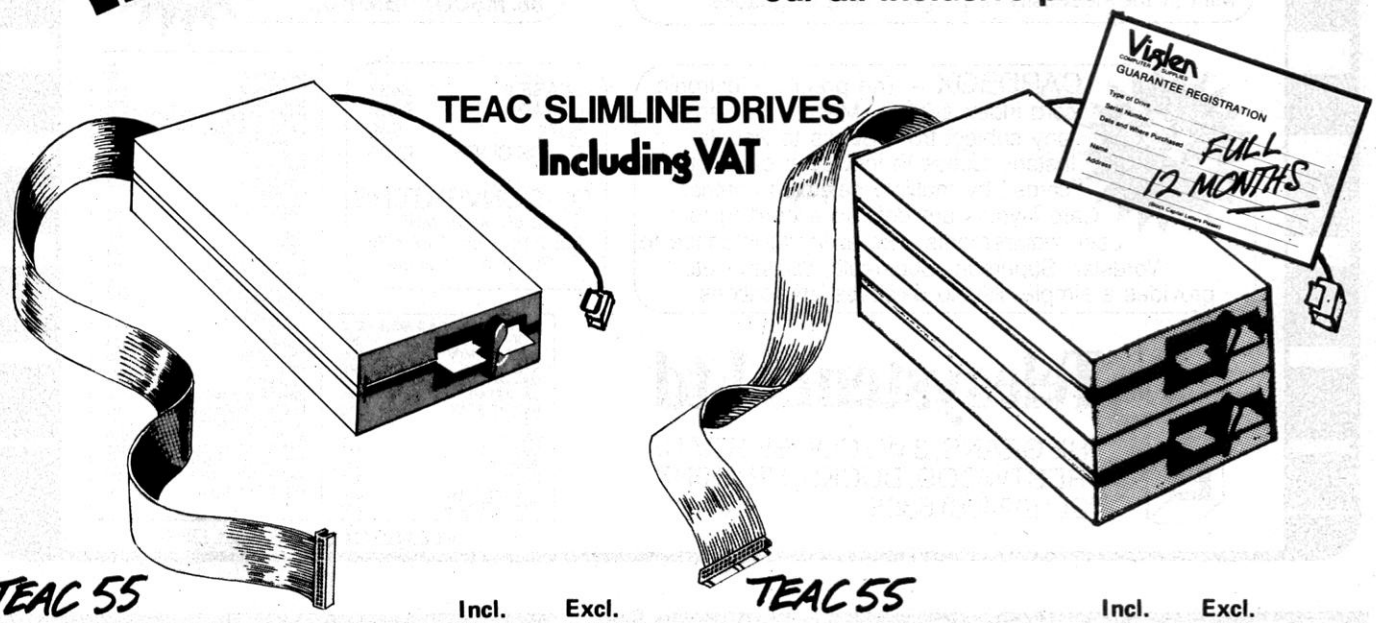

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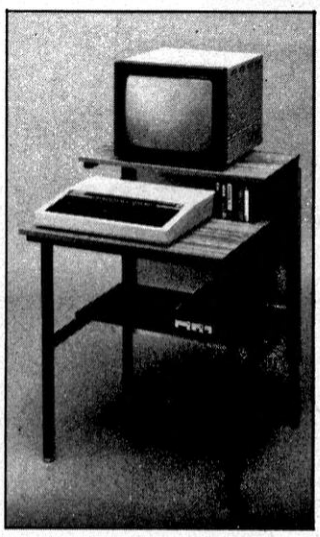

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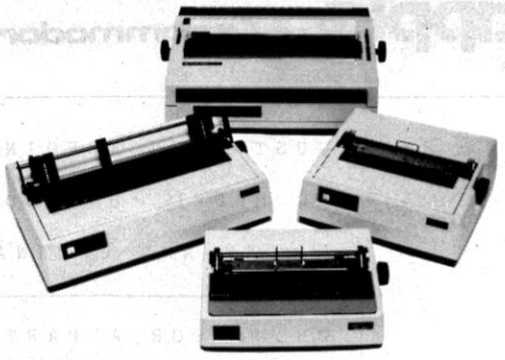

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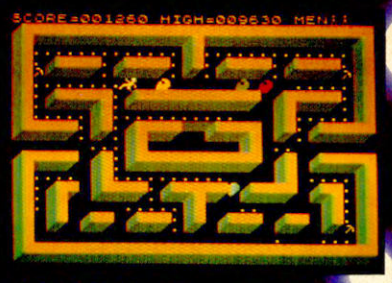

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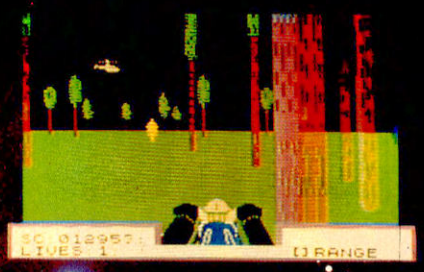

