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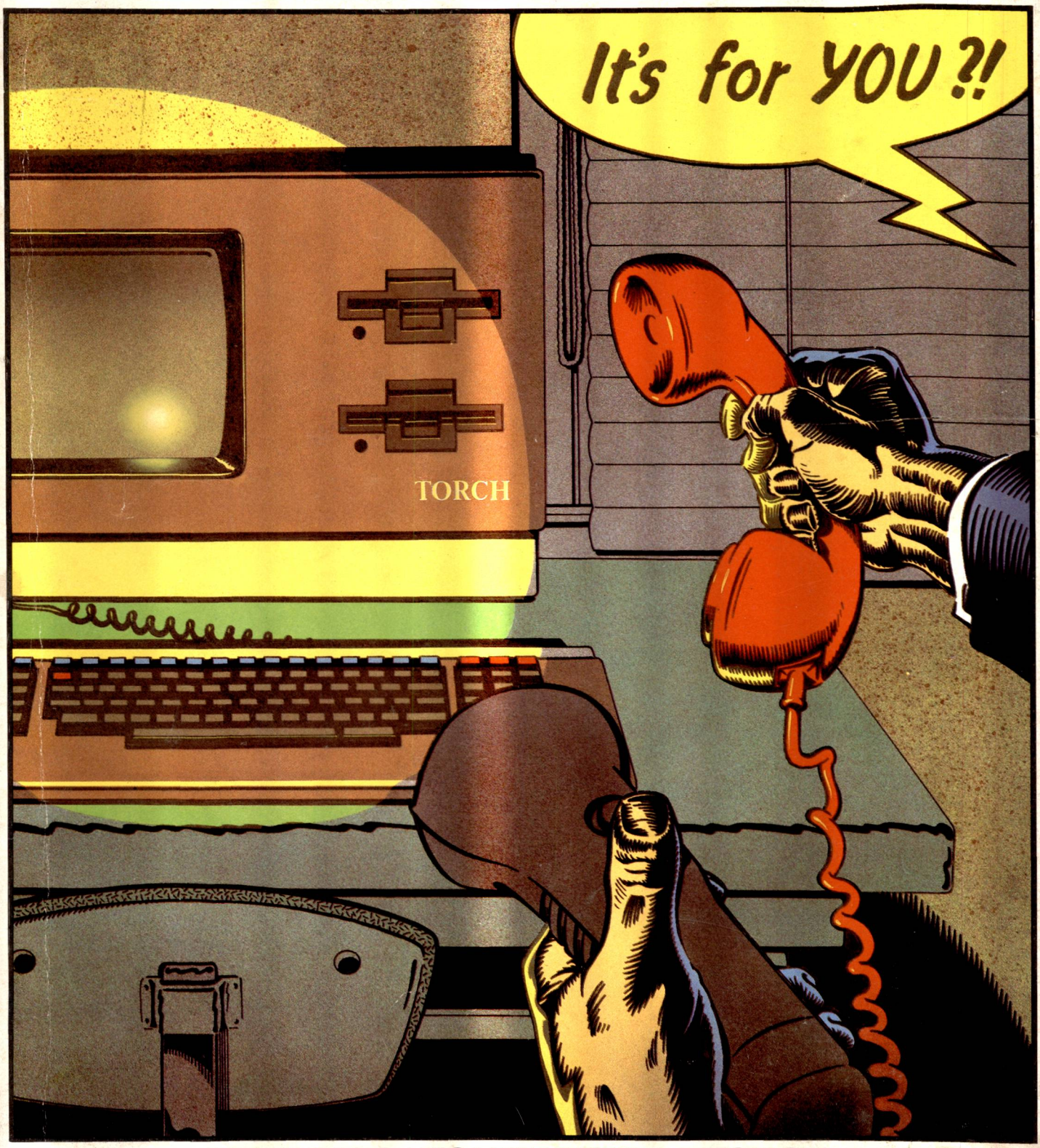

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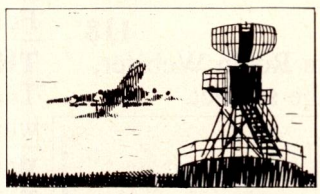

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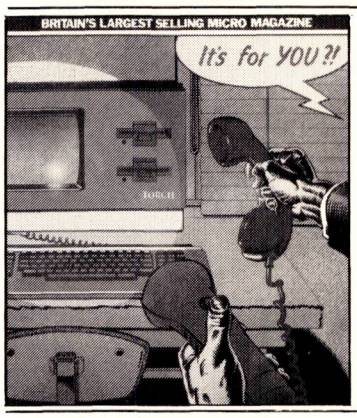

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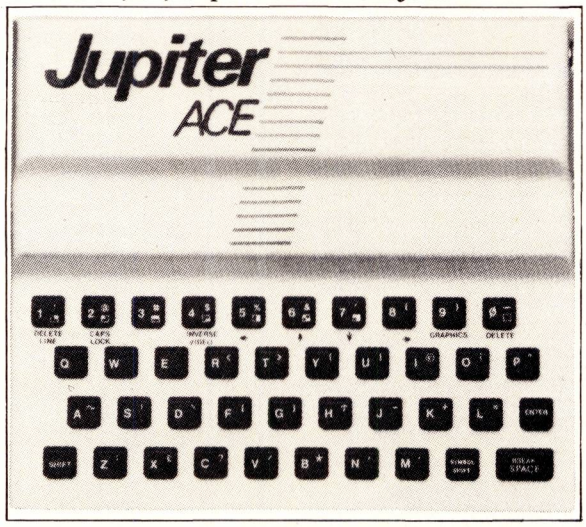

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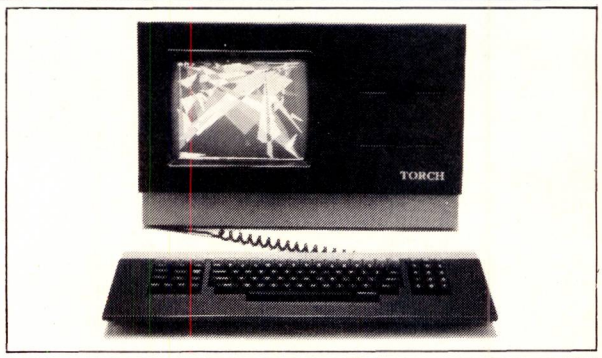

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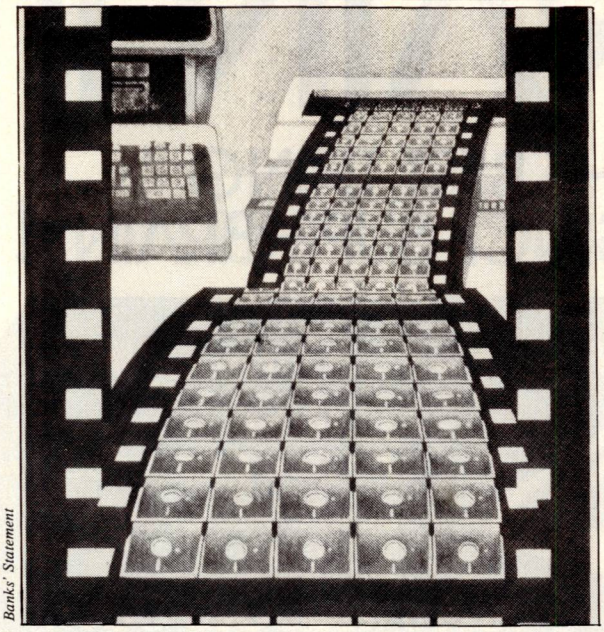

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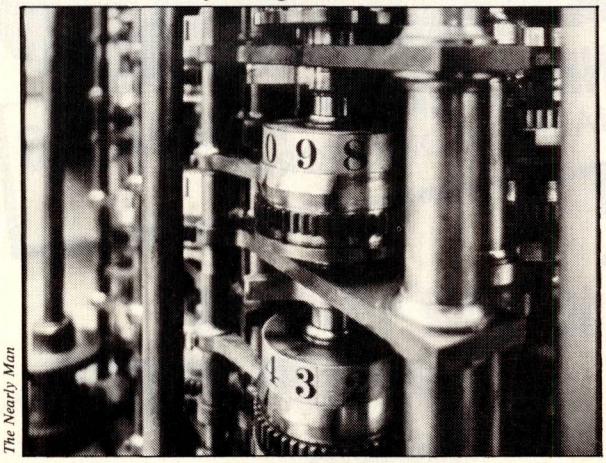

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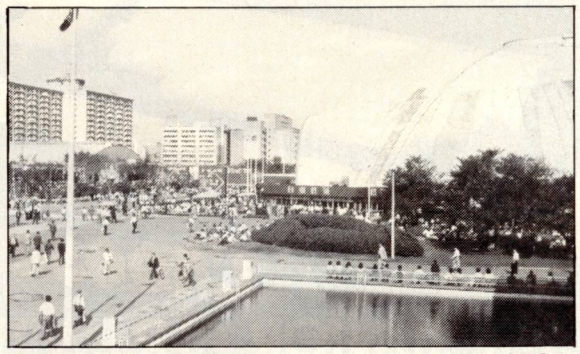

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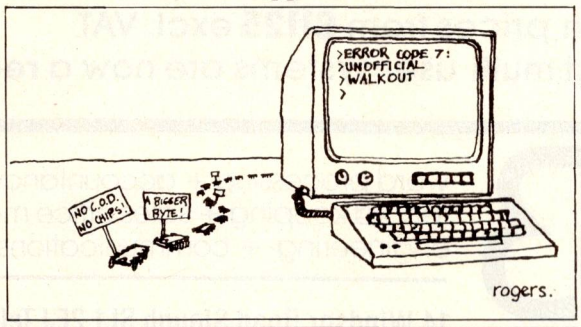

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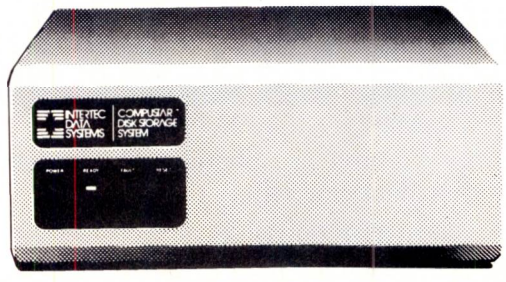

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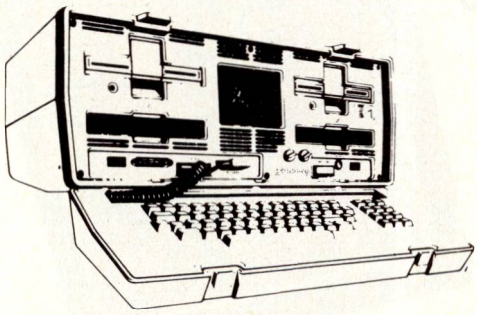

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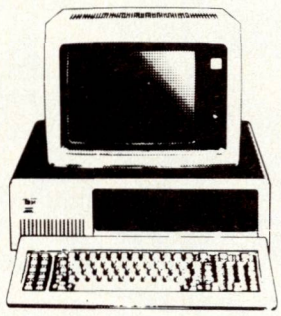

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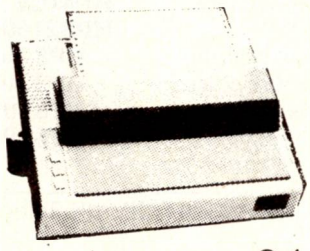

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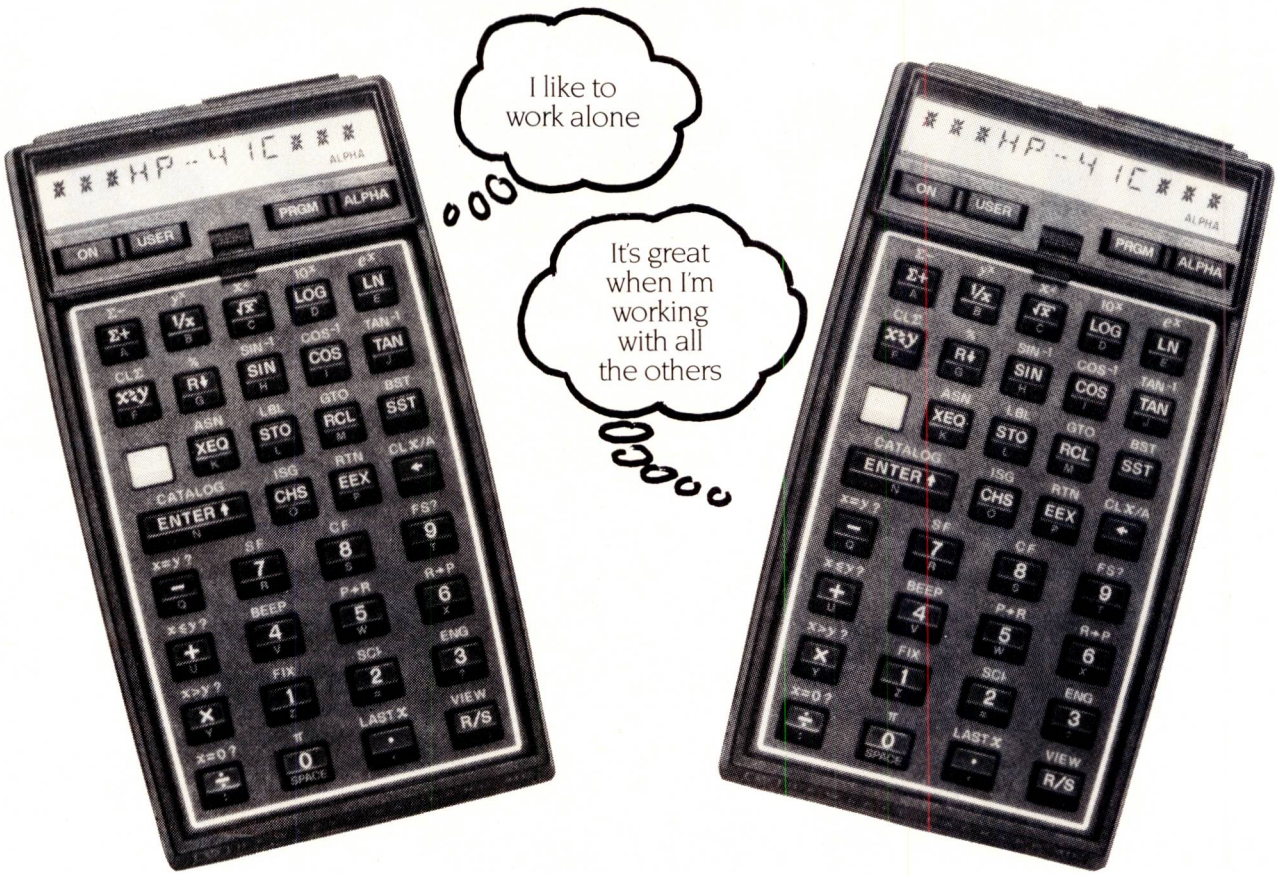

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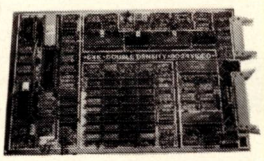

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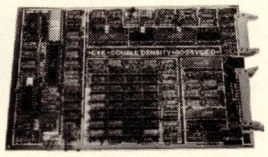

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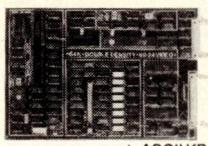

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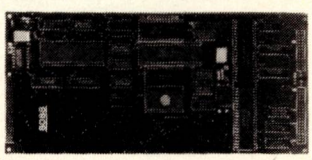

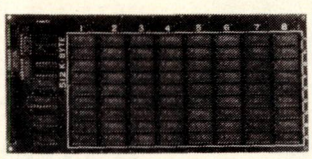

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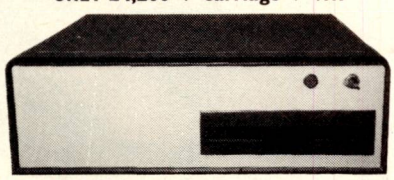

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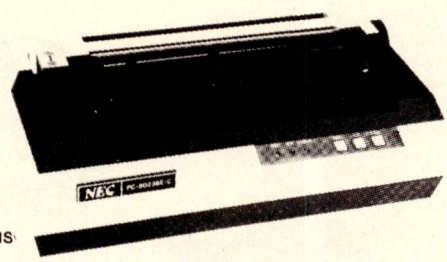

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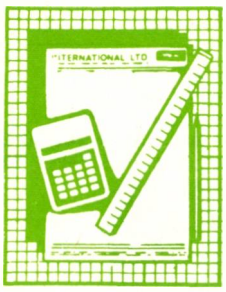

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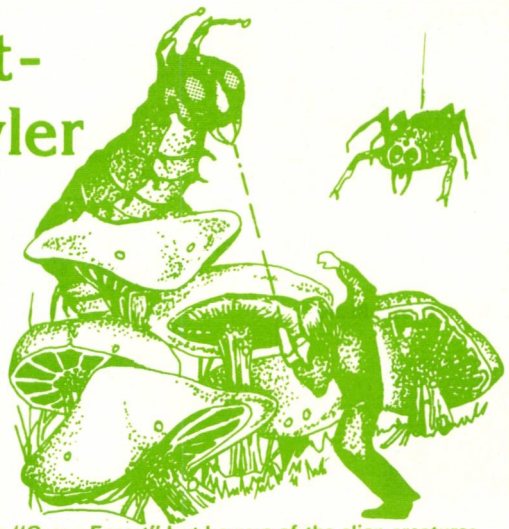

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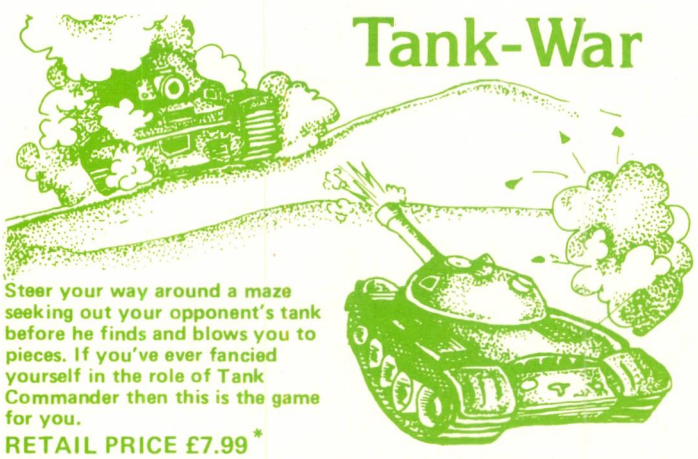

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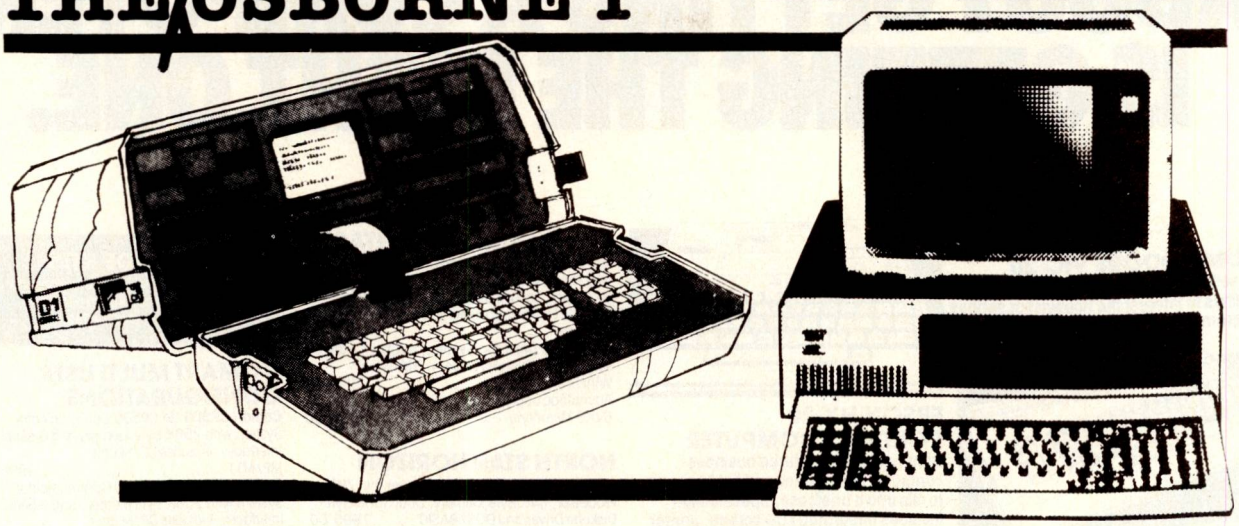

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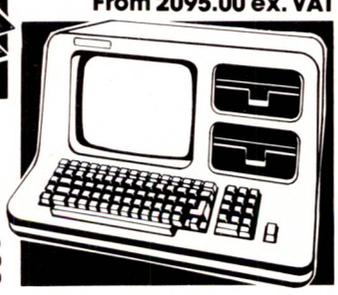

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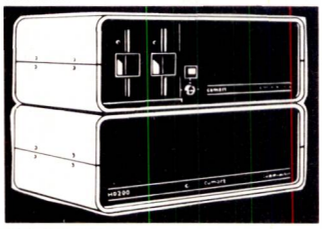

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There are so many micro computers on the market that choosing the right one is far from easy.

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And unlike some other office database management programs, Administrator allows you to control it in English via the screen. You do not need specialist programming knowledge to tailor Administrator to your precise requirements.

Use the Administrator to run your mailing lists in conjunction with a word-processing link; for invoicing; personnel records; stock control; valuations; analyses; control reports on projects; and even for narrative files where each record needs to hold a large amount of written information.

Administrator really scores here.

It is able to accept any length of narrative text on any of its records. You have no space limits other than the capacity of your disk storage equipment.

Try that on a comparable system and see how far you get.

We know your business is unique. You or your predecessors set up the systems in one particular way. Administrator will accept that way. You tell it what you want. You set up the system.

When you have astonished yourself by finding out how clever the Administrator is you will probably think of improvements in your own system. So Administrator allows you to amend the system which you originally set up, so that, for example, you can add one item of information to all previously stored records which in turn will allow you to extract more informative management reports.

Administrator is flexible.

It is also mathematically inclined and can total your analytical columns, provide grand totals and make comparisons of targets and performance to provide you with the selective information you specify.

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System cost, including a Commodore 8000-series computer, twin floppy disk drives and one of a selection of printers depending on your needs, is between £3300 and £4000. The latter figure would include a letter-quality daisywheel printer. Both prices include the cost of Administrator and word-processing program, but do not include VAT.

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commodore COMPUTER

Why buy British?

Britain has a unique opportunity to establish itself alongside the United States and Japan as a major producer of microcomputers and microcomputer software. In particular, the UK has a tremendous advantage in this field when looking at the markets of the remainder of Western Europe.
The continental people have begun to look to Britain for innovative and competitive computer products. Also, it is obviously much easier for them to communicate with this country rather than California or Japan. The recent Compec Exhibition held in London underlines the importance of the UK to the European market.

It is not easy to analyse the reasons for this situation arising. Obviously, the fact that we are an English-speaking country has had significant influence since the industry has been led from its early days by the Americans. Next, we do appear a naturally ingenious people. The number of inventions generated from within these islands is out of proportion to the population when compared to some of our other trading partners. Regrettably however, these opportunities slipped through our hands and were developed elsewhere. Finally, there has been a very strong hobby electronics market and this has possibly been the most important single influence since so many microcomputer companies owe their origins to the dedicated enthusiast.

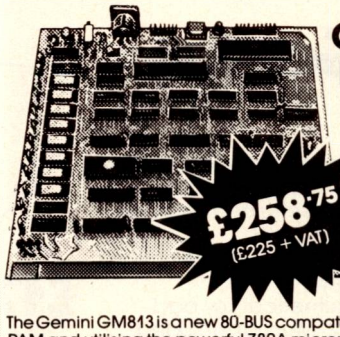
There is a wide range of machines available from British manufacturers. In most cases, the products are very competitive and, for this reason, it should not be difficult for the potential customer to find a British-made solution for his particular requirement. However, I believe that this attitude should be extended and that the Government, local authorities and other bodies should do their utmost to ensure that they buy British and they should try to influence other people to buy British. For instance, there seems little benefit to anyone if a Government body actively or passively promotes overseas' manufactured equipment. Unfortunately, this is the case. What everybody should remember is that buying British means generating jobs here.

Few people realise that for some strange reason, the Government of this country and its EEC partners have rigged import duties to the disadvantage of the UK manufacturer. Manufactured computer systems attract duty of between 6-7%. Many of the components needed to build computer systems are only manufactured overseas and in particular, the 17% duty on semi-conductors gives the importers virtually a 10% edge on their domestic rivals. Whilst I acknowledge the fact that it would be difficult to force through changes rapidly, there must be a way of giving temporary relief to our industry. The Government have the authority to waive duty in certain instances on an ad hoc basis and this could be considered. It really makes no sense for the tax payer's money to be spent on foreign products or the import duty paid by manufacturers on their component supplies.

If all prospective microcomputer customers gave very careful consideration to the UK manufacturers' machines instead of imported ones, the sheer volume of business available would provide the profits that are needed to pay for the large R&D programmes we all have to sustain. Successful development mean lower prices and even more competition for our foreign counterparts. I believe that the manufacturers in this country have proven that they have the capability of manufacturing and designing the equipment which the market place wants. What we need now is recognition and support.

JOHN MARSHALL
MicroValue Group/Gemini Microcomputers Ltd

MULTIBOARD



GM813 — CPU/64K RAM Board

★ 4 MHz Z80A CPU
★ 64K Dynamic RAM
★ RS232 Serial Interface
★ Two 8-Bit I/O Ports
★ 1200 Baud Cassette Interface
★ Extended and Page Addressing Modes

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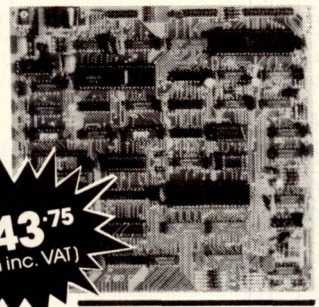
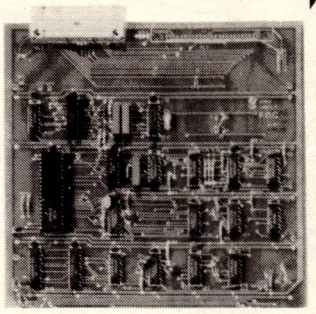
The Gemini GM813 is a new 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 — CPU Board

★ 4MHz Z80A CPU
★ Four 'Bytewide' Memory Sockets
★ Two 8-Bit Input/Output Ports
★ 8 Bit Input Port
★ RS232 Serial Interface
★ 1200 Baud CUTS Cassette Interface

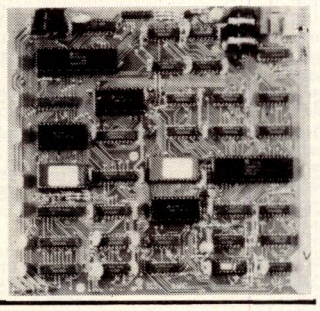


£143.75 (each inc. VAT)



GM812 — IVC Board

★ 80x25 Display Format
★ On-board Z80A Microprocessor
★ Buffered Keyboard Input
★ Programmable Character Generator
★ 160x75 Pixel Graphics
★ Light Pen Input



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- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
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- ★Numerical key pad
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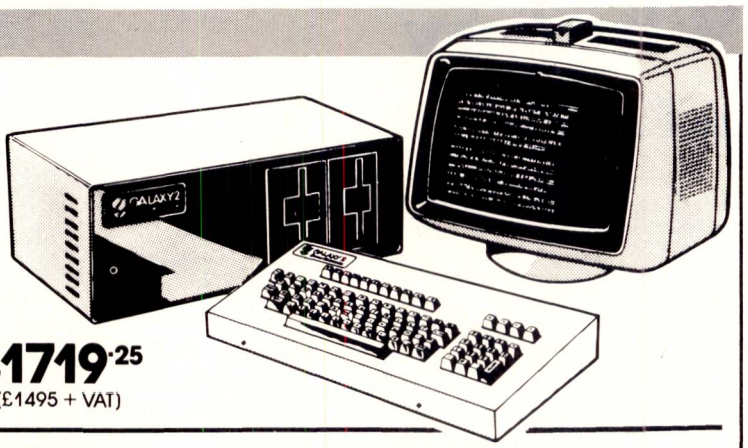

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Total support for Gemini & nascom Products

nascom 3 available from MicroValue

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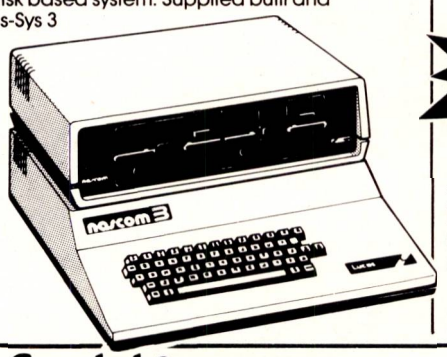

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Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£402.50 (£350 + VAT)

Dual Drive System
GM825-2S
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CP/M2.2 Package
(G513) for Gemini
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CP/M2.2 Package
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POLYDOS 4
for Nascom
£103.50 (£90 + VAT)

GM809 Disk Controller Card
for 8" and 5.25" drives
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for 8", 5.25" and Winchester Drives
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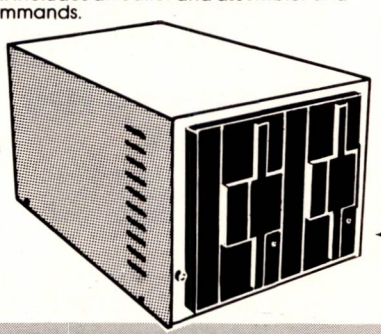

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- ★Industry Standard SASI interface
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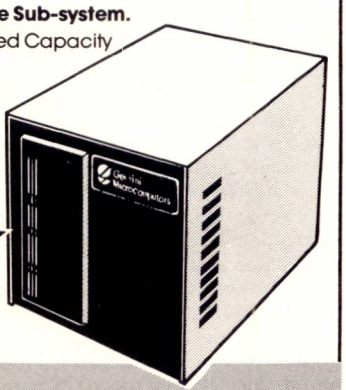
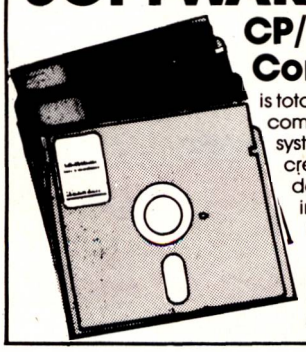


SOFTWARE



CP/M Software Compas

is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

£138.00 (inc. VAT)

'The Last One' is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

£379.50 (inc. VAT)

*MBASIC – MicroValue Price if purchased with 'The Last One' – **£178.95 inc.VAT**

VIZ:APL is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.

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GEM PEN Text Editor	**£51.75 inc. VAT**
GEM ZAP Assembler	**£51.75 inc. VAT**
GEM DEBUG Debugging Utility	**£34.50 inc. VAT**
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A wide range of software for Nascom also available.

When ordering disks, please specify format.

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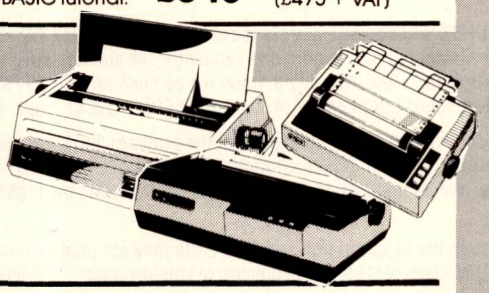

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* CP/M 2.2
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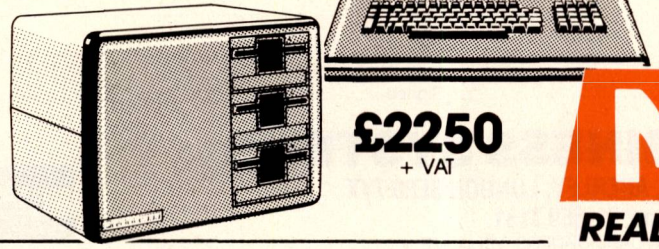

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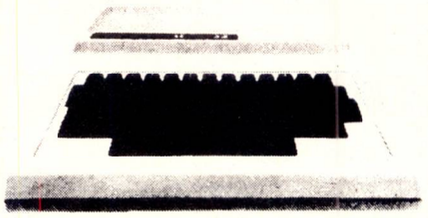

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for TRS80 and Genies

Premier's WORD4WORD word processing program has been a best-seller since the day of its release. It's author David, has now produced his latest masterpiece which exceeds even W4W's incredibly high standards, **T U R B O.**

TURBO will compile any standard TRS80/GENIE disk BASIC program.

It will cope with any TRS Disk BASIC command, including full random and sequential file access. TURBO recognises and compiles almost all TRS/GENIE BASIC words (with several very minor exceptions), except for a few immediate mode words such as LIST, SYSTEM, DELETE, etc, which shouldn't be in your program anyway!! It can handle all usual programming techniques (jumping out of incomplete FOR...NEXT loops, for example), and, more importantly, all disk file words.

TURBO compiles the entire BASIC program – it does not 'avoid' difficult parts of the program and leave the user with several routines to access from the remaining BASIC (as some so-called 'compilers' do). Nearly all your BASIC programs will compile WITHOUT ANY ALTERATION WHATSOEVER, to give a fantastic improvement in running time. Graphics will now appear instantly to screen! TURBO contains its own 'garbage collection' routine, making its ability to manipulate strings for sorts, etc, very impressive.

Many BASIC compilers require that you go through the program first and alter parts they are unable to interpret. With TURBO, the only changes you are likely to have to make is to move DEFINT, DEFSTR, and DIM statements to the beginning of your program – not very difficult!!!

TURBO will compile all BASIC programs using double precision arithmetic – many comparable compilers cannot even do single precision arithmetic – TURBO can!!

Operation of TURBO is simple type in its filename, the filename of the BASIC program, then sit and watch as it rapidly lists through your program, compiling as it goes along. If TURBO finds something it cannot interpret (syntax errors in your coding, illegal use of BASIC words, etc), compiling halts and an error message is generated under the line in question. As well as being an excellent compiler, TURBO can also be used to check for correct syntax through an entire BASIC program in seconds!

TURBO is flexible. Options allow direct spooling from disk (thus saving memory space), memory protection for machine code programs, and integration of the run-time package with the compiled program. A special VARS facility allows you to print out variable values during a halt in the compiled program – invaluable for debugging!!

TURBO is available NOW at a special introductory price of £59.95 inc VAT (+95p P&P). It requires at least one disk drive, and a minimum 32K RAM. An application form is below.

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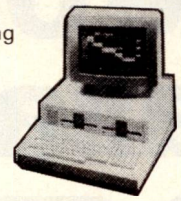

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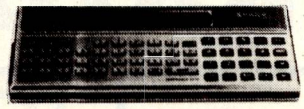

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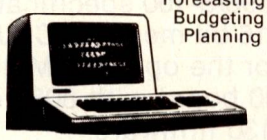

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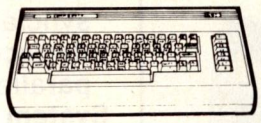

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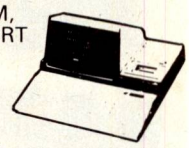

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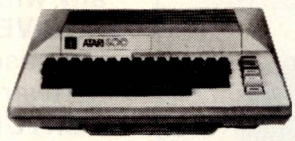

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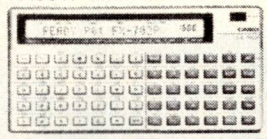

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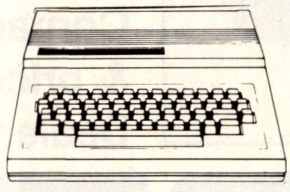

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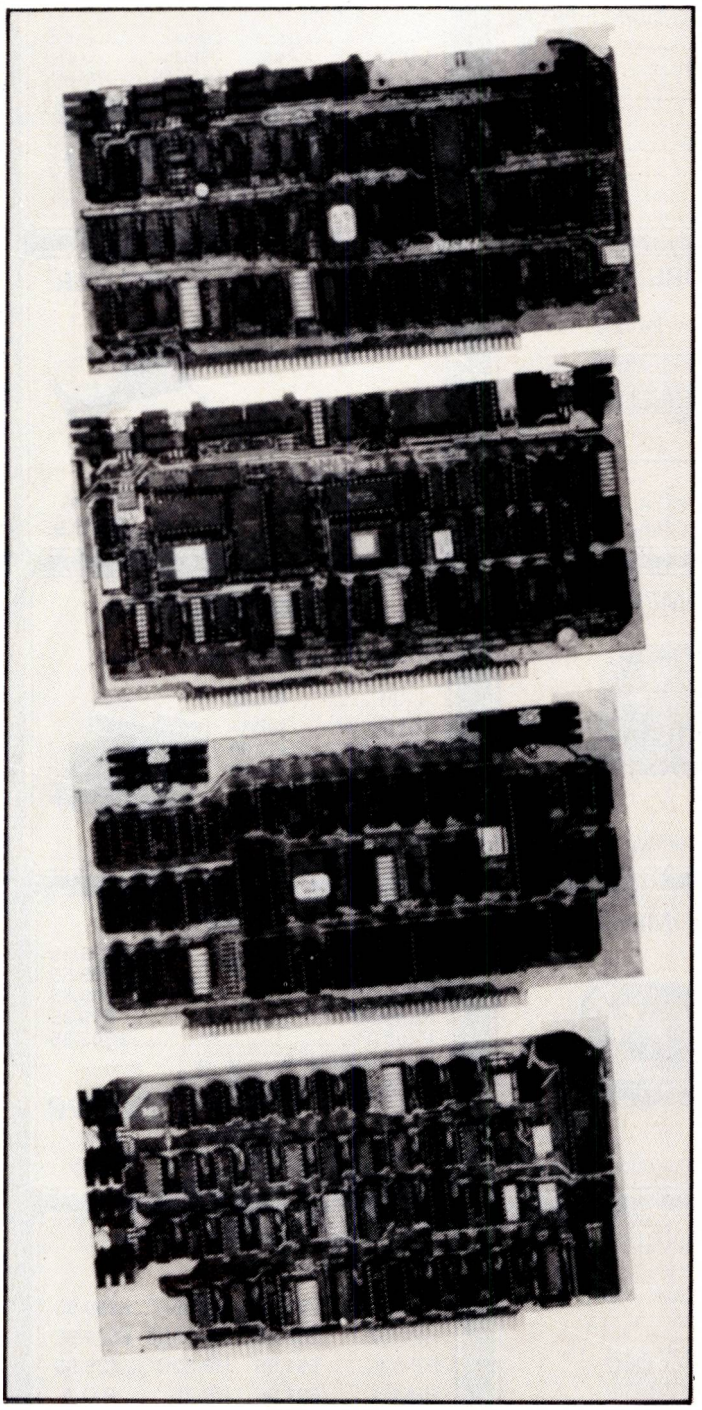