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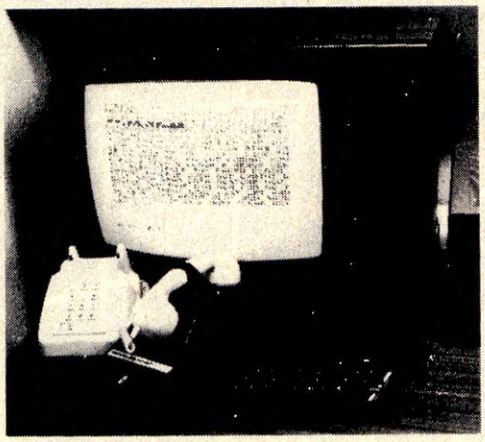

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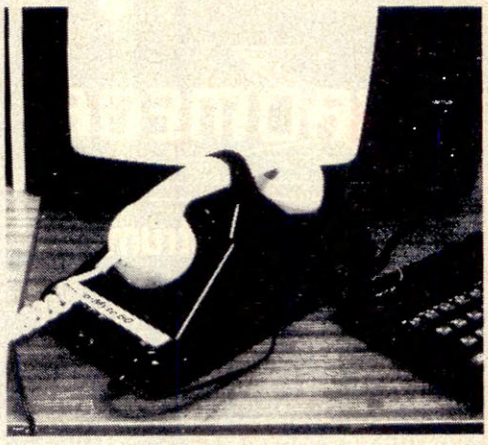

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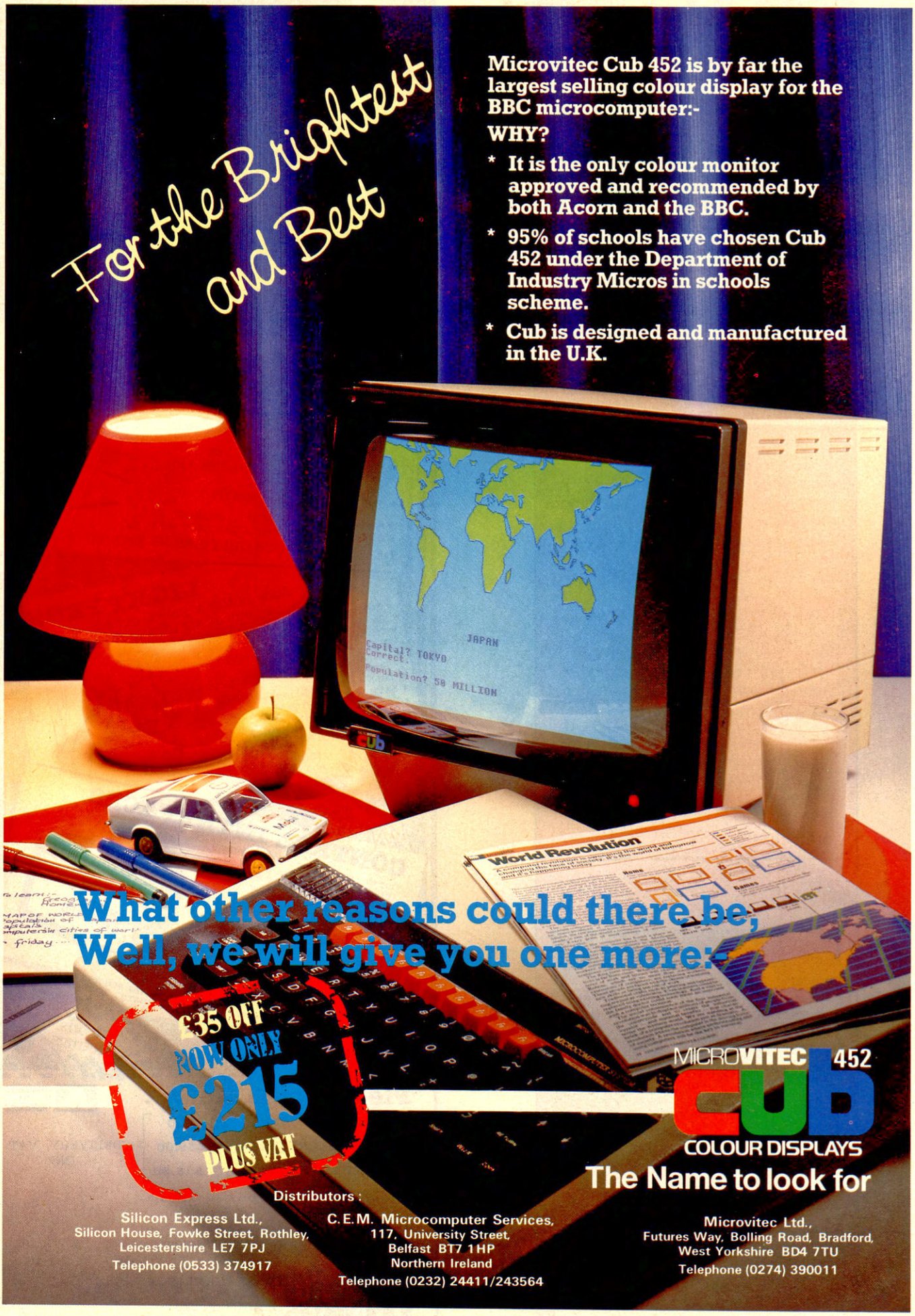
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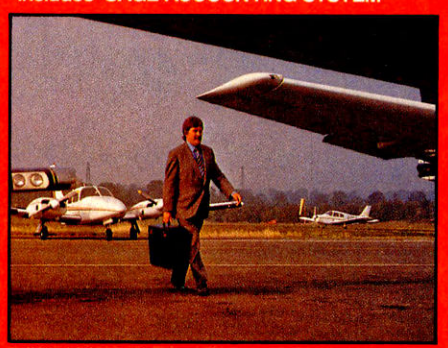