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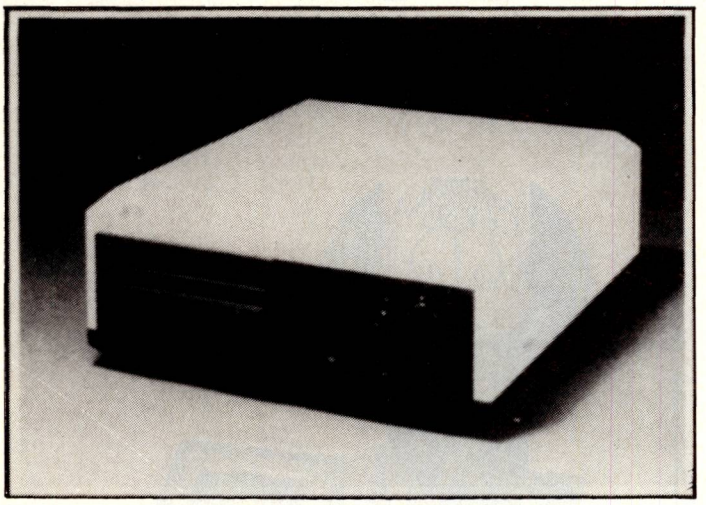

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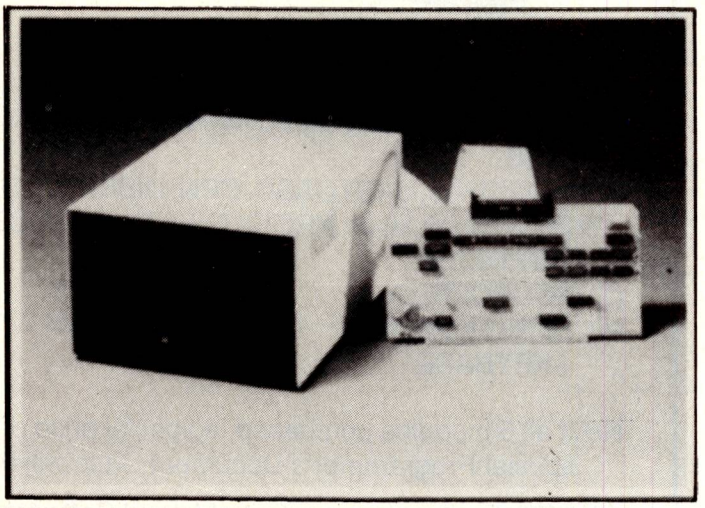

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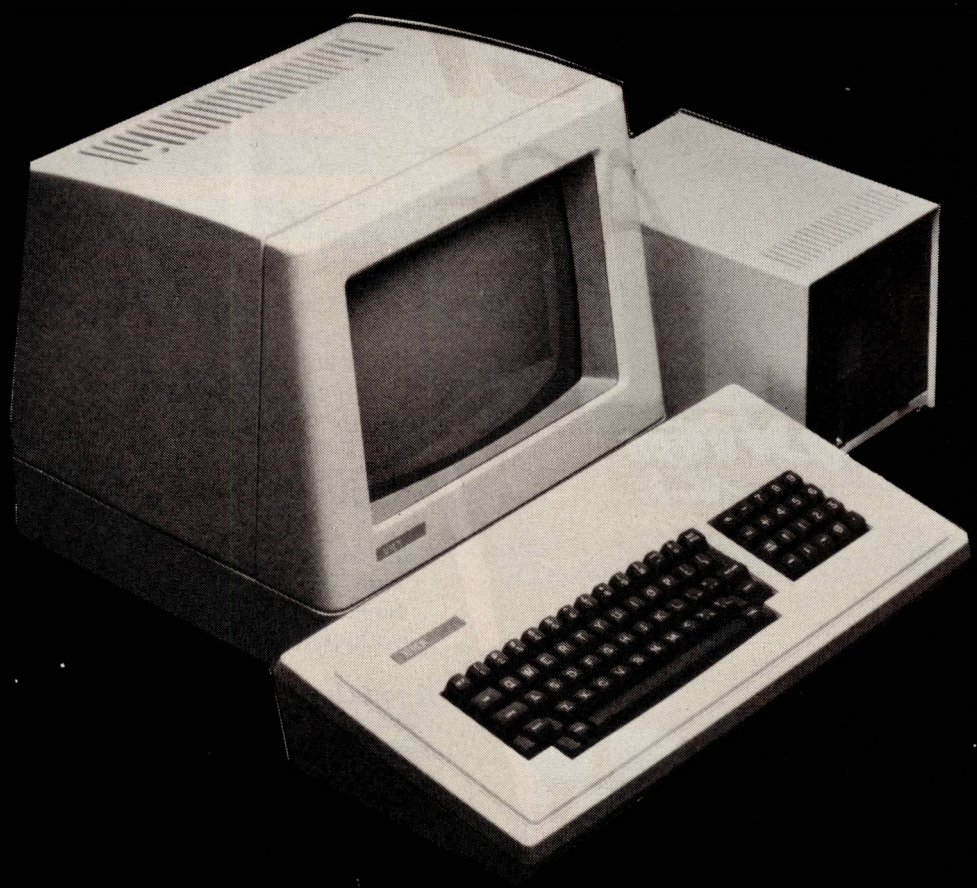

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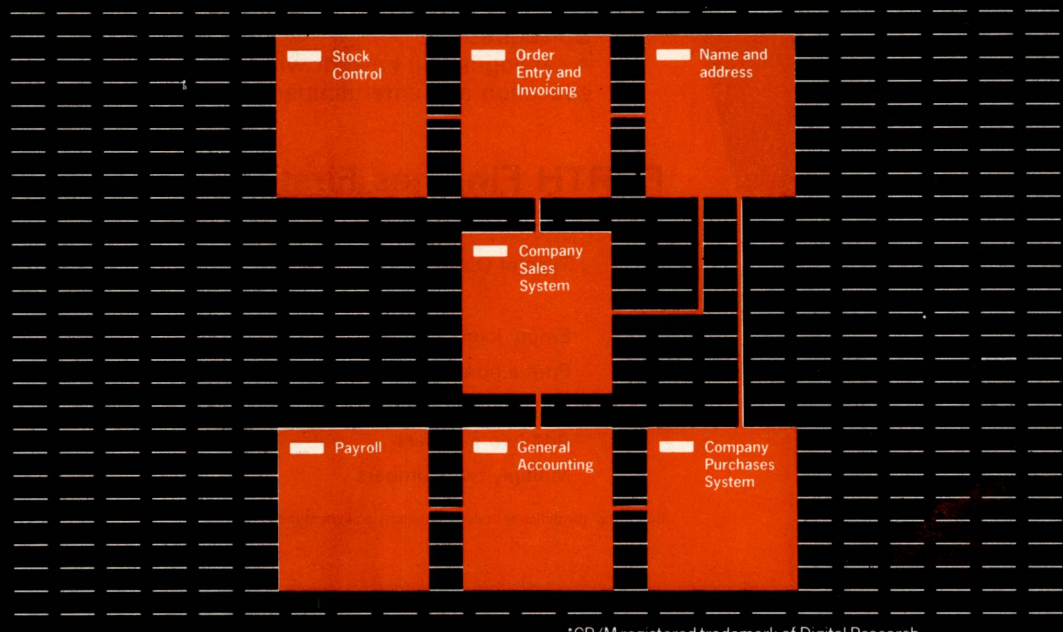

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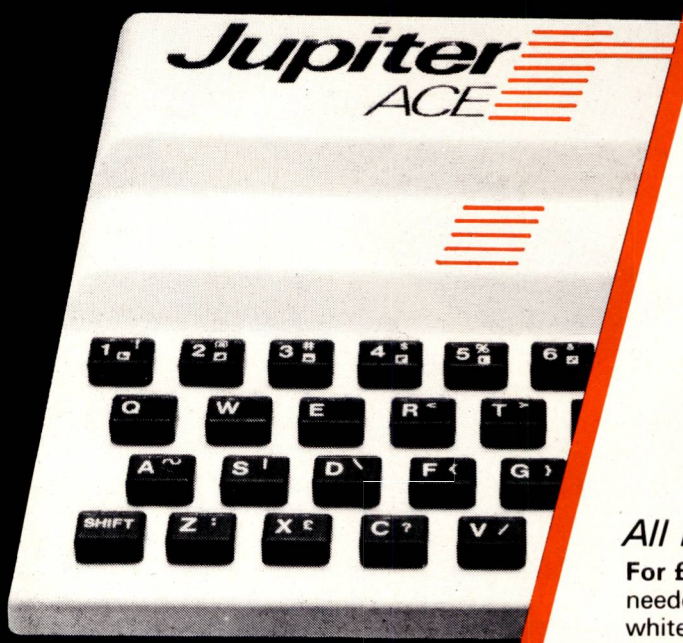
Jupiter ACE



The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

If you own a personal computer you will be aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled. The Jupiter Ace is your answer.

If you already know FORTH, the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

All inclusive price

For £89.95 you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual.
The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace.
Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming.
The price includes postage, packing and V.A.T.
The Jupiter Ace is backed by a full 12 month warranty.

"The Ace is an excellent way of using FORTH"

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Plug-on parallel printer interface.
For around £20.00 this will connect your Jupiter Ace to anything from high-speed dot matrix to letter-quality daisy wheel printers.

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For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving you instant access to enormous amounts of information.

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A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

"FORTH is an easy language"

Byte

FORTH Finishes First!

Speed Comparison Chart showing times in seconds to perform one thousand operations.

Type of Operation	Jupiter Ace	BBC Micro	Vic 20	Spectrum	ZX81
Empty loop	0.12	0.67	1.3	4.2	17.7
Print a number	7.5	13.5	26	19	430
Print a character	0.62	1.3	3.1	7.5	24
Add two numbers	0.45	1.4	5.5	7.5	28
Multiply two numbers	0.9	1.6	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

only £89.95

Designed by Jupiter Cantab

Computer Designers Steven Vickers and Richard Altwasser played a major role in creating the ZX Spectrum and then formed Jupiter Cantab to develop advanced ideas in personal computing. The Ace is the result, another all-British computer to lead the world.

Technical Information

Hardware
Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

Keyboard
40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen
Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii character set.

Graphics
Chunky graphics (64 x 46 pixels) may be plotted, unplotted or over-plotted (XOR operation). Also, the entire character set (128 characters and their video inverses) may be redefined allowing intricate shapes to be drawn with a resolution equivalent to 256 x 192 pixels.

Control Structures
IF–ELSE–THEN, DO–LOOP DO–+LOOP, BEGIN–WHILE–REPEAT, BEGIN–UNTIL, all may be mixed and nested to any depth.

Cassette
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

Expansion Port
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound
Internal loudspeaker may be programmed to operate over the entire audio spectrum.

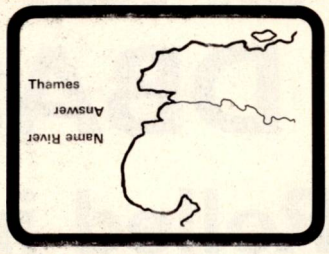
Programming in FORTH

Programming in FORTH
FORTH programs are constructed without line-numbers, as words which are defined in terms of other words that already exist. Consider the following definition of the word **STARS**. Comments are in parenthesis and have no action.

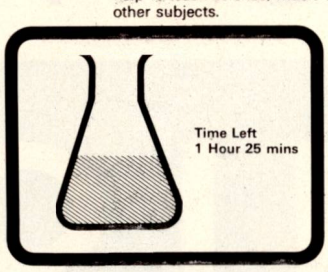
```
STARS          (: starts word definition)
." *** "       (print 3 asterisks)
200 100 BEEP   (play a note for
                100 mSecs)
```

The semi colon at the end finishes the word definition. Now, whenever you say **STARS** the computer will print out 3 asterisks and sound a short tone. (Notice how the word **BEEP** comes after the numbers it uses, 200 and 100. This characteristic occurs throughout FORTH so that you write, for instance, 28 76 + instead of 28 + 76.)

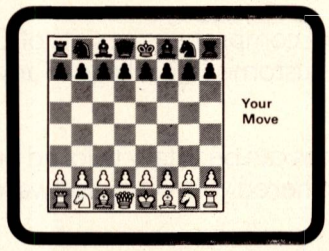
The Jupiter Ace already has 140 FORTH words defined in ROM.



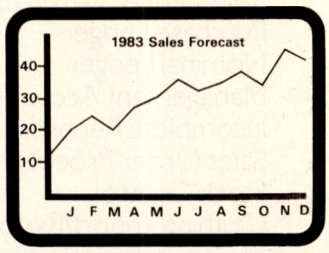
In Schools Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.



At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

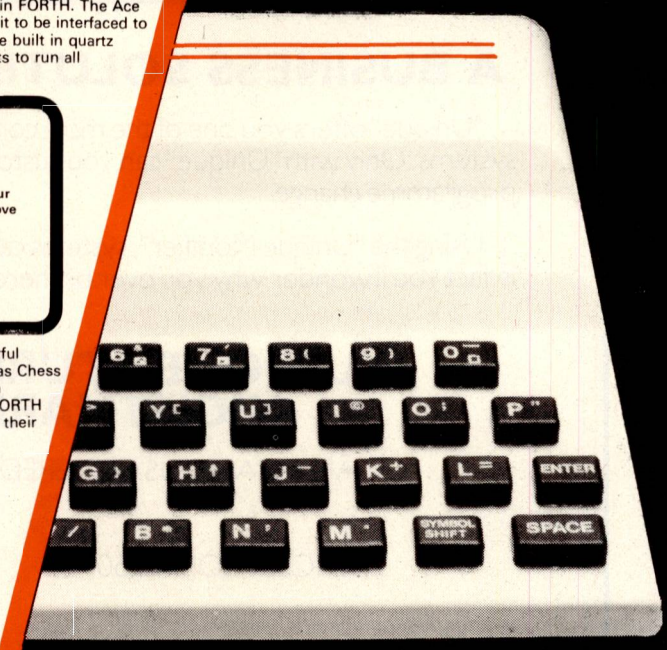
"FORTH is very flexible"

"FORTH is compact"

Electronics and computing

"FORTH is in general very much faster than BASIC"

Computing Today



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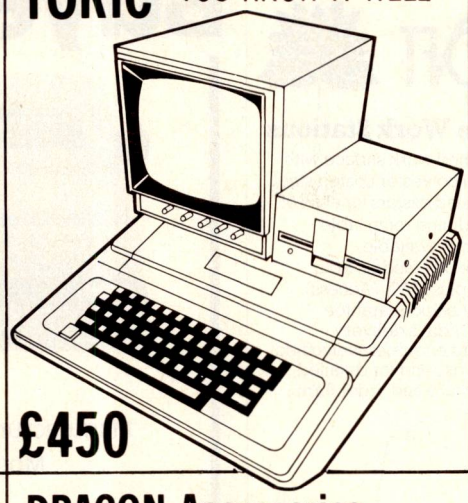

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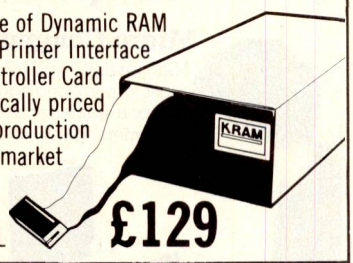

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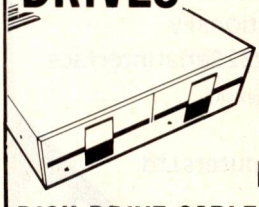

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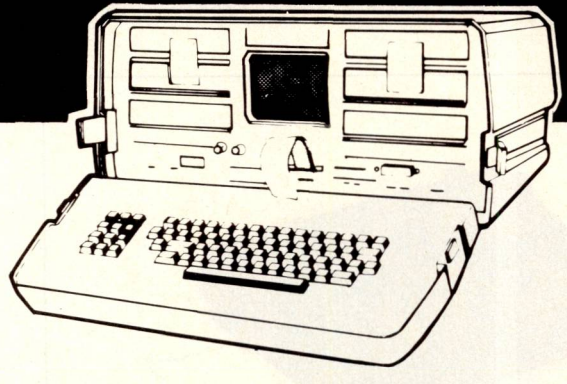

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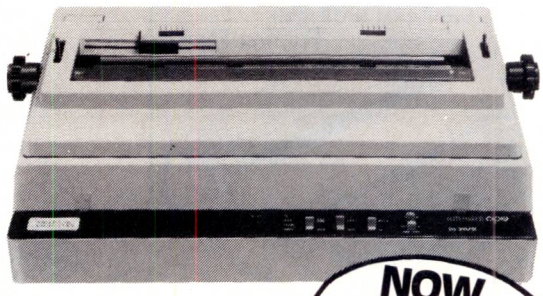

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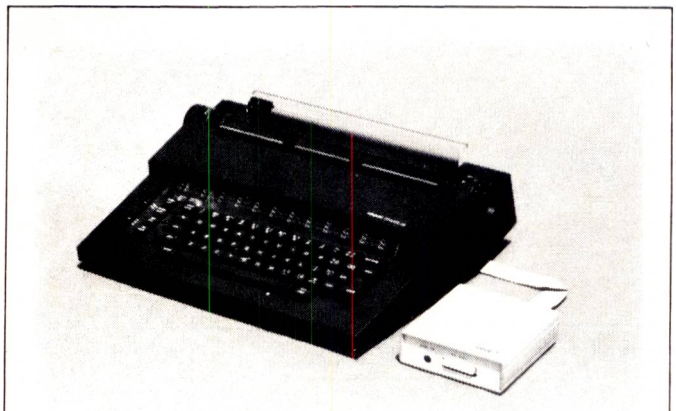

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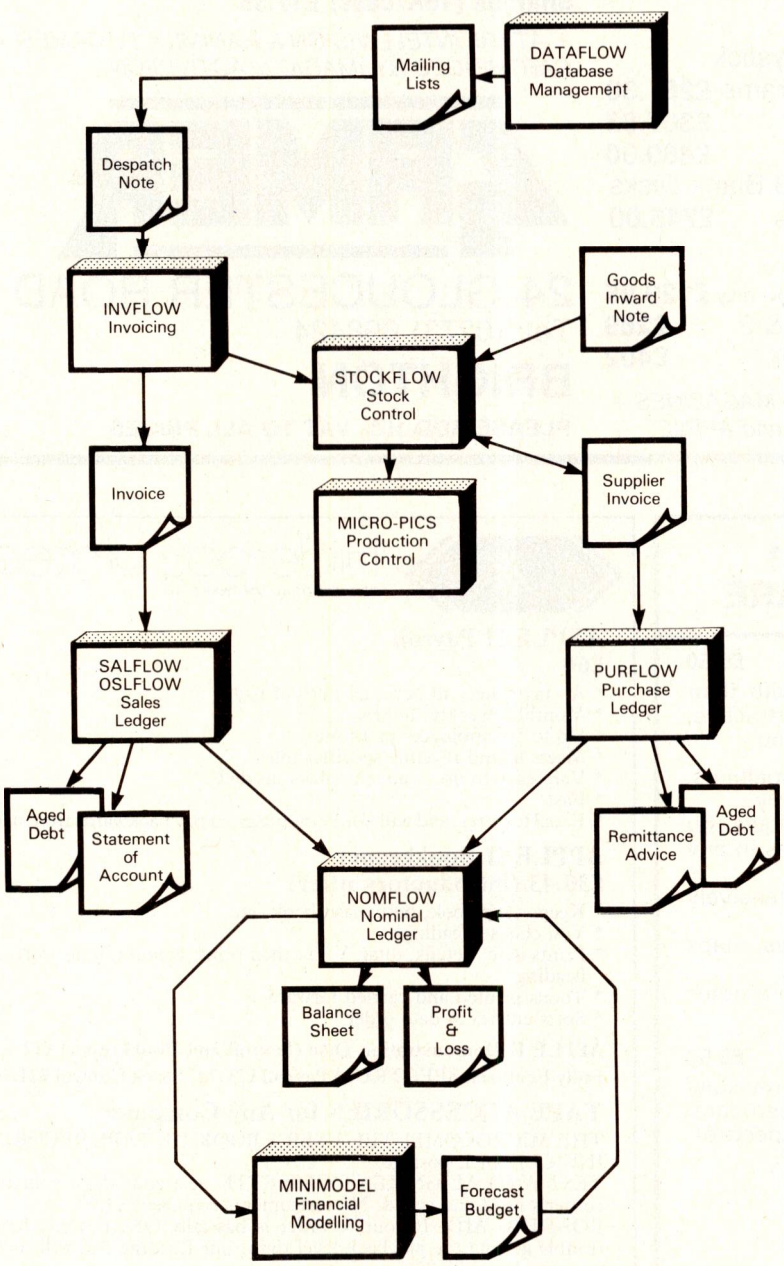

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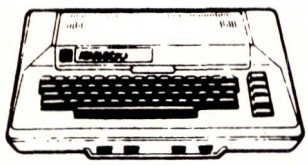

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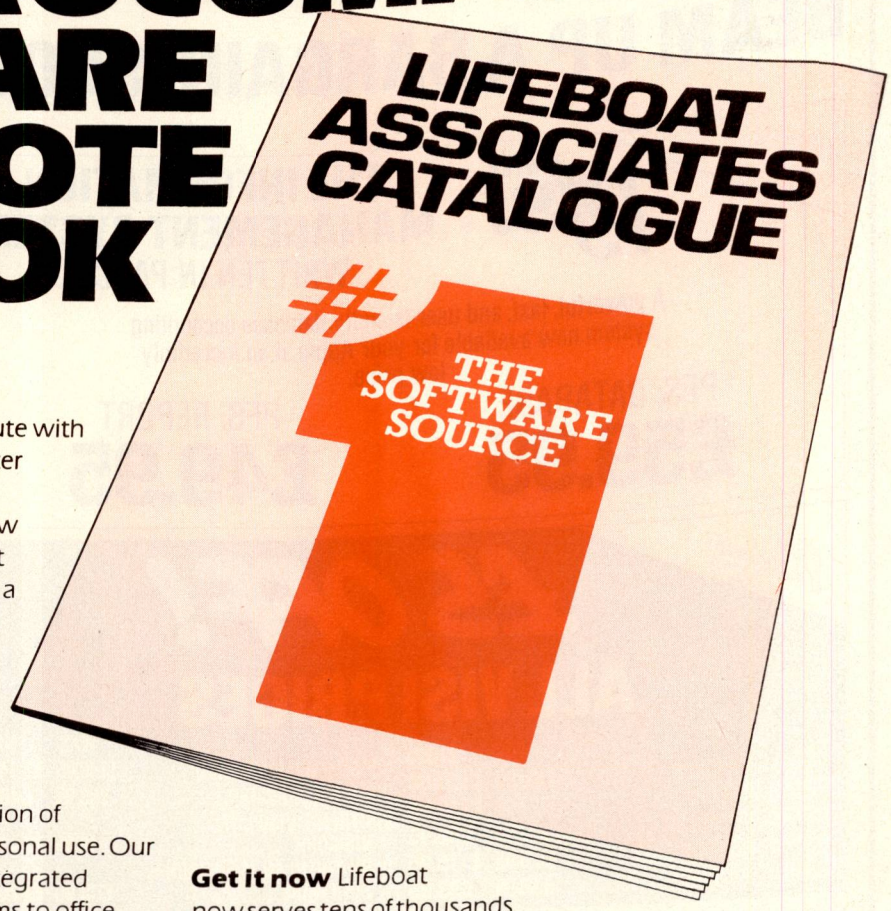

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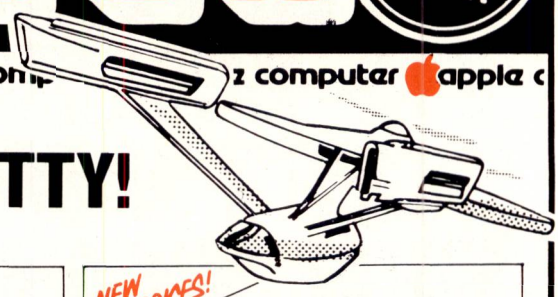

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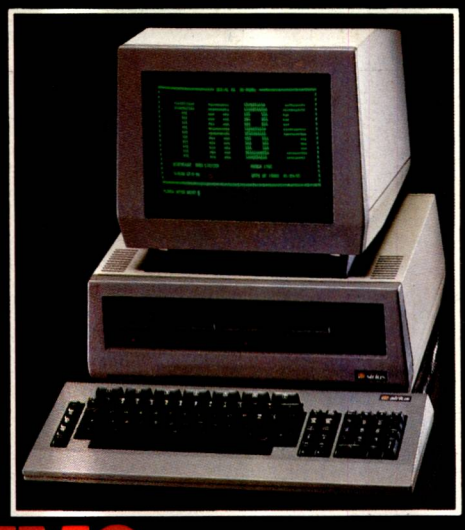

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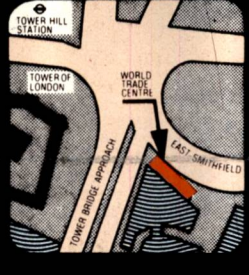

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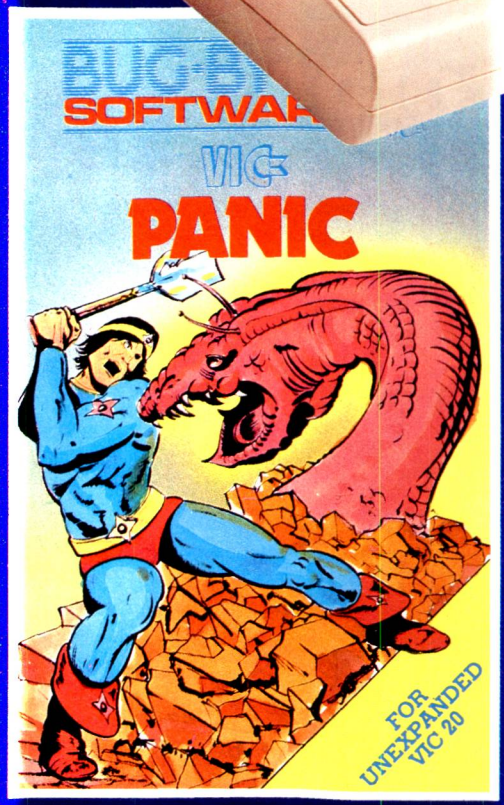

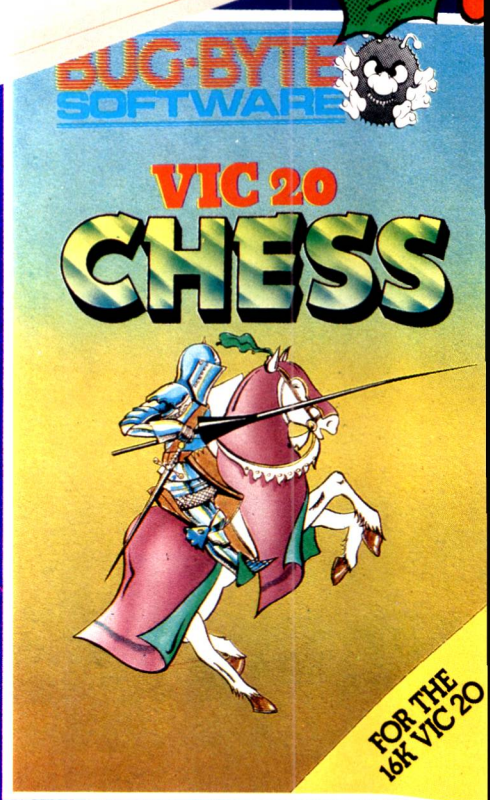

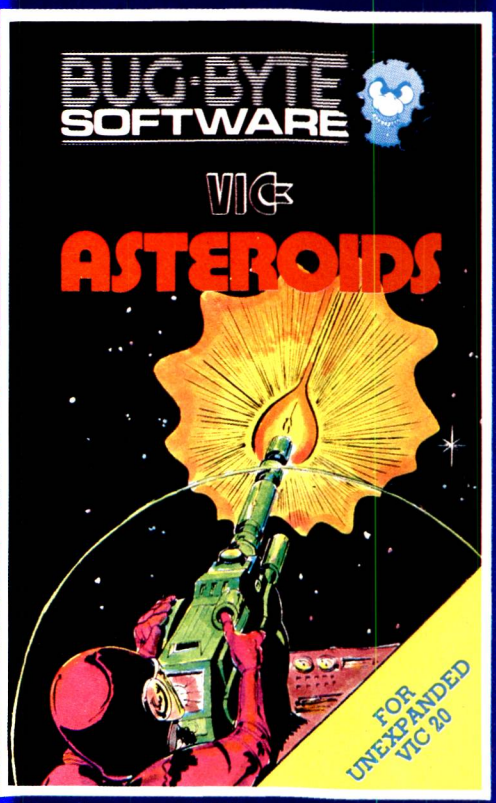

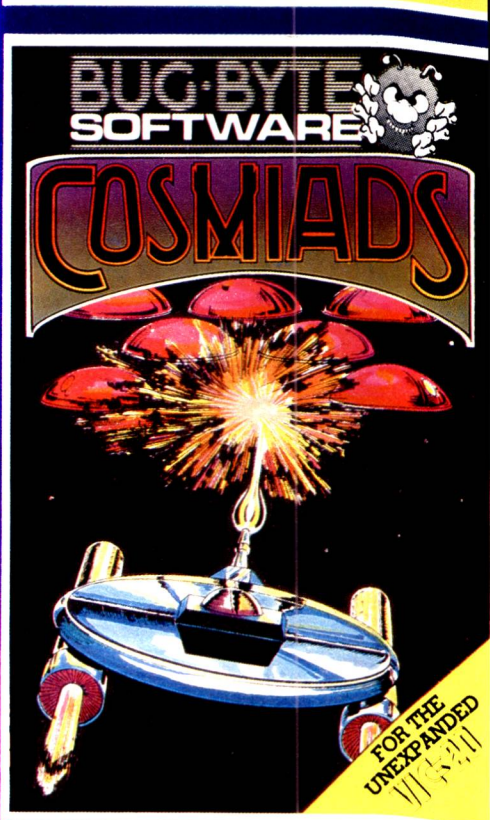

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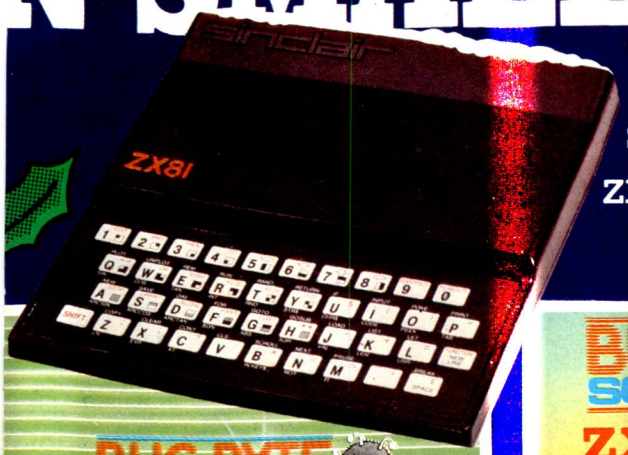

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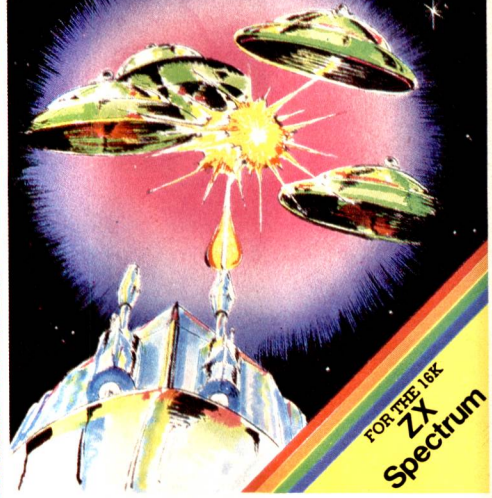

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PCW/1/83

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of £269.95 including VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

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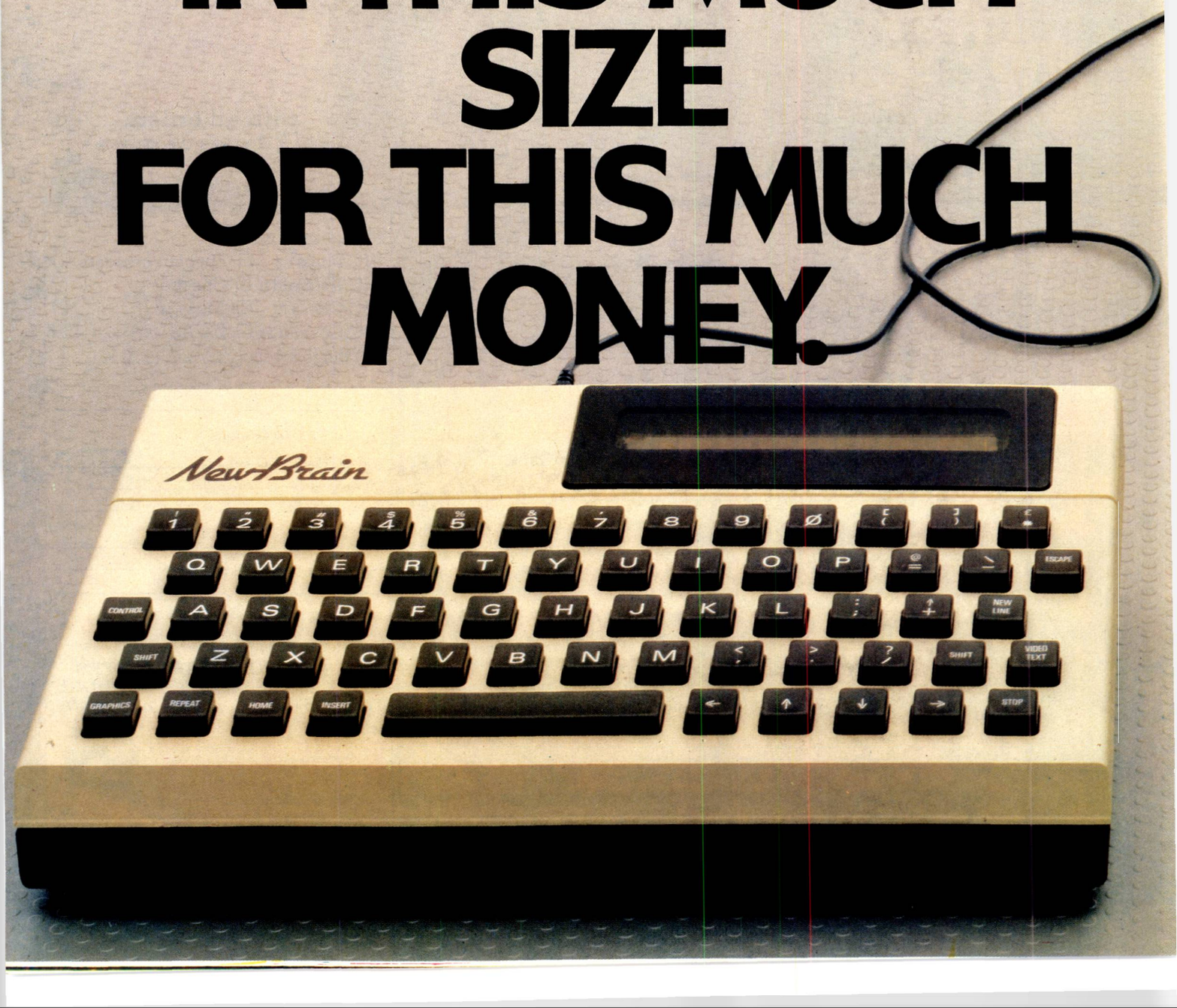

So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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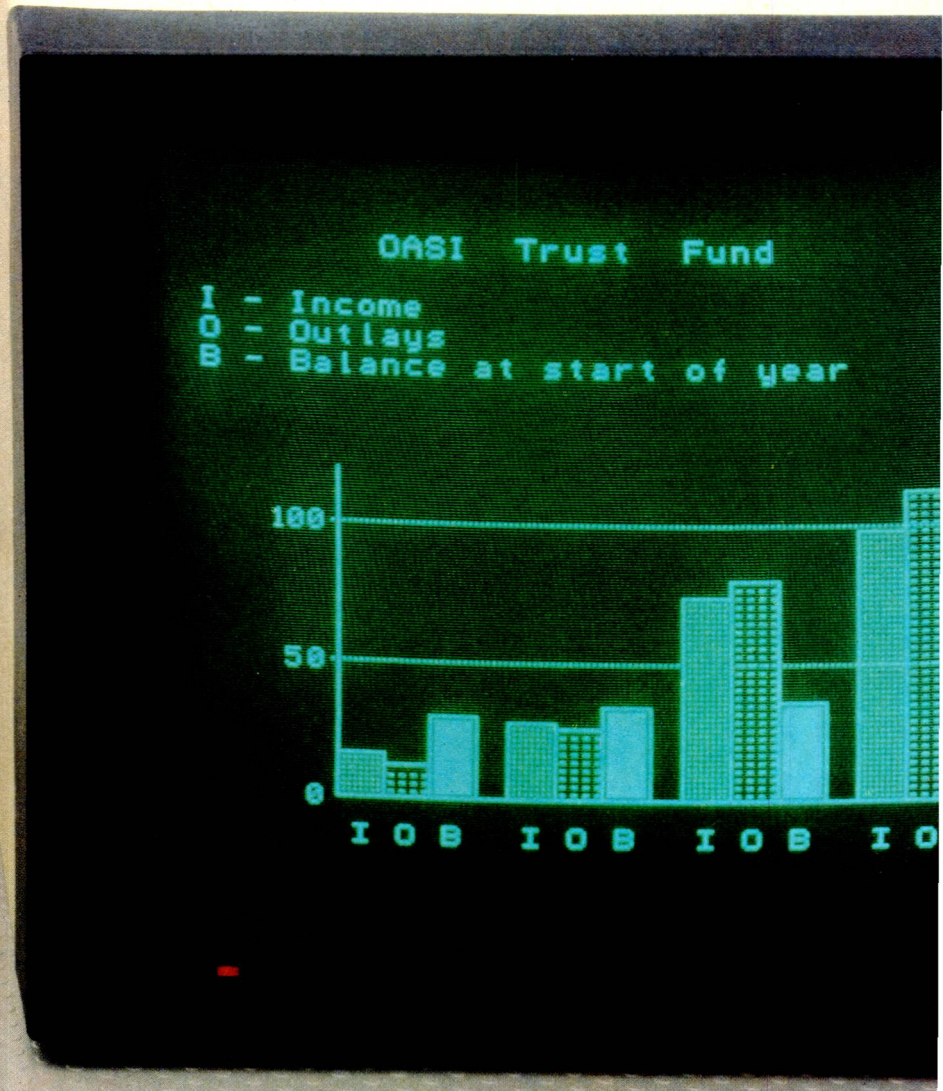

Technical Specifications

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M operating system, and the addition of 5¼ flexible and Winchester disks, 12 green phosphor professional standard monitor, 80 cps professional quality dot matrix printer with pin addressable graphics.