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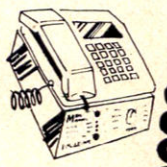

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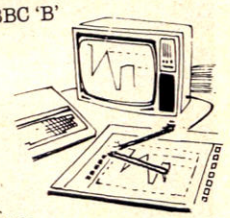

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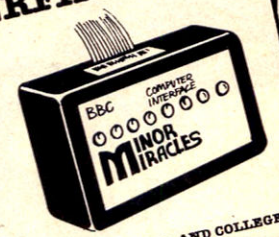

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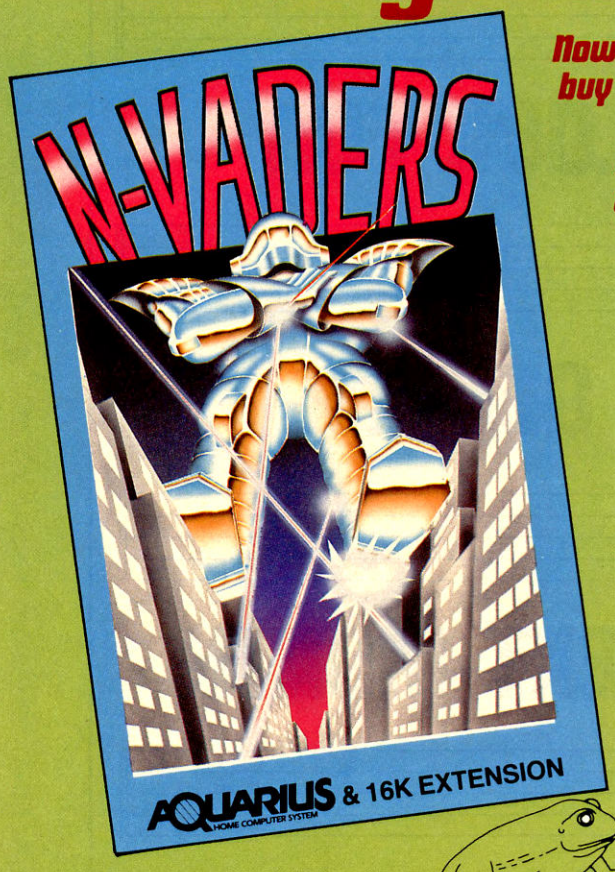

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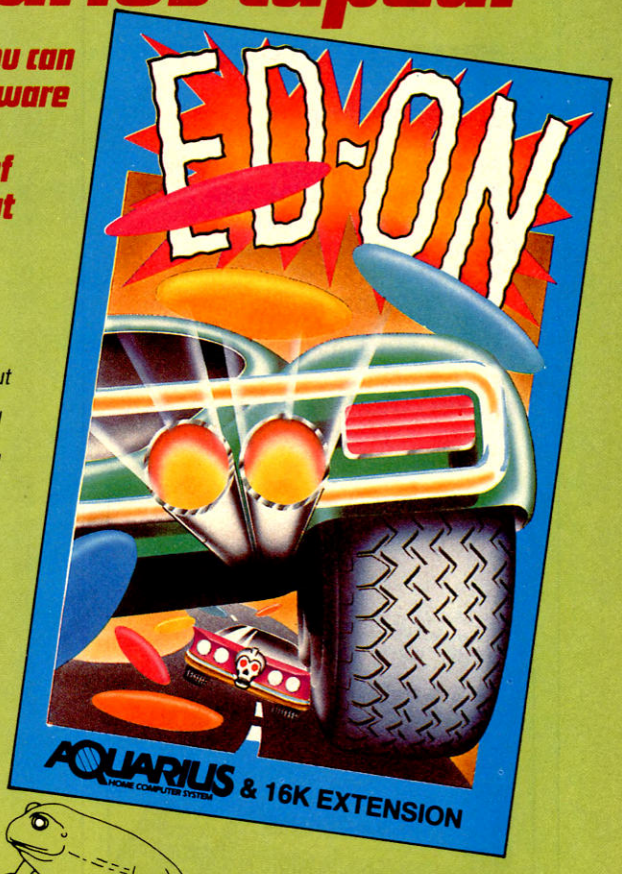

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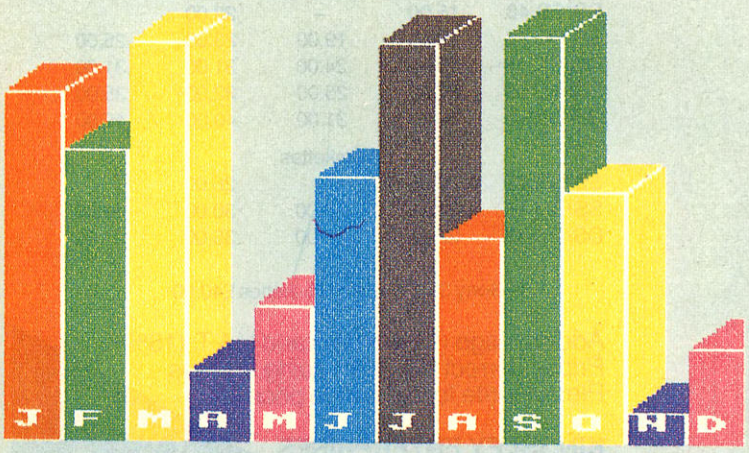

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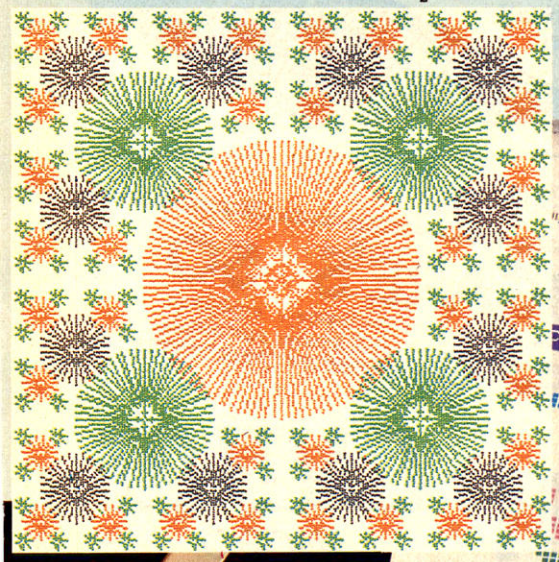

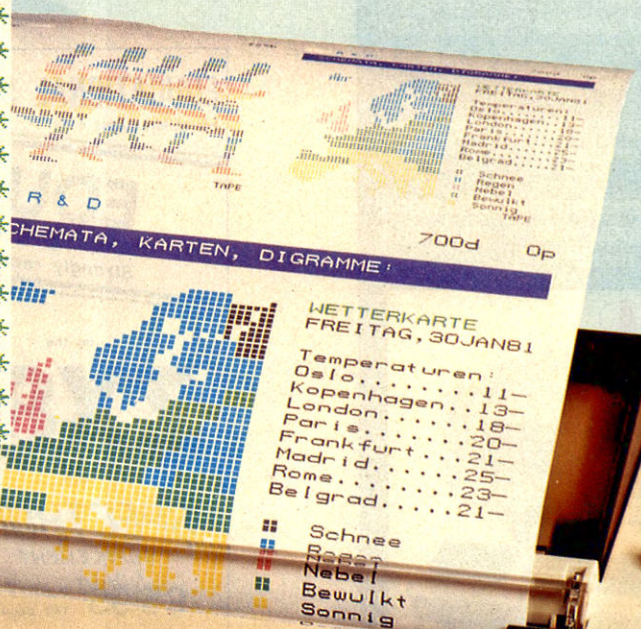

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one, two, three

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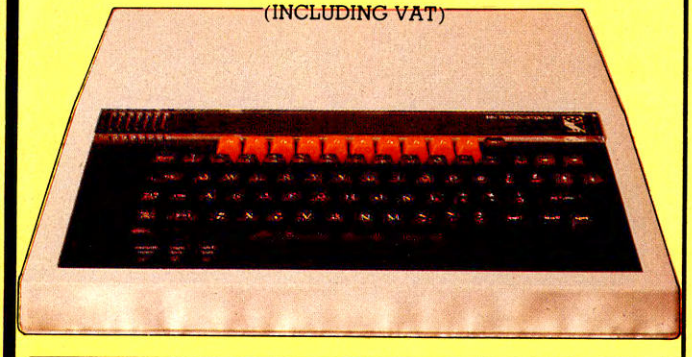