Z80A cpu and COP 420M input/output microprocessors. 32K RAM expandable to 2 Mbytes. 29K ROM. Dual Cassette Ports. UHF TV port. CCITT Monitor Port Video 40/80 Character x 25/30 lines. 256, 320, 512, 640 x 250 Pixels. Expansion Port. V24 Bi-directional Port. V24 Printer Port. 16-character display (AD only).

Software: Enhanced BASIC (ANSI x 3.2/78) Independent Operating System (12 device drivers). Multi Page Screen Editor (32 Control Commands). Maths (10 Signficant Figures). Graphics (Absolute & Relative Plotting, Line & Arc Drawing, Shading, 20 English Language Commands).

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The MIMI's operating system OS/M† is fully CP/M‡ compatible so you have access to a very comprehensive range of software, extending from word processing to accounting.

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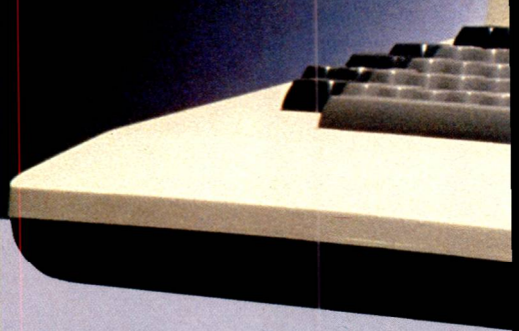

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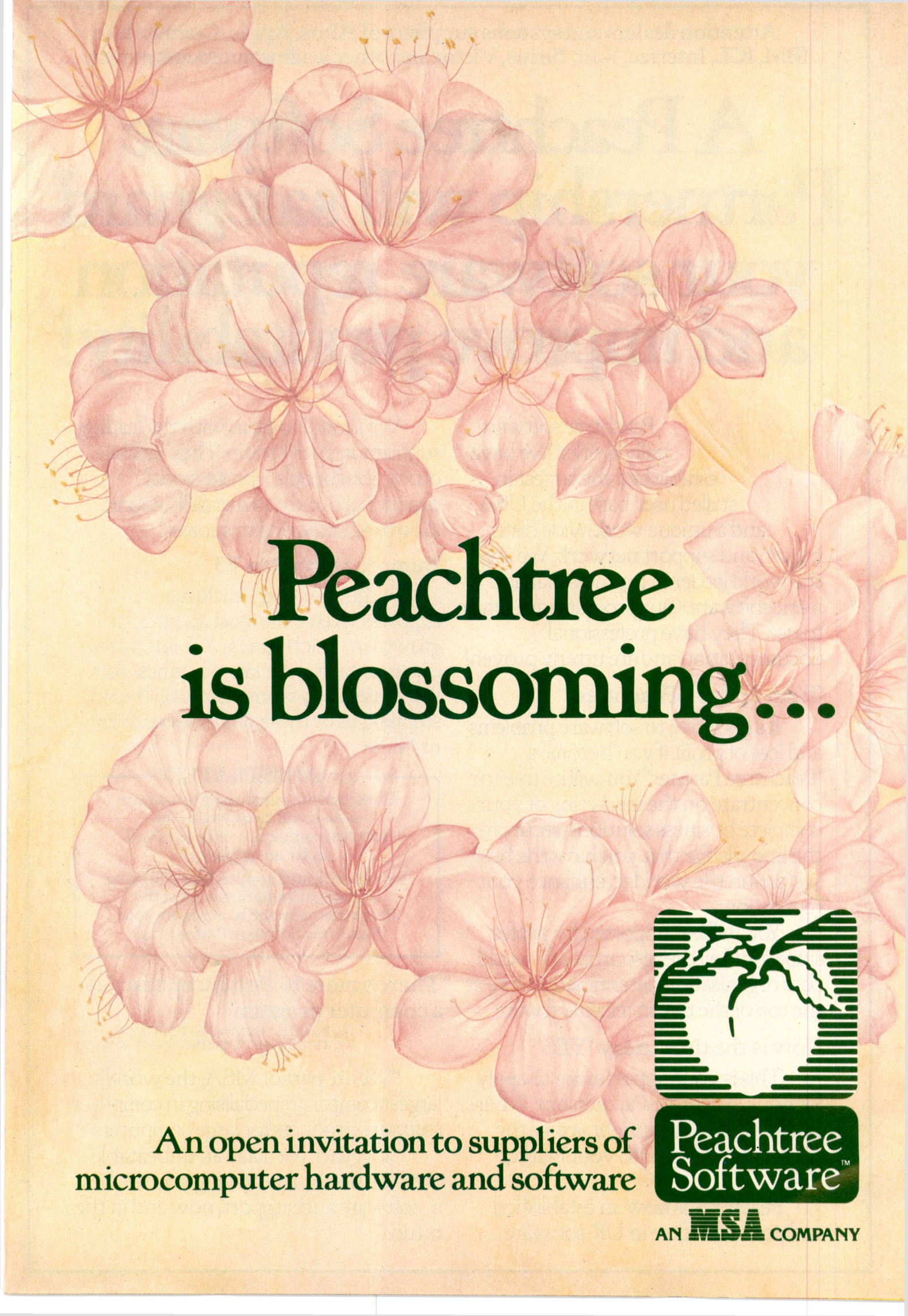
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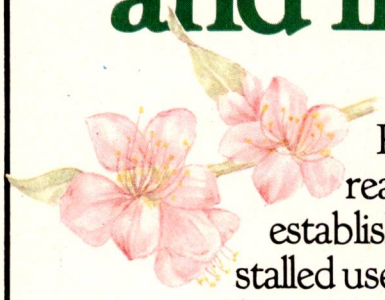

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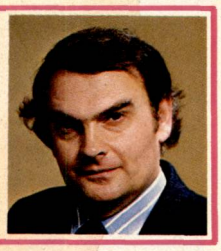

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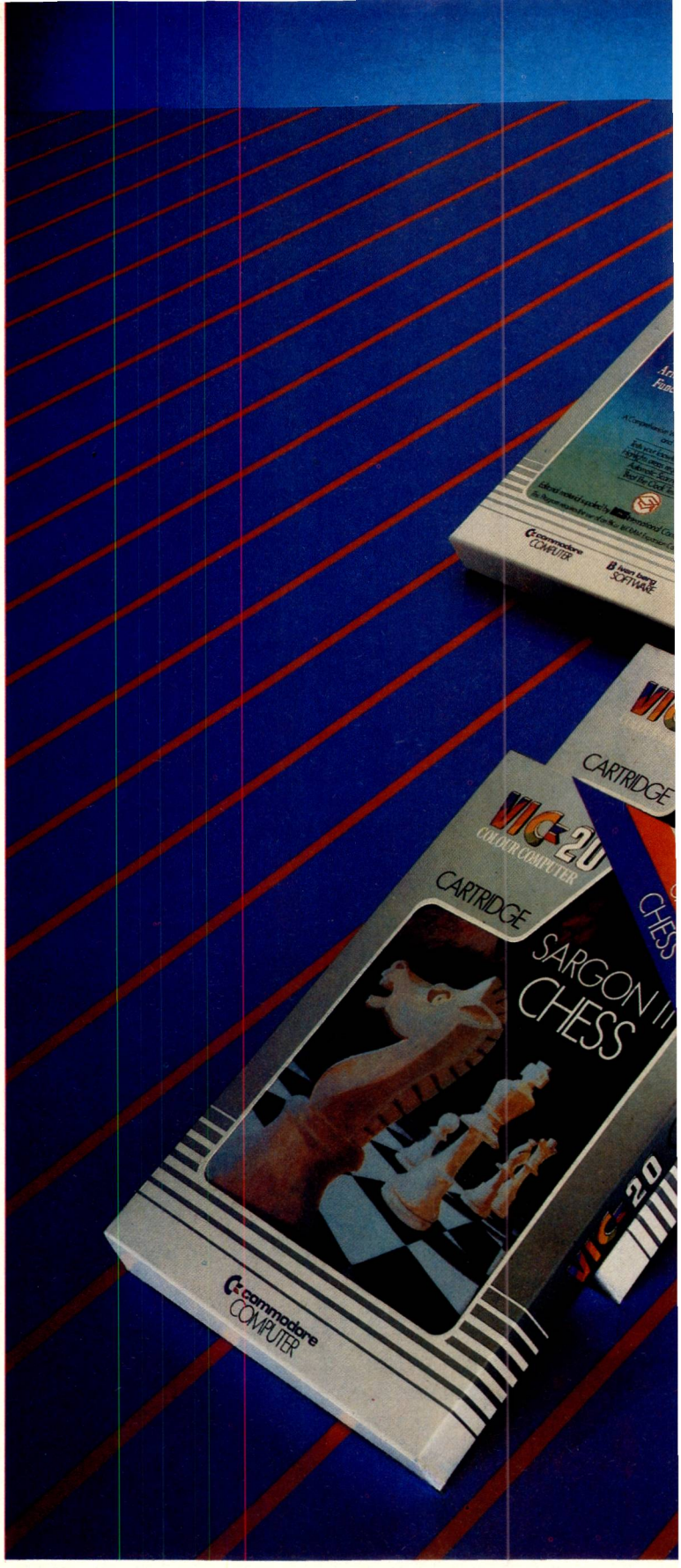



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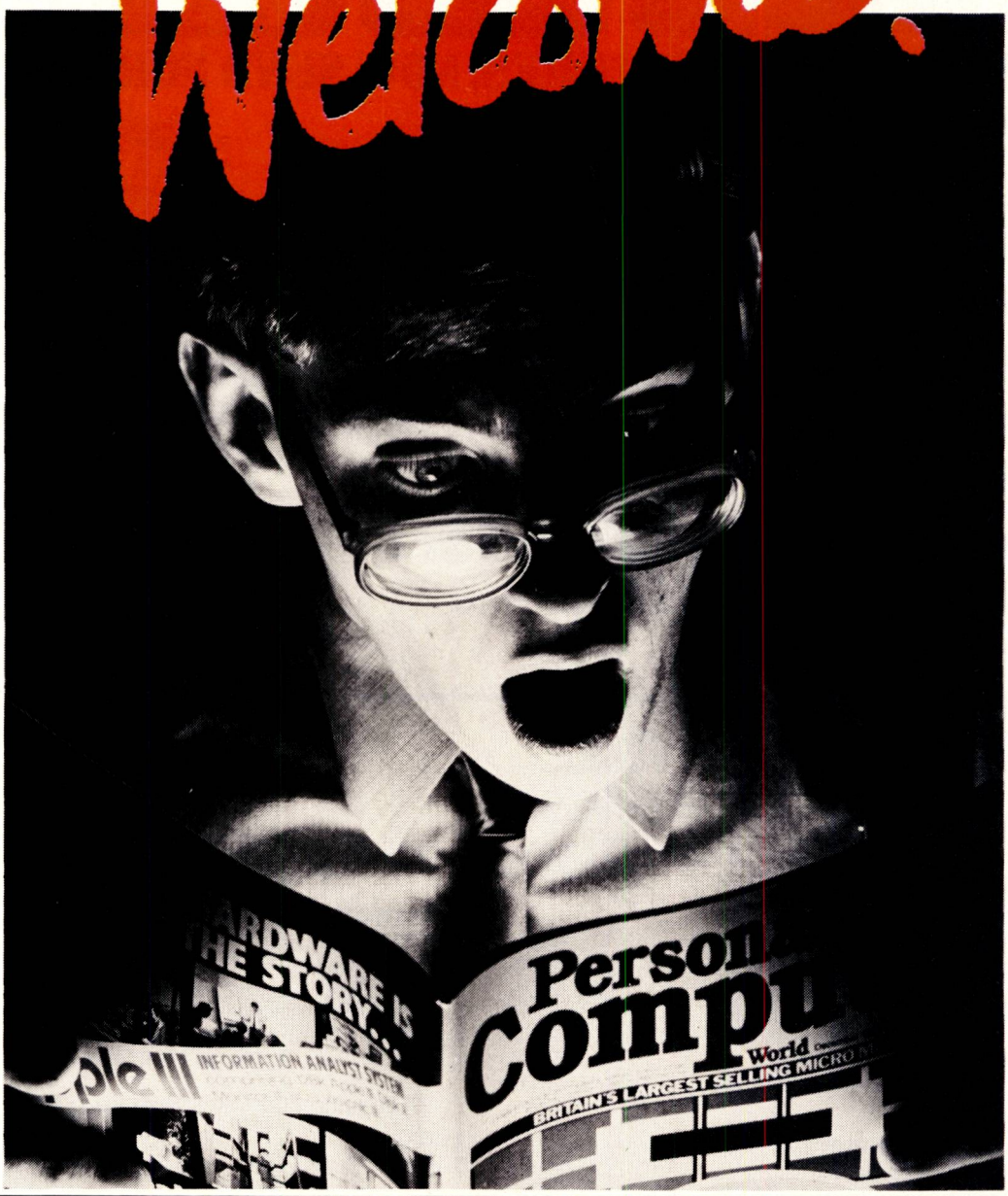

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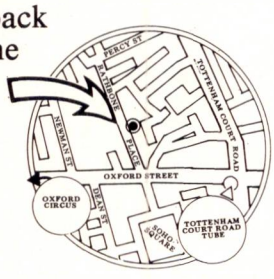

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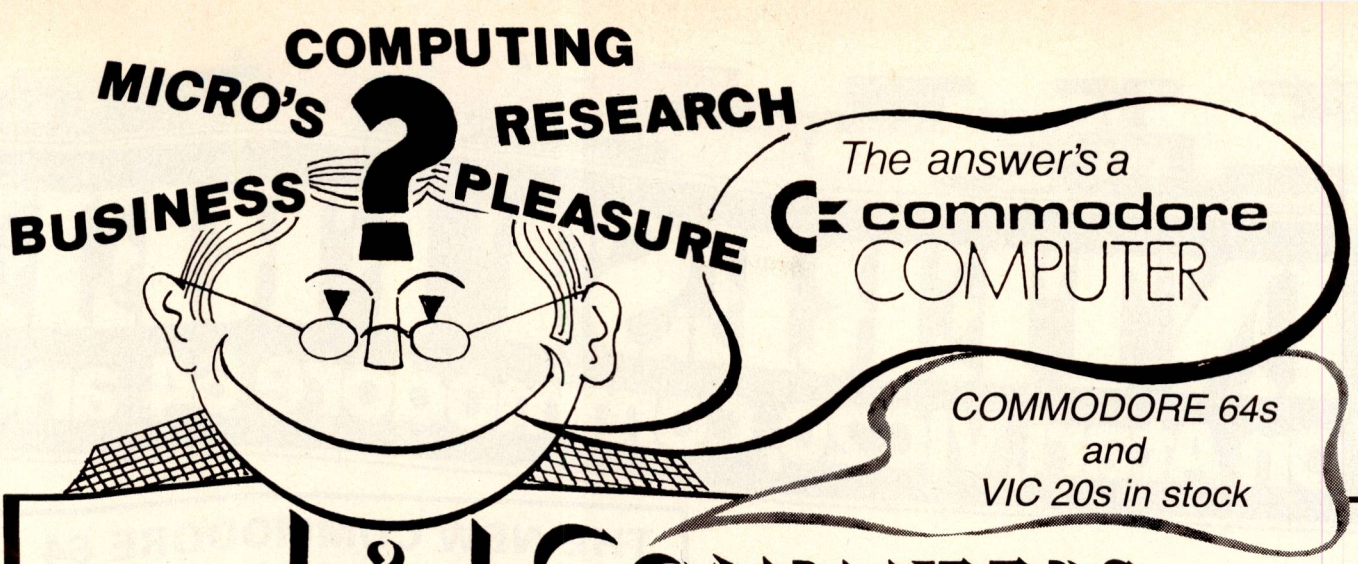

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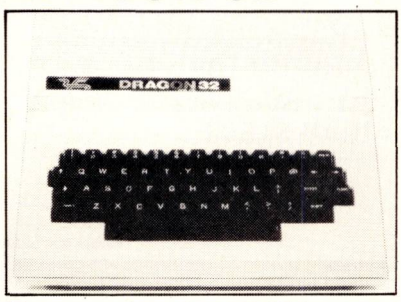

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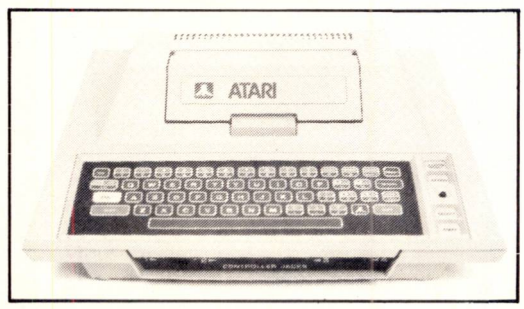

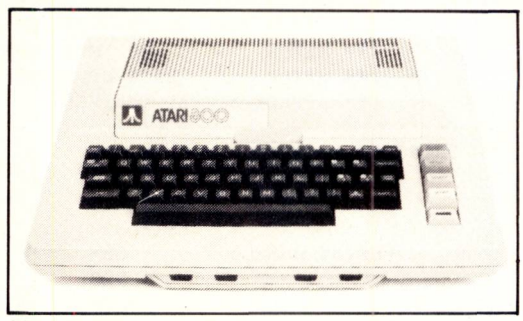

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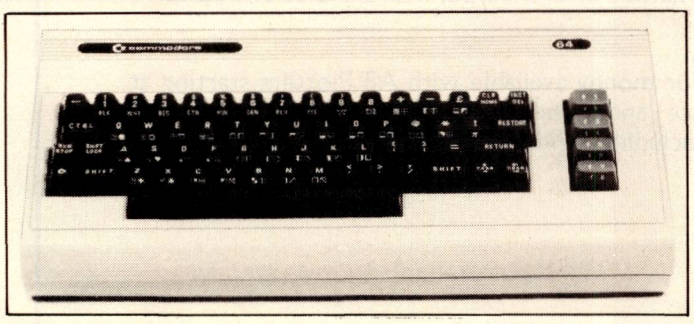

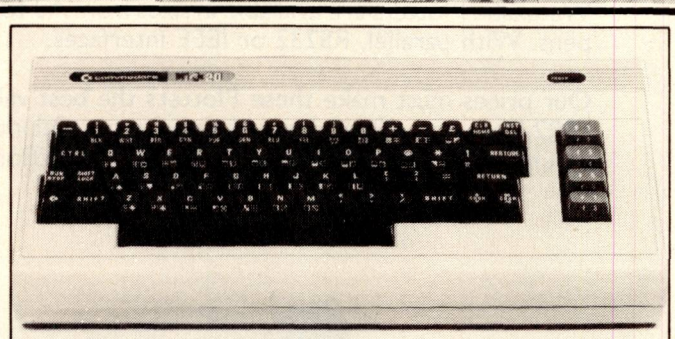

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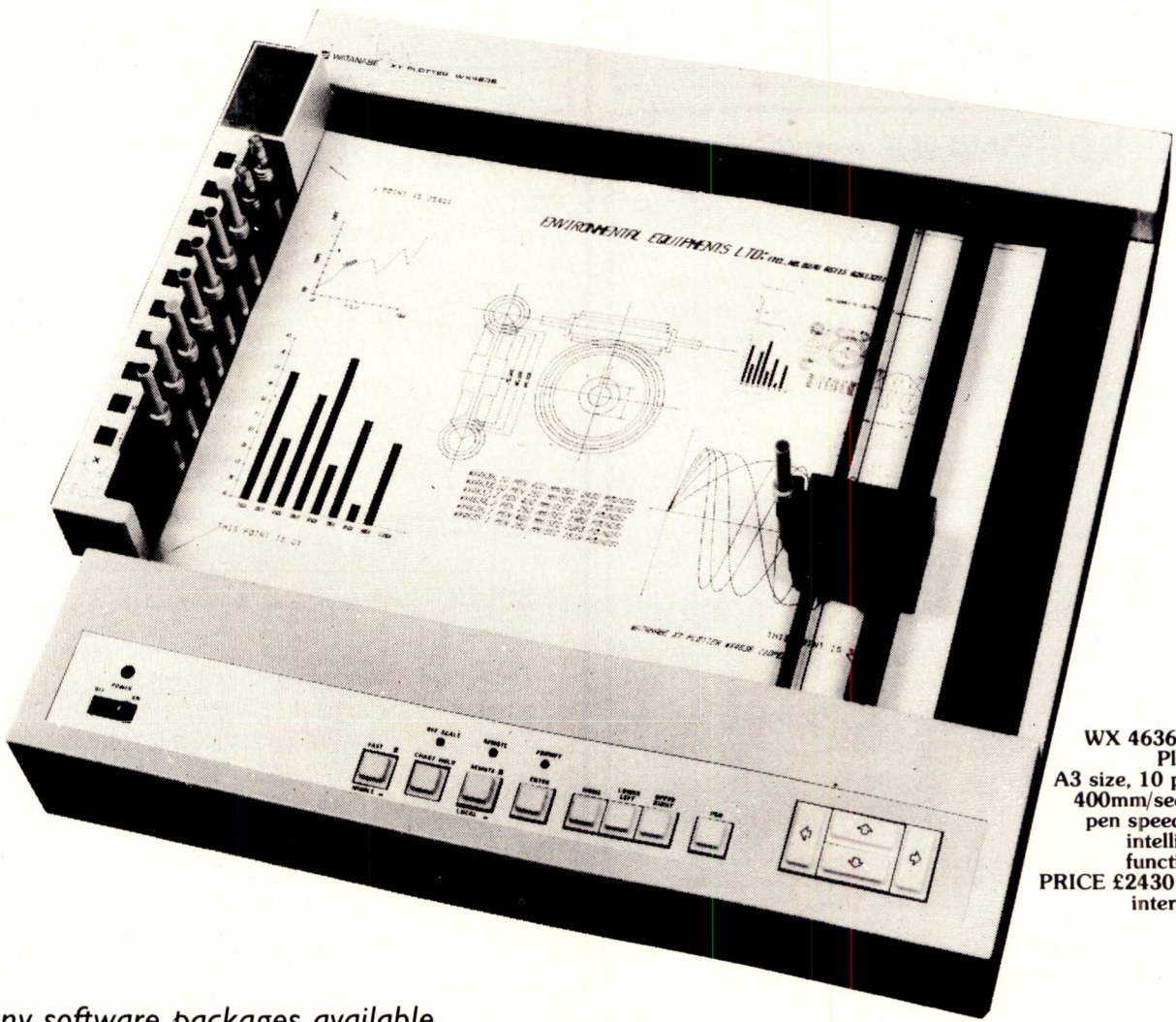

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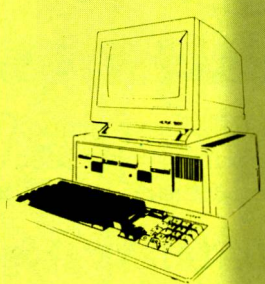

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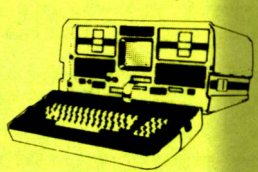

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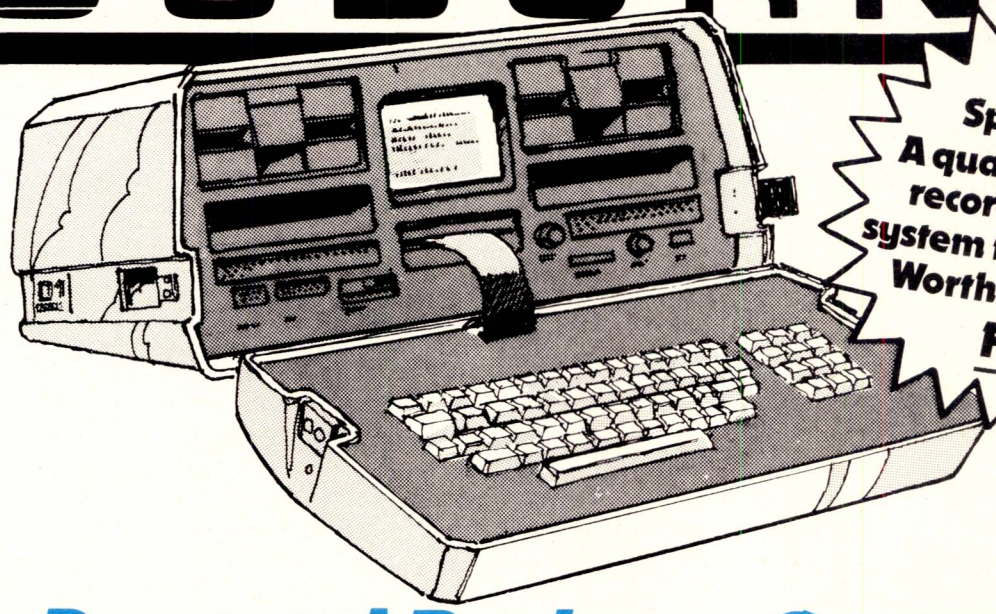

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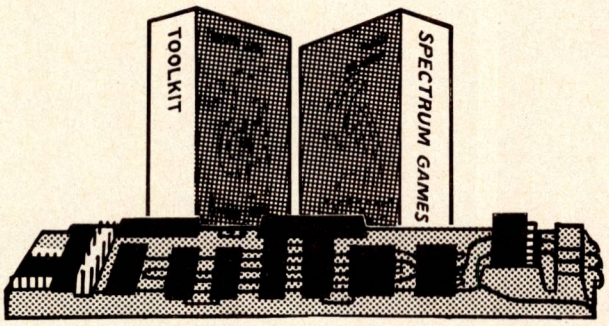

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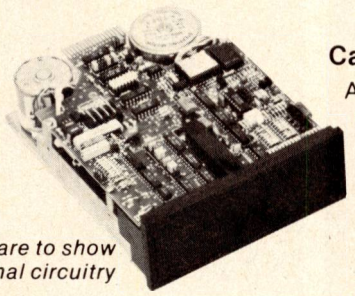

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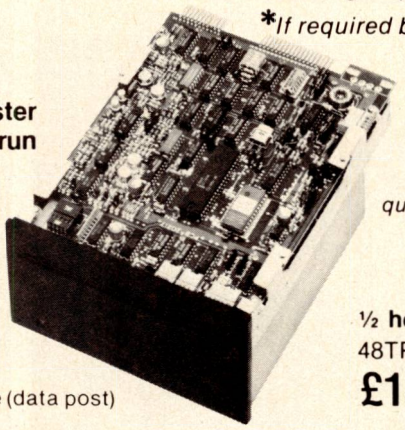

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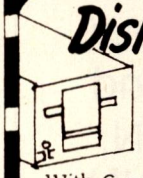

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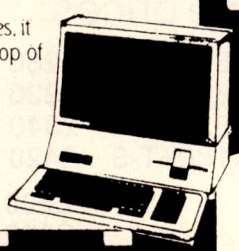

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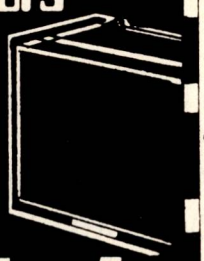

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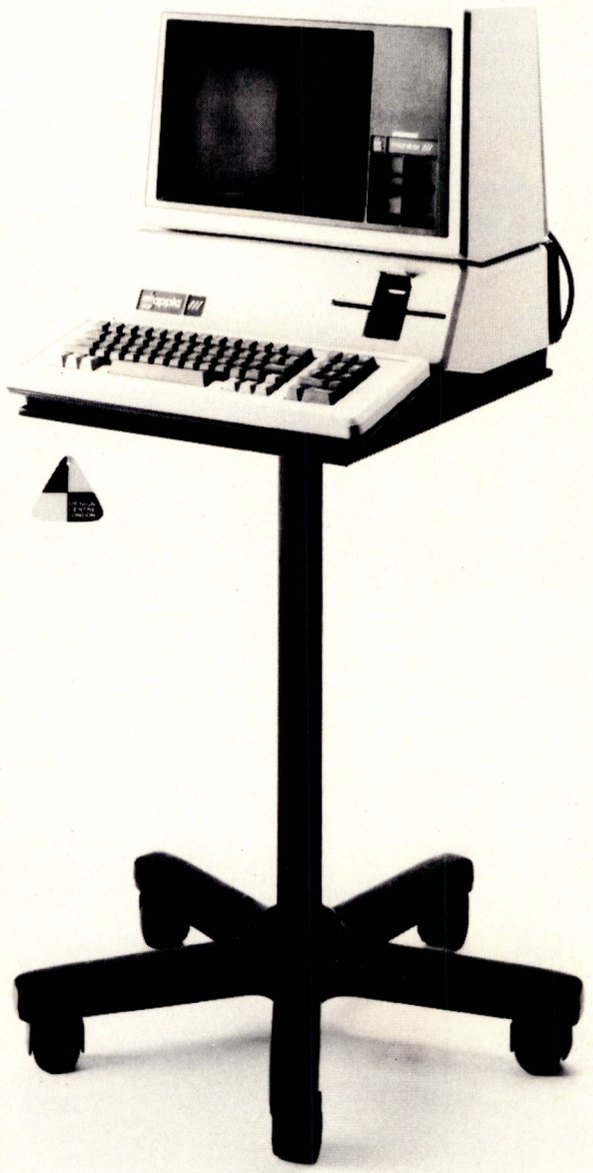

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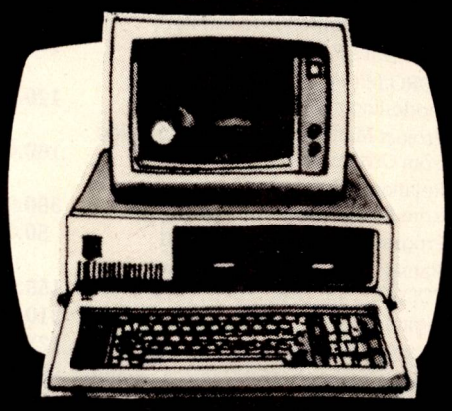

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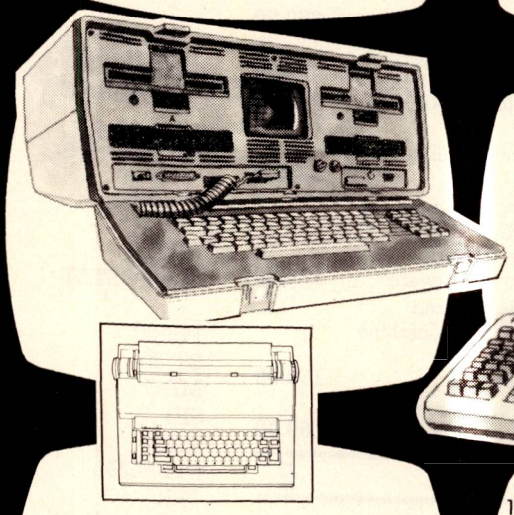

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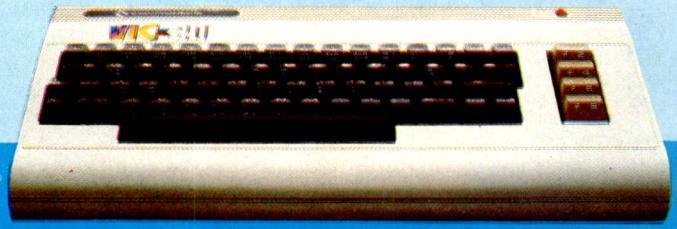

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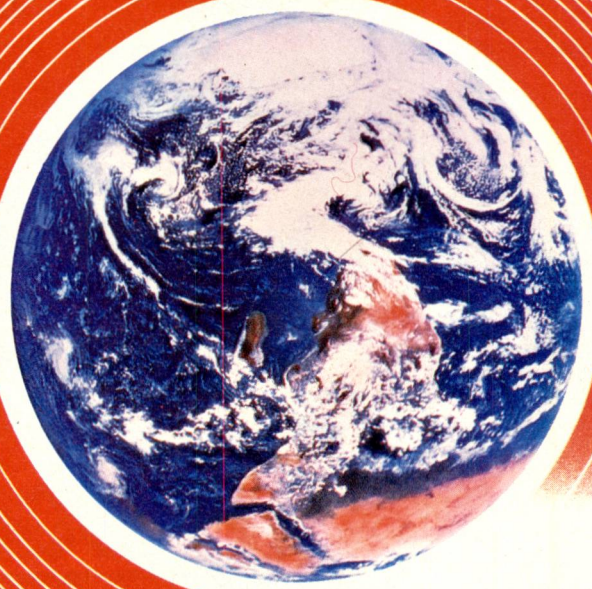

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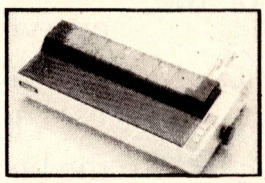

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[1]For comparison purposes, typical professional configurations consists of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

[2]Columbia Data Products also supports CP/M 80 with an optionally available Z-80 CP/M Expansion Board.

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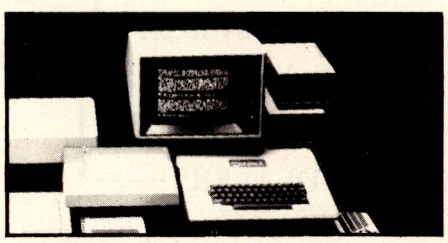

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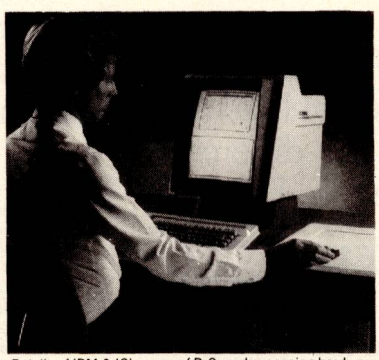

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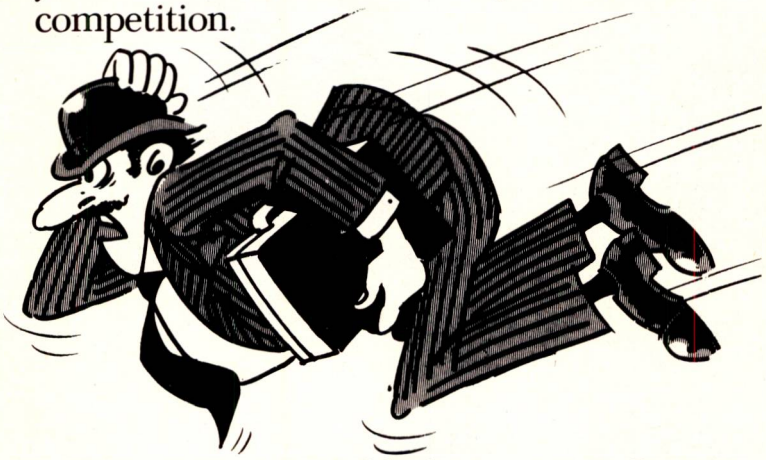

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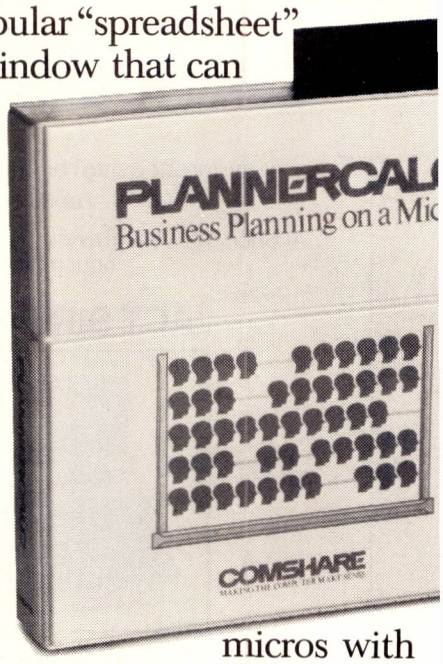

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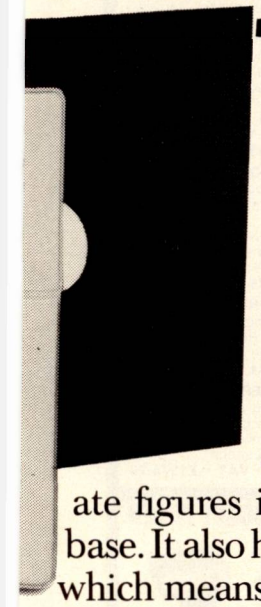