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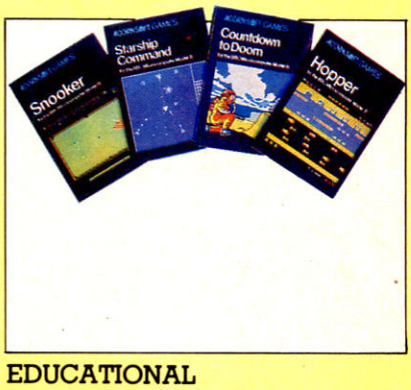

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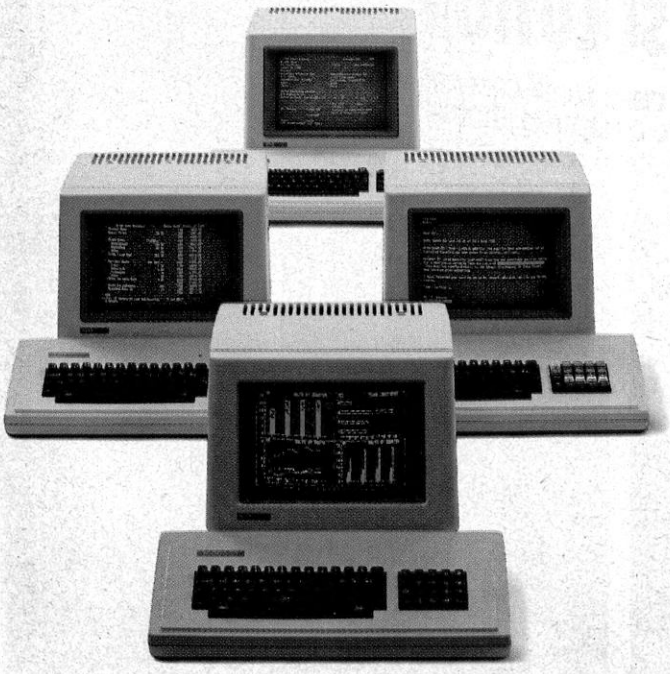

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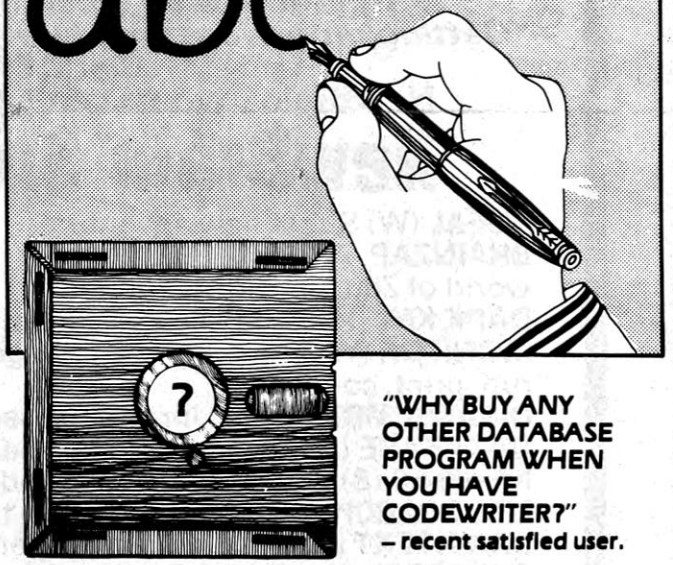

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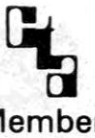

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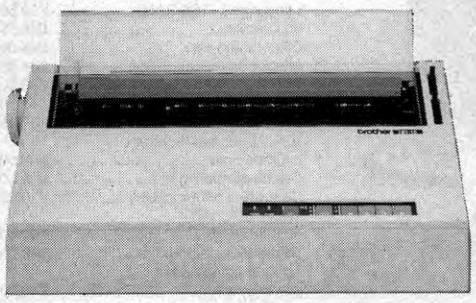

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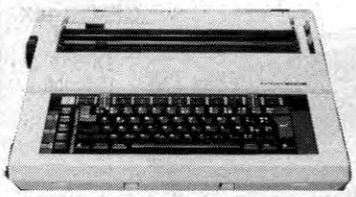

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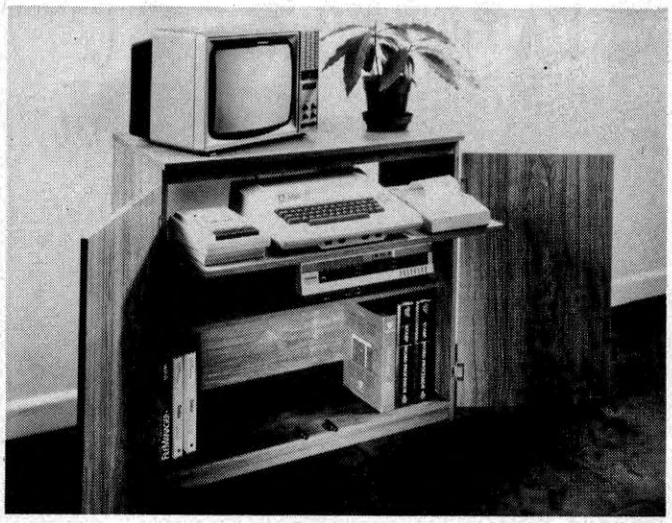