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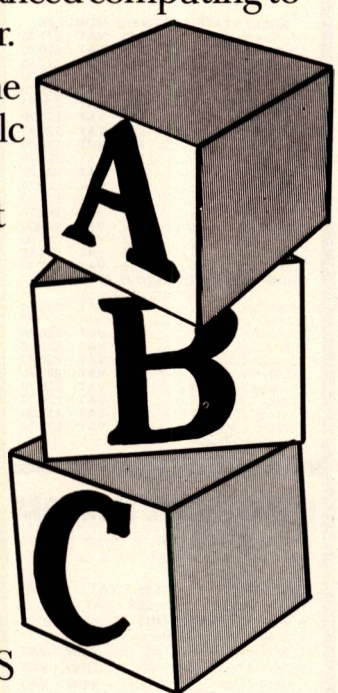

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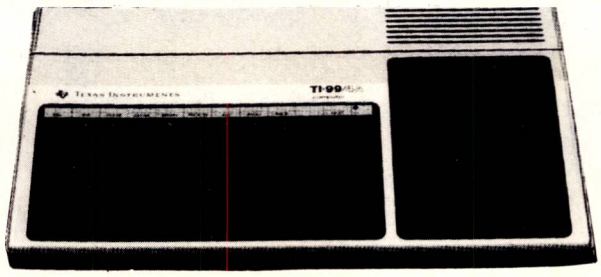

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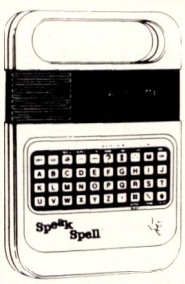

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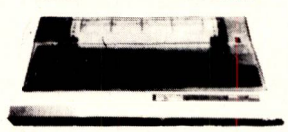

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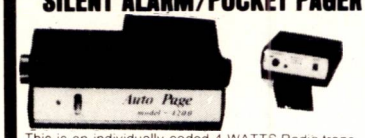

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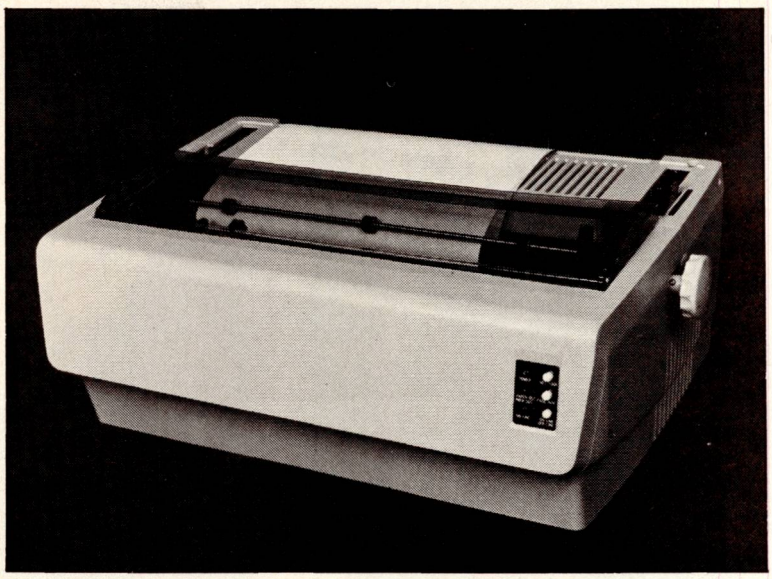

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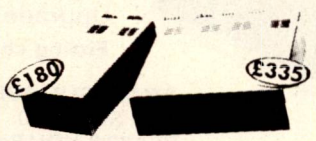

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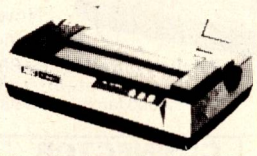

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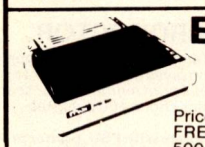

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1 843M	200	20 0MHz	200
2 0MHz	225	24 0MHz	170
3 2768M	150	24 930M	325
3 57594	98	48 0M	175
3 6864M	300	100 0M	375
4 0MHz	150		
4 433619	100		
5 0MHz	160		
6 0MHz	140		
6 144MHz	150		
6 5536M	200		
7 0MHz	150		
7 168MHz	160		
7 68MHz	200		
8 0MHz	150		
9 0MHz	200		
9 375M	350		
10 0MHz	175		
10 7MHz	150		
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Watford's specially designed 4K Ultimate Monitor IC for UK101 & Superboard

Onlv £10.

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Two rows	90p	99p	85p	120p
10 way	130p	150p	110p	—
16 way	145p	166p	125p	195p
20 way	175p	200p	150p	240p
26 way	205p	236p	160p	320p
34 way	235p	270p	190p	340p
40 way	220p	250p	200p	395p
50 way				

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Single Ended Lead. 24" Long

Length	14pin	16pin	24pin	40pin
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6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

IDC FEMALE RECEPTACLE JUMPER LEADS

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24" 1end	160p	200p	260p	300p
2end	290	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	Colour
	Price per Foot	
10	12p	22p
16	25p	32p
20	25p	40p
26	35p	52p
34	48p	60p
40	55p	70p
60	75p	115p

DIL PLUGS (Header)

	Solder	IDC
14pin	38p	95p
16pin	42p	100p
24pin	88p	130p
40pin	195p	218p

AMPHENOL PLUGS

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DIN41617 31way 41612 A+B	170p	—	—	175p
2×32way 41612 A+C	285p	325p	220p	295p
2×32way 41612 A B C	300p	325p	240p	300p
3×32way	360p	385p	260p	400p

EDGE CONNECTORS

TWO ROWS	.1"	.156"
2×10way		135p
2×15way		140p
2×18way	180p	145p
2×22way	199p	200p
2×23way	195p	
2×25way	225p	
2x28way	210p	
2×30way	245p	
2×36way	295p	
2x40way	315p	
2x43way	395p	

D CONNECTORS Miniature

Male

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

Female

Solder	110p	160p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	100p	95p	100p	110p

IDC 25way 'D' plug 385p Skt 450p

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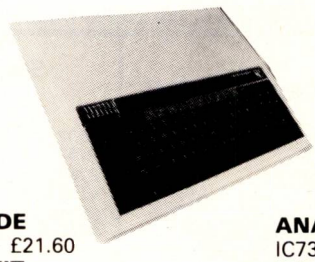

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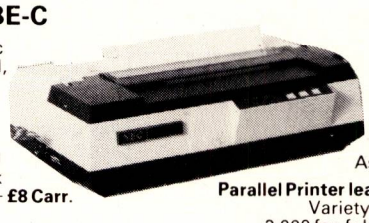

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20 way	145p	125p	240p
26 way	175p	150p	300p
34 way	200p	160p	380p
40 way	220p	190p	550p
50 way	235p	200p	600p

JUMPER LEADS

24" Cable with DIP Headers

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

Cable with Sockets

	20way	26way	34way	40way
Single End 24"	185p	210p	270p	300p
Double End 18"	290p	385p	490p	540p

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(Grey)

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Solder Bucket	110p	160p	210p	350p
Angled Pins	175p	240p	275p	500p
IDC	–	375p	475p	750p
Hoods	100p	100p	100p	130p

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	Solder Type	IDC Type
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16 pin	50p	140p
24 pin	100p	200p
40 pin	200p	225p

EUROCONNECTORS

	Plug	Socket
DIN 41617 21 way	180p	180p
DIN 41617 31 way	200p	200p
DIN 41612 2×32 way Straight pins	290p	330p
2x32 way Ang. pin	325p	400p
2x32 way wire wrap	325p	375p
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2x32 way U Connector = £15
(please specify a+b or a+c)

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2x22 way	200p	250p
2x23 way	200p	–
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2x43 way	395p	–
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When ordering CP/M software please specify the format you require. All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT. Please add £3.75 (plus VAT) for postage and packing for the first item purchased, and then £1.00 for each extra item. For overseas please add £6.50 per item and then £1.50 for each extra item required. Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders. These details and prices are all current as of November 1982. Our prices reflect an exchange rate of U.S. $1.7 to £1.00. (Telephone at time of purchase to confirm latest prices.) All payments must be in Sterling and drawn against a U.K. bank.

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APPLE CP/M-80 13 Sector	RG	CSSN Backup	T1	Industrial Microsystems 5000	RA	NCR 8140/9010	A1	SD Systems 8in	A1
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Blackhawk Micropolis Mod II	Q2	Datapoint 1550/2150	A1	Intel MDS SD	A1	NNC-80W	A1	Sharp PC-3201	R8
British Micros Mimi	RK	Dec VT 180 SSDD	RV	Intertec Superbrain SSDD	RK	North Star Advantage	P2	Shelton Signet	RK
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Cromemco System 2 SD/SS	R6	IBM CP/M-86 SSDD	C3	Micropolis Mod II	Q2	Rair Black Box	A1	Vector Systems B	RN
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■ Memory expandable to 32K ■ High resolution (full PET type) graphics ■ 16 Screen colours and 8 border colours ■ Plugs in to your T.V. or monitor ■ Add Disk Drive & Printer for impressive 170K Byte system ■ Can act as an intelligent terminal for a larger computer.

Sensational NEW LOW price

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64K DYNAMIC RAM PACK for VIC-20
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Limited stocks are just arriving of this super new micro. Just look what it offers!

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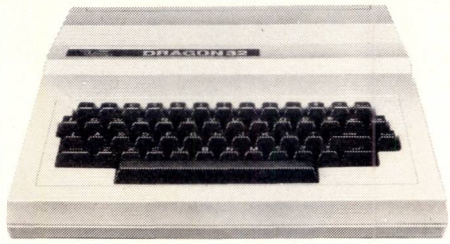
The ideal family computer! DRAGON 32



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Spectrum LOW Price £173.00 Price inc. VAT £198.95

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ATARI 800 16K RAM

Sensational new LOW price



Sensational

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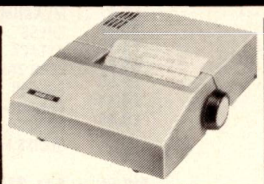

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PCW 85

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Spectrum LOW price £189.00 Price inc. VAT £217.35

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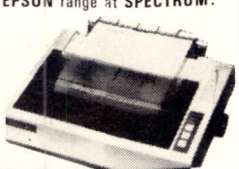

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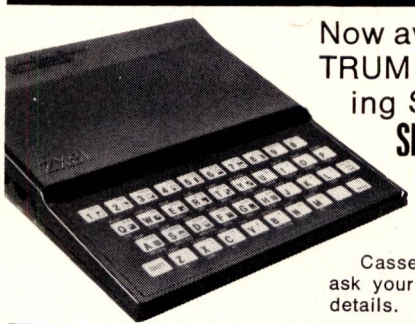
SINCLAIR ZX-81



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ORIC 48K
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NASCOM
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Spectrum LOW price £494.44 inc VAT (£429.95 ex VAT)

48K RAM Plug in board . . £149.50 inc VAT

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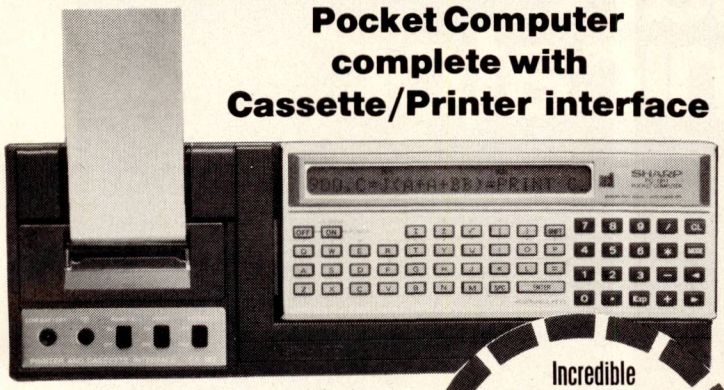
Sensational SCOOP Offer!

LESS THAN WHOLESALE PRICE!

SHARP PC-1211

Pocket Computer complete with Cassette/Printer interface



Here's a **tremendous SCOOP OFFER** from **SPECTRUM** – the **SHARP PC-1211** Pocket Computer, a **ready-to-use** set up complete with **printer** & a **cassette interface.** And ALL for an **amazing £95.90 ex. VAT. THAT'S LESS THAN WHOLESALE PRICE!** Employing BASIC language. Complex interest rates, budget, statistics, engineering and architectural formulae can be handled quickly and easily. Connects to almost any cassette recorder. If you're looking for a pocket computer you must take a look at this **sensational offer from SPECTRUM – FIRST!**

Incredible Value from Spectrum!

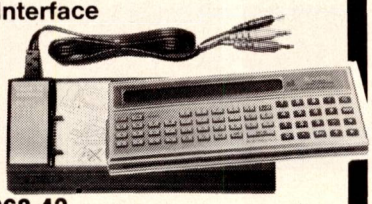
ONLY £95.90 Ex. VAT £110.28 Inc. VAT

COMPLETE

SHARP PC-1211

Pocket computer complete with CE-121 Cassette Interface

■ Ideal for SCHOOL, OFFICE or HOME use ■ High performance functions with easy to understand BASIC language ■ Cassette Interface allows easy connection to almost any tape recorder for storage of programmes and data, etc. ■ 24 Digit alphanumeric dot matrix display ■ Plus many more top features.



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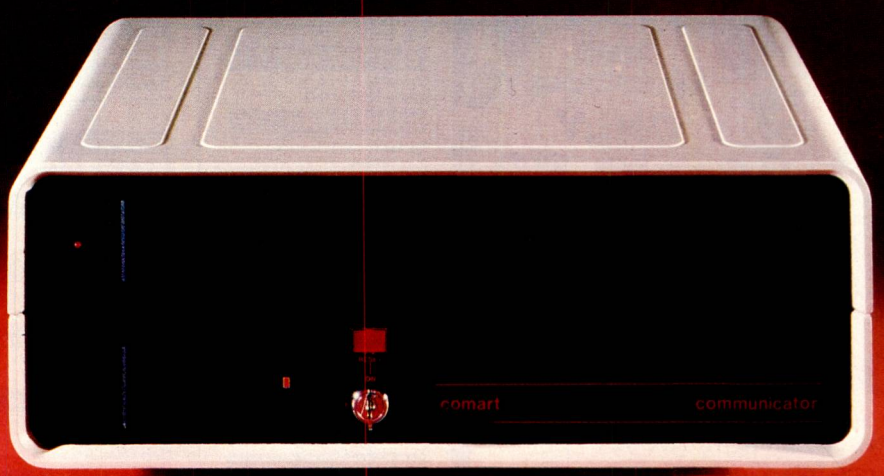

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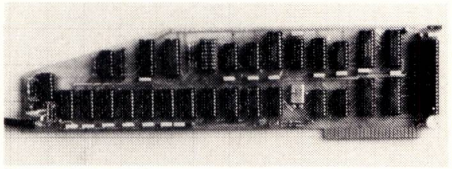

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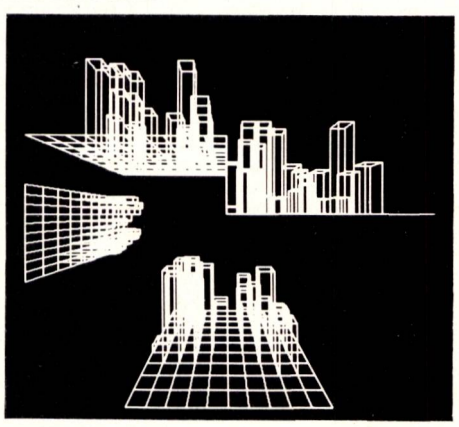

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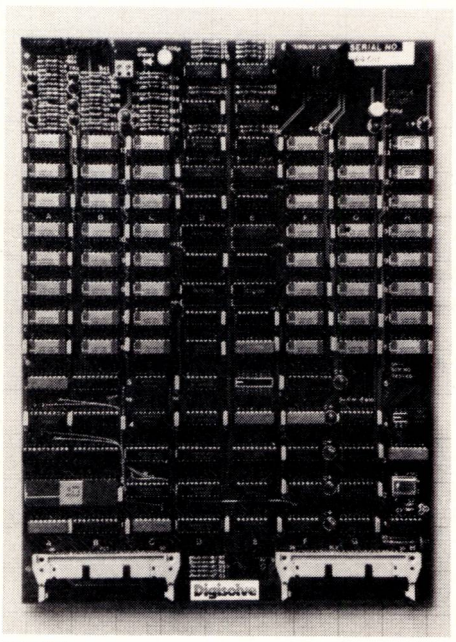

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The last three months should have taught prospective buyers one lesson: never put off buying a system simply because there may be a better one just round the corner.

First, there is *always* a better one just round the corner, and if you wait until you are round it there will be an even better one round the next corner. And all the people who bought before are going to be that much in front of you on their way to becoming experts.

Second, the corner takes a long time to get round. The Oric, a machine which appeared in these columns so long ago that we have had time to publish a retraction of our silly price (actually £169) is promised for the middle of December — in time for Christmas.

Whether this proves to be true or whether instead the magic custom-built ULA chips turn out to need one or two refinements (it has happened to other people) hardly matters. Either way, you will be lucky to get your sticky hands on one, because demand will follow custom and be too much for supply.

There are machines like the Commodore 64, which also should be here by now. It's mid-November as I write and I have yet to get hold of a European production version of that (very nice) machine. Commodore offered *PCW* a US standard machine for a Benchtest, but we felt we should wait for a proper version.

Last year I got very excited about the Z80 add-on to the BBC Micro, due around March 1982. Best estimate (unless you want to buy the Torch add-on, around £800) is for March 1983.

Acorn also promised to have an Electron ready for the big Compec computer show. The Electron, people first said, would be available before the end of the year, and would make fools of all those who bought Sinclair Spectrums (Spectra?).

In the business machine world, things are no better. Commodore is safe from having deceived the world into thinking that 500 and 700 series 'Porsche' machines would be available in September — but the only reason they failed to deceive the world is that nobody was stupid enough to believe them in May.

Corvus showed the Concept (through Keen Computers) in early summer (at the Apple show, of all places). So far, we haven't received one to review, but probably will have by the time you read this.

The star of last year's Las Vegas Comdex show — apart from Chuck Peddle and the Sirius 1 (or Victor 9000 — same beast) was the Fortune 16:32. You just might be able to get one now — and then again, you may find it difficult to make the journey to the nearest dealer — there aren't exactly hundreds of them. But that's quite appropriate, really, since there aren't exactly thousands of machines ready for them to sell.

The Digital Equipment people got quite shirty with us for failing to mention the launch of their Rainbow and Professional machines when they were announced in spring. We were a bit embarrassed ourselves. But even though our review (courtesy of David Ahl) appeared two issues ago, you still can't find any UK users.

And of course everybody knows that there are still no IBM Personal Computers for UK users. more than a year after they started being provided to US users. Some people have gone bust waiting. (Microcomputerland, for example.)

Apple is now very close to announcing the Mini-II, offering less silicon than the II and very little else with the network-based 68000 machine even further off. If you had decided you liked the sound of that particular dream machine when first you heard of it, you might have been waiting two years in vain by now — and there is more waiting to do.