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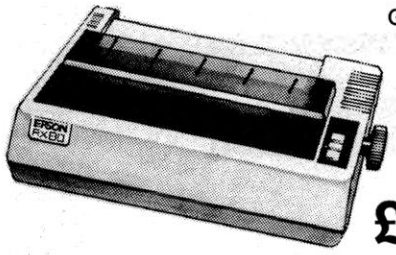

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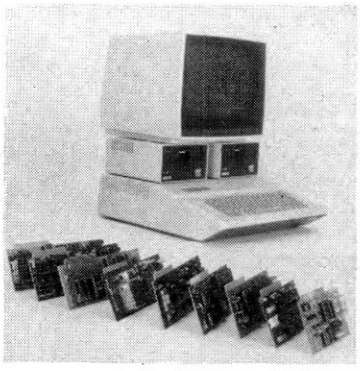

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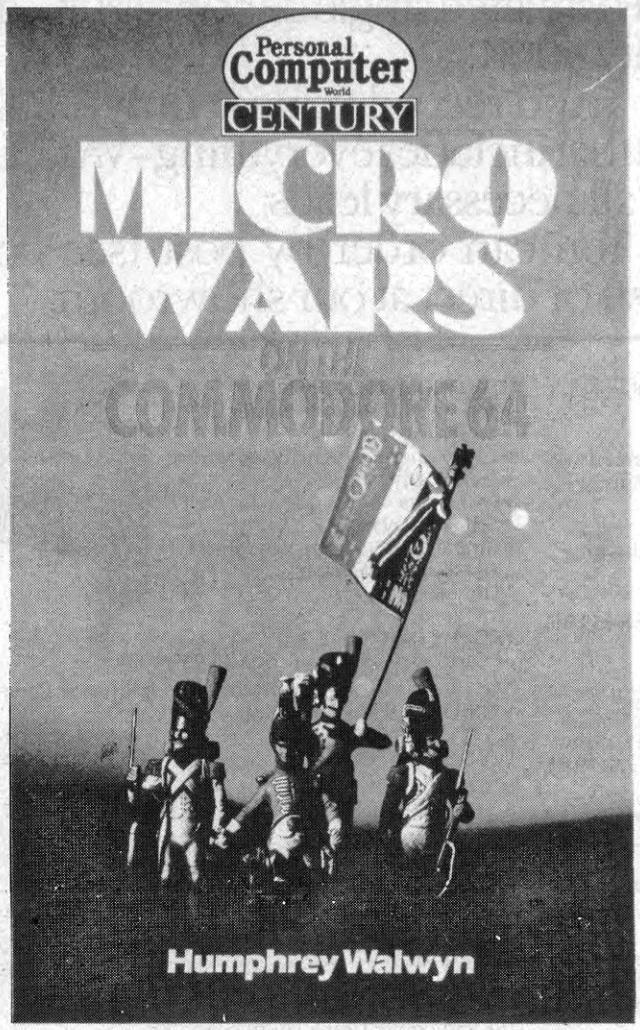

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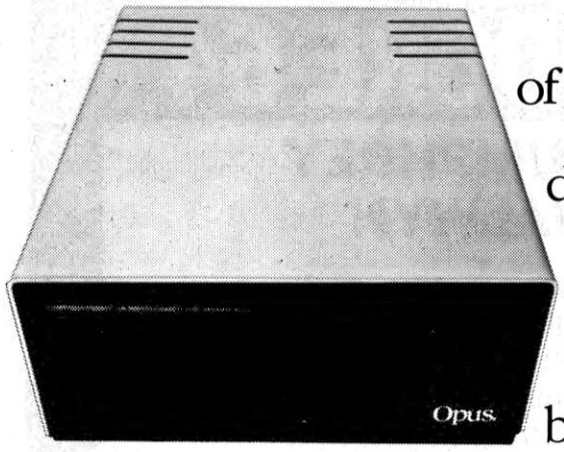

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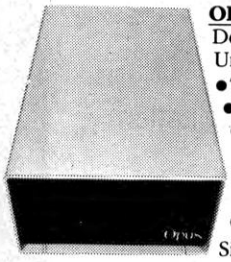

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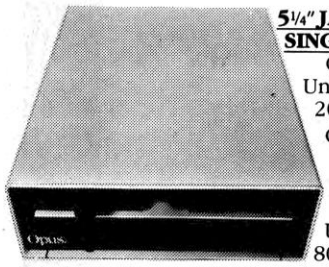

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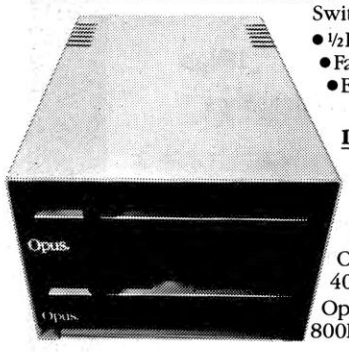

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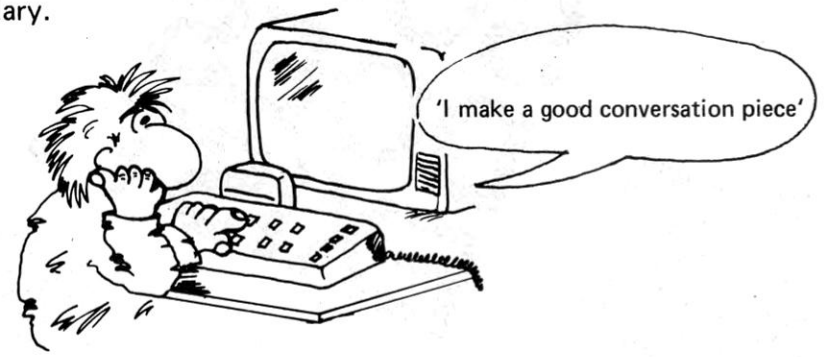

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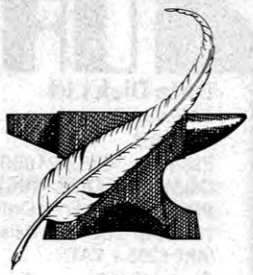

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CHIP CHAT

Someone, somewhere has got the wrong idea about computer towns, (CTUK!). A letter addressed to CTUK! arrived at the *PCW* office recently, offering the services of a modelling/promotion girl agency. We've heard the 'Have you seen my twin floppies?' joke many a time, but we wonder how anyone in their right mind could have got the idea that CTUK!, of all things, would want to use scantily-attired females to draw attention to its activities. According to this correspondence, 'using the right girls' can be a 'cost effective exercise' — using the right girls for what, we ask?...

Still on the subject of the fairer sex, information reaches us that Harvey Nichols is to begin selling business computers — Apricots. 'Yes, madam, we do accept Access, and would you like a matching scarf?' . . .

As an answer to the Hewlett-Packard service to sailing and Epson's use of a QX-10 on the hilarious Ultra Quiz programme, Commodore is giving a 'long-term boost' to British basketball. The thought of Commodore being able to give a long-term boost to anything is fairly unbelievable. Commodore, however, claims a long involvement with the computerisation of British sport. It is also providing computers for use in the World Disco Dance Championships, and has been involved in the computerisation of cricket and water-skiing scores as well as marathon times. Now we know where all the Commodore 700s have got to! Epson, incidentally, is larking around with Miss World again, running the scoring system. It seems we have a new trend in the application of Information Technology, though we may well ask if technology is bringing us a better society?...

And now . . . the Oric traffic wardens! Yes, Oric has put a team of merchandising representatives on the road to give support and after-sales service to dealer outfits. The 14 'Oric Angels', as they are known, are smartly attired in a navy and burgundy uniform (yuk!). One cannot but dwell on what their recruitment advertisements must have been like — join the Oric Angels, wear the Oric Angel's badge of pride; you get to wear a smart uniform, etc. Oric, incidentally, fought off the effects of a large fire at its assembly plant in Feltham. One wonders if this fire might have been caused by one of the Oric Angels, who could have been a devil in disguise . . .

LSI, of Leviathan M-3 and M-4 fame, has probably given us the last word in terms of silly commercials. By now you may have seen the television ads showing old computers lying about in dustbins, and being mangled and squashed in the iron jaws of garbage vans. Viewers are led to believe that the same fate will not befall the LSI Octopus (the company's next computer will be called the Slug, we hear), as disappointed dustmen scan empty dustbins outside city offices supposedly occupied by happy Octopus users.

The dustmen who arrived on the scene the day the commercial was filmed were not in the least bit disappointed. LSI had provided old computers for the occasion and these were piled into dustbins. To protect these offbeat props from possible pilferers while more film was being shot elsewhere, a guard was posted. And the ad agency had the foresight to check with the local council that no garbage collections would take place on Saturday mornings. Suitably reassured, it undertook filming accordingly.

The TV crew arrived to film the scene with the computer-laden dustbins only to find them empty and, disappearing into the distance, a bona fide garbage van. Frantic pursuit, desperate phone calls, a police chase, all proved fruitless. It was revealed finally that the depot had, after all, sent out one van that morning. It must have passed just as the guard was called away. Chip Chat will here refrain from making any comment whatsoever about appropriate quirks of fate, etc...