If you feel like reading more about this, write it yourself — there's plenty of material. Just look through back issues, and write down the new machine announcements of the past 12 months.

Even the machines which are in full production, like the Dragon or BBC Micro, have been available only to the few for most of their lives.

And the VIC 20 was supposed to be dead now — it isn't, it's going to carry on being made 'for the foreseeable future' according to Jack Tramiel. He's the boss of CBM and when he says 'the foreseeable future', he means it. (One should perhaps add that Commodore works in three-month cycles, and, while he may mean it, what he actually means is 'until February, anyway'.)

There are also the add-ons — the Sinclair 'disks' (or 'Interchangeable Storage Medium' as Clive would say), for example — which are always 'around the corner' too.

Actually, I've taken some care to list everything which I have some reason to believe will be in the shops come February. All of it is late now, and will be desperately late if it still isn't around in February.

The moral of the sermon is: if you want to buy, buy what is in the shops on the day you have the money, not what looks like it's going to be great next month.

At the moment, the 'toys' in the shops include the BBC Micro, the VIC-20, the Texas Instruments 99/4A, the Sinclair ZX81, the Spectrum, the Dragon, and the Atari. Precious little else is available, and some of that lot is hard to get hold of.

The 'business machines' in the shops are things like boring old Superbrains, boring old Osbornes, boring old Apples, boring old PETs and boring old Signets, plus the occasional interesting machine like the Sirius.

By all means read this section of *PCW*, and make an intelligent study of what's on the horizon. Being well-informed about the future can help tremendously in making decisions about the present.

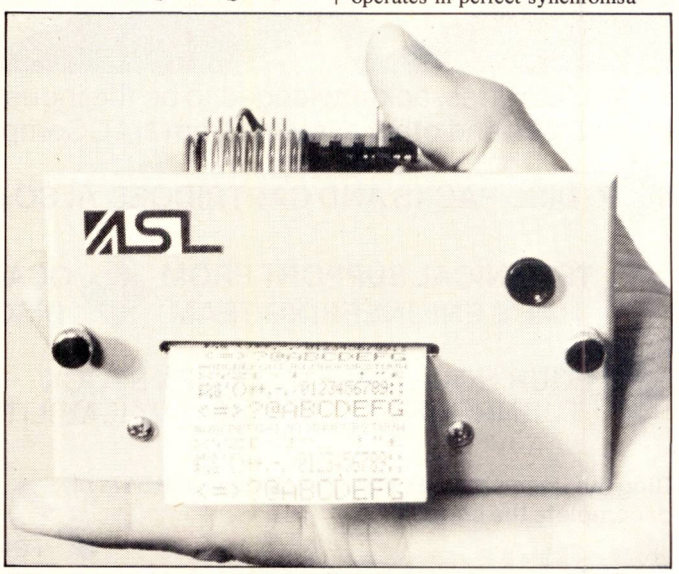
As long as you don't forget that the horizon is not here, and the future is not now.

Going Dutch

In Amsterdam, there was recently a show called Comdex Europe, where top US industry pundit Adam Osborne had hoped to address an attentive audience of the most powerful European corporate tradesmen.

Instead, he found himself telling a largely empty hall containing his chief computer designer, Lee Felsenstein (and a few colleagues) that 'designing the hardware is easy — to succeed in this business, you have to provide other things like software support'.

Lee took this tactlessness in good part, since it is his opinion that the 30-odd imitation Osbornes prove that the hardware isn't all that easy. He may be able to get timing signals out of the system to make sure that every chip operates in perfect synchronisa-



This printer can print both up and down: 'when mounted vertically, the printout can be made to emerge downwards, wiith the last printed line at the top (data mode) or upwards, with the last line lowest (text mode)' — according to Able Systems Limited.

It took me a couple of minutes to work out that what it actually does is to print either left to right, normally, or right to left, upside down. You think about it.

Details on Northwich (0606) 48689.



From the picture, you might deduce that this isn't a VIC with only 20 characters per line, but the Commodore 64, which has 40.

You would be wrong: it's a VIC with an add-on Stack product which gives 40 or even 80 columns. The only drawback I can see is that it costs £115, which just happens to be the lowest price I have heard of for the VIC itself. But if you already have a VIC, it sounds like worth having.

Details through Vicsoft, the VIC users' club, or from Stack at 290 Derby Road, Bootle, Liverpool L20 8LN.

tion but others don't have that skill. 'Three crystals,' Lee whispered while someone was talking about one particular rival system. 'Three crystals to generate all the timing signals. Two in the computer and one on the keyboard!'

Apart from that bright moment, the exhibition was the sort of show only a journalist would enjoy.

Comdex in America is a twice-yearly affair, for trade buyers and sellers only — none of you lot who just want to buy a packet of disks or play Pacman. Even with that restriction, the enormous aisles are crowded to bursting. Comdex Europe didn't have that problem.

One exhibitor had hit upon the brilliant idea of using female anatomy to publicise his wares. A belly-dancer with the astonishing trade-name of Yonina started up every couple of hours in what appeared to be competent style. At the end of her performacne, she seized a microphone, cracked two or three (very breathless) bluish jokes ('we hope you'll come onto the stand and take a look, and look at the computers too') in a Pan-European accent. Nobody from the crowd did, of course. (They never do, because most of them are either interested only in the girl, or too shy to come near a female they obviously can't impress with their worldliness, or otherwise daunt.) This time, however, they didn't come onto the stand, because they felt they ought to get back onto their own stands. They were all exhibitors.

Which Unix?

People wanting big power in a personal processing system usually end up listening to a salesman talking about Unix, because Unix is generally agreed (by the people who build bigger micros) to be suitable for big systems.

The trouble with Unix is that there is Unix and there is also Unix, and then there is a group of things like Xenix and Onyx and Uniflex.

British operating system expert Eddie Bleasdale has got himself into a bit of a stew about it all, since he sells a system with Unix and reckons that it is the only 'real' system with 'real' Unix — something which he can think if he likes but which his competitors get steamed up about if he says it.

Bleasdale sells one system based on the Z8000 and another based on the 68000 — the numbers refer to the central processing chips inside the systems. Lined up as his rivals nowadays is a longish list, starting with Fortune 32:16, Wicat, Victory (a new one) and Onyx.

The trouble is knowing what we are all talking about. Unix Version 7 is the sort of Unix which most people have on offer — or else a version of Version 7 which they have written themselves.

Bell Labs, however, invented Unix, and is currently selling System III of the operating system. Oddly enough, that is a later version (Version 7 is Version Seven of System II).

Just to confuse everybody, Bell has produced System 4 as well and Berkeley University has produced 4.2, which is appearing on various systems. It's supposed to be a secret, but on a machine called the Sun, at Compec in London last month, 4.2 appeared on the screen with the suggestion that it would be on sale in March through Tim Keen. Even more secret, System Five is near to readiness.

Having established which version (or system) you may be talking about, the next thing is to establish whether that version (or system) is actually running. Here, you're on your own, because the number of people in this country who really can tell whether Unix is working properly is very limited.

No, this is not an attempt to answer the question in a couple of paragraphs, just to warn you that you really do need an impartial expert when choosing a system with Unix. And to add that Bleasdale is contactable on 01-828 6661, since he has just announced a Sun-based system with Version 7.

Print problems solved

The best-selling word processing package for personal machines is Wordstar, and the best-selling personal printer is the Epson.

It comes as quite a surprise, then, to find out that there are no commercial versions of Wordstar which can drive the Epson properly.

Even more of a surprise was the discovery that experts who can advise on how to link the two are equally few and far between and, until last month (November, if you are reading this January edition in December!), authorities on Wordstar itself didn't include its inventor, MicroPro.

MicroPro has now arrived in the UK. At press time (during the Compec exhibition) nobody was properly installed in their new



Dials, dials, dials, all the fascinating and inscrutable dials which used to make good old-fashioned sci-fi thriller movies so terrifically hi tech, used to do their thrilling by one simple little trick. They were mysterious and hard to understand. For building up tension in a movie, dials are fine. For showing a group of children what's actually happening in a science laboratory, a dial is often useless. You need a better display.

Anybody with a personal computer, of course, has a pretty good display. It can be programmed to display graphs, bar charts, numbers, and even (if you like) dials. All you need is something that does the actual measuring. For that, you go to Educational Instruments, which produces a range for physics and biology measurements (primarily) and says the equipment is particularly well suited for teaching because it is safe. It can connect a wide variety of measuring modules to most 'approved' educational computers.

Details at 30 Lake Street, Leighton Buzzard, Beds LU7 8RX, phone (0525) 373666.

THE GENIUS YOU CAN TAKE TO BREAKFAST.

Now, at last, real portable computer power. The new Sharp PC 1500 pocket computer. A pocket-sized genius that will travel with you to conferences, seminars and business breakfasts.

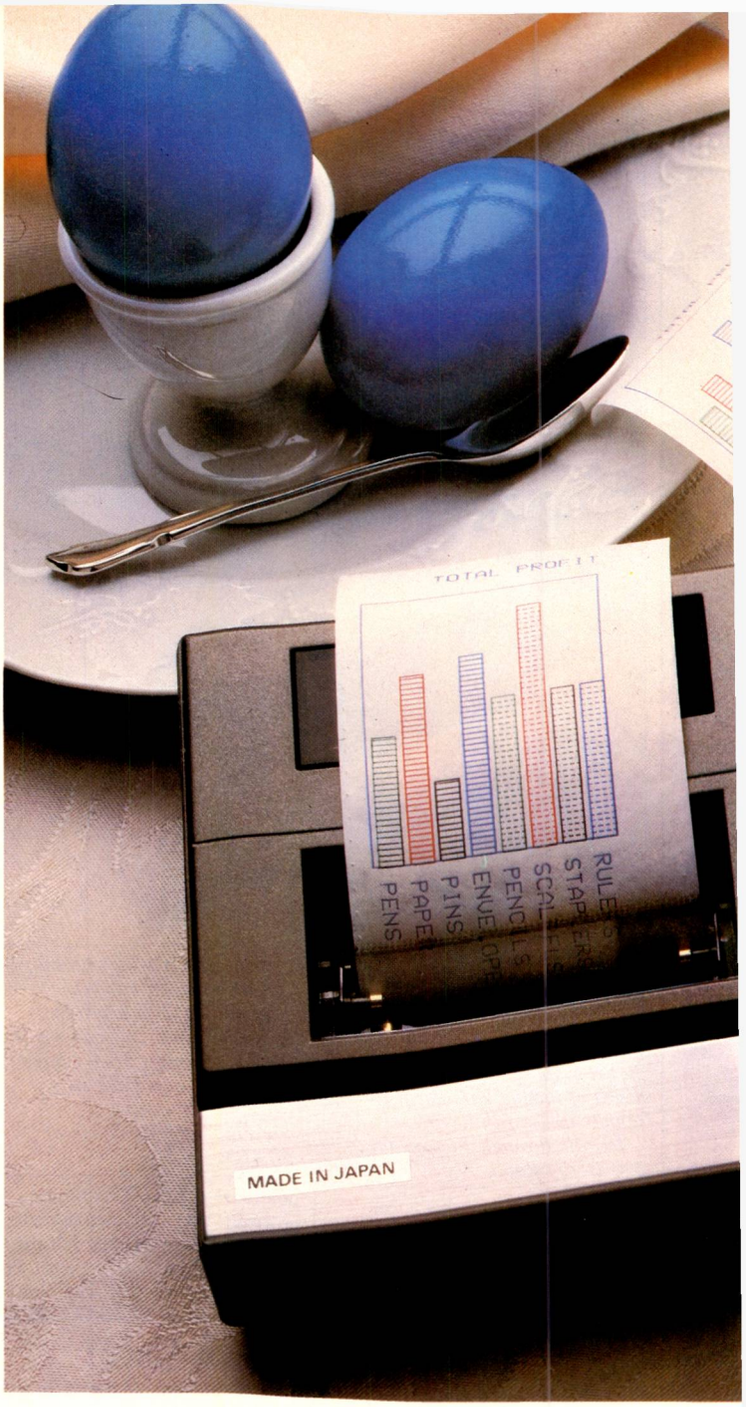
The PC 1500 has the capacity and BASIC language usage that is very nearly that of the desk-size Personal Computer. When fitted with the optional 4-colour graphic printer, it is one of the most powerful pocket computers on earth.

Chores can be handled swiftly and accurately any time of day, wherever you happen to be. Estimates, records and charts of sales, billings and other important data can be re-programmed, calculated and summoned at the touch of a button. It can even play blackjack, analyse your biorhythms or give you a beeped reminder of a scheduled meeting.

Large memory capacity, up to 11.5K bytes. 4-colour print-out. Six user-programmable keys.

The incredible new PC 1500. A revolution in pocket computers.

From Sharp. Where great ideas come to life.



SPECIFICATIONS PC 1500

Number of calculations	10 digits (mantissa) + 2 digits (exponent)
Program language	BASIC
CPU	C-MOS 8-bit CPU
Capacity	ROM: 16K bytes RAM: 3.5K bytes expandable to 11.5K bytes
Memory protection	C-MOS battery back-up
Display	7 x 156 dots mini-graphic display (English upper- and lower-case letters, numbers, special signs, etc.)

CE 150 Colour Graphic Printer/Cassette interface (Optional)

Colour Graphic Printer	
Power source	Built-in rechargeable battery
Printing digits	Standard 18 digits (36, 18, 12, 9, 7, 6, 5, 4 digits selectable)
Printing system	X-Y axis plotter system
Printing mode	Graph/Text switchables
Character sizes	9 different sizes from 1.2 x 0.8 mm to 10.8 x 7.2 mm (from 1/16" x 1/32" to 7/16" x 9/32")
Printing colours	Red, blue, green, black
Printing directions	Right, left, up, down
Minimum step width	0.2 mm (1/64")
Cassette Interface	Up to two cassette tape recorders can be connected

CE 151 Memory Module (Optional)

Capacity	4k-byte C-MOS RAM

CE 155 Memory Module (Optional)

Capacity	8K-byte C-MOS RAM

CE 153 Software Board (Optional)

140 key soft-touch definable keyboard

CE 152 Cassette Recorder (Optional)

Audio cassette recorder to match PC1500

CE 159 Battery Back-Up Memory Module (Optional)

Capacity 8K-bytes, will retain memory contents when removed from PC1500.

CE 158 RS 232 Interface

RS 232C Interface also incorporating Centronics parallel interface.



BASIC LANGUAGE SPECIFICATIONS
PC 1500

Commands	RUN, NEW, LIST, CONT, TR ON, TR OFF, LOCK, UNLOCK, STATUS, MEM
Statements	INPUT, PRINT, GPRINT, CURSOR, GCURSOR, PAUSE, USING, WAIT, CLS, IF . . . THEN, STOP, GOTO, ON . . . GOTO, GOSUB, ON . . . GOSUB, RETURN, ON ERROR GOTO, FOR . . . TO . . . STEP, NEXT, END, DIM, LET, REM, DATA, READ, RESTORE, BEEP, AREAD, ARUN, CLEAR, RANDOM, DEGREE, RADIAN, GRAD, BEEP ON, BEEP OFF
Functions	SIN, COS, TAN, ASN ACS, ATN, LN, LOG, EXP, DEG, DMS, RND, SQR (√‾), SGN, ABS, INT, PI (π), LEFT$, RIGHT$, MID$, ASC, VAL, LEN, CHR$, STR$, POINT
Variables	A ~ Z, A$ ~ Z$, two-letter variables possible, two-dimensional arrays applicable
Operations	+, —, *, /, (,), >, <, >=, <=, <>, =, ^, AND, OR, NOT, &
Others	INKEY$, TIME, , ; : "

CE 150 Printer

Commands	LLIST, TEST
Statements	LPRINT, TAB, LF, ROTATE, COLOR, GLCURSOR, SORGN, LINE, RLINE, CSIZE, TEXT, GRAPH, LCURSOR

Cassette Interface

Commands	CSAVE, CLOAD, CLOAD?, MERGE
Statements	INPUT#, PRINT#, CHAIN, RMT ON, RMT OFF

To: Sharp Electronics (UK) Ltd, Computer Division, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Tel: 061-205 2333.

Please send me details of the Sharp PC 1500

Type of application: _____

_____

Name: _____

Address: _____

_____

_____

_____

_____ Tel No: _____

PCW3

The world of
SHARP
where great ideas come to life.



Design and specifications subject to change without notice.

London offices at 31 Dover Street, but by now you should be able to contact Kristi LaBianca, director of MicroPro UK, at that address.

Incidentally, the new Epson printers (the Mark III) are much cleverer than the ones most of us have bought. They can do things like teeny tiny little super-script and sub-script letters, like emphasised print, like double-width letters, like 132 letters per column.

The old Epsons could do some of these things but not very well. If they did double width characters, it had to be a whole line at a time, so if they were required to do two lines of double width characters, you had to reset the thing each line.

Now here's an interesting thing: the difference between the old Epsons and the new ones is simply the memory chips inside them. Take your old Epson Mark 2 to a dealer, pay him £25, he will put the new chips in — and Shazam! a Mark III Epson.

For some reason, Epson isn't publicising this fact too heavily.

Bravery

It takes a brave man to announce Ethernet for a microsystem, since Ethernet is widely agreed to be neither fully operational, nor cheap. Two brave hardware companies, then: Altos, which had Ethernet on show in Amsterdam recently, and a company called 3COM.

The 3COM system is going to be built round the IBM Personal Computers (when we have them) to provide a line of products that will connect several users into a network. That way they can share big disks, expensive 'tape spoolers', and messages.

Anybody fancying trying the experiment can contact the company's agent, Ambar Components, on (0296) 34141 at Gatehouse Road, Aylesbury, Bucks, HP19 3ED.

Dithering

Osborne in the US is still dithering about how or when it will announce 80-column displays for current users.

Logic appears (but only appears) to be on its side. It has polled its customers to see how many of them will buy the 80-column display option if they make it available and the customers mostly say they don't need it.

This is hardly suprising, since it is about as clever a question as asking a convention of one-eyed cinema enthusiasts if the club films should be shot in 3-D. Naturally, everybody who wants an 80-column display (a lot of people) decided not to buy an Osborne in the first place.

Osborne should poll the people who nearly bought one, and didn't.

Free micros!

You presumably want to know how the world's first hard-disk portable computer ended up being sold through Rymans office shops? Read on.

Rymans used to sell an American-built overpriced system called Dynabyte, imported by Metrotech. Then Rymans and Metrotech and Dynabyte all split up.

Rymans has thought a bit about this and has returned to the market with a British product range — the extraordinary Andromeda family from ITCS in Staines.

This is the family of 'free' microcomputers which has attracted both controversy ('he can't do it!') and enthusiasm ('we've done £2.5 million worth of business in less than six weeks from startup') because the machines are not only free, but come complete with some cheap software.

The idea is simple enough: ITCS will lend a machine suitable for running the software it sells and maintain it for a reasonable fee, for three years.

All the machines (over 20 different combinations from six basic designs, including an Osborne-like portable) run CP/M on an identical central processor.

The difference between the systems is the size of the keyboard, the size of the screen, the density of the disks