Let's focus our attentions on the possibilities of man-dolphin communication. The Syntauri corporation is a front runner for the Silliest Software Package of the Year award for its dolphin communications package, running on an Apple II. Yes, folks, you, too, can have a dialogue with dolphins! You may be wondering how it can be proved that dolphins can actually understand the high-pitched gibberish produced by the program. Well, Syntauri (working at the Institute of Delphinid Research in Florida) plans to build an underwater link (a microphone to you, guv) between dolphins and the computer, so that dolphins can produce their own combination of words. 'Imagine a dolphin composing and communicating an intelligent, unique sentence to a human!' says the blurb. Yes, we're imagining, and we can't repeat what that intelligent, unique sentence might be . . .

A well informed source tells us that a company in the construction industry, having decided to use computers, spent £100,000 on lots of new equipment. Only after the equipment arrived was it realised that software is needed to make a computer work.

Hard to believe... but it's true. Needless to say our source would give no names. It's to be hoped that suitable software was available for the machines purchased, otherwise the company in question will have learnt the expensive way that it pays to get expert advice at the start.

In keeping with its commitment to the education of kids of all ages, Acornsoft has just released two new programs entitled '..I Do' and 'The Dating Game'.

According to Acornsoft, these programs could improve people's love lives and help bring down the divorce rate. The programs use 'personality questionnaires' developed by Professor Hans Eysenck and Dr Glenn Wilson, where each person answers multiple choice questions to reveal his/her real personality.

According to Ivan Berg who developed the programs: 'We have found that people are much more honest answering the questions of a computer than those of another human being.' How could anyone lie to their Beeb?

'..I Do' asks each partner over 400 questions and then (if you are still awake) tells you how you rate on each of 11 'compatibility scales'.

'The Dating Game' analyses your character and personality and provides hints on how to find compatible friends or lovers (look under a park bench perhaps?). The program can match up to 40 people at one time. 'We anticipate that "The Dating Game" with its match-making facility will break the ice at this year's Christmas parties,' commented David Johnson-Davies, managing director of Acornsoft. If this program runs true to other Acorn products it will find your ideal partner, but that person won't be available until 'sometime next year'. . .

END

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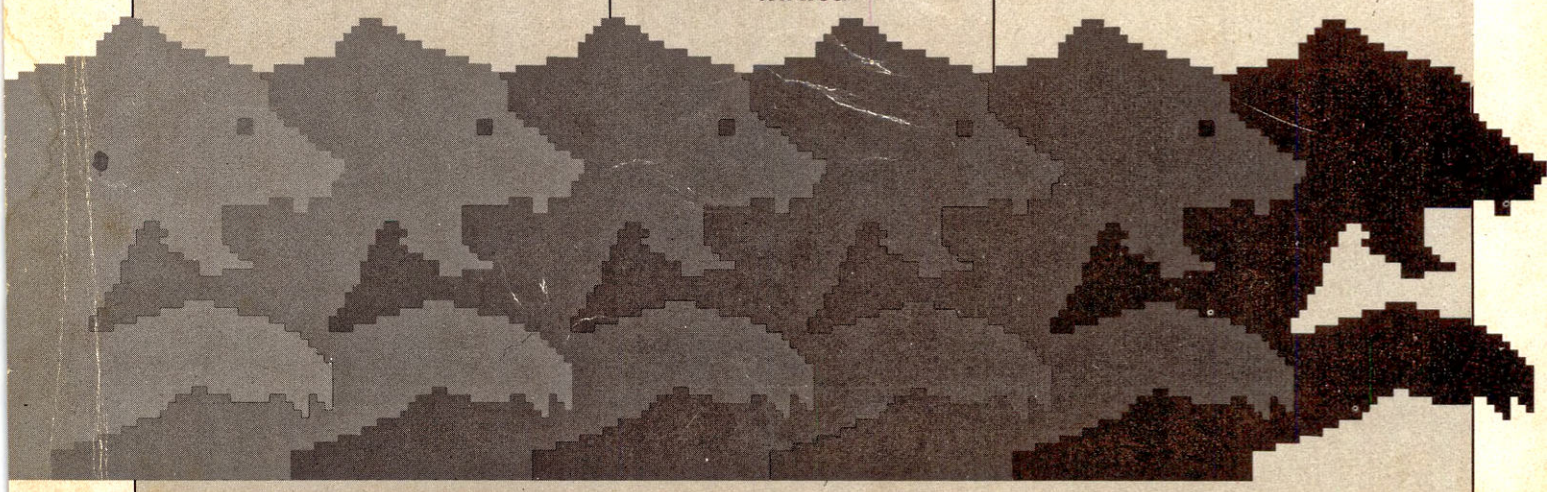

Merry Christmas!

The staff at Personal Computers Limited would like to wish all their customers, friends and mice, a very merry Christmas and a prosperous New Year.

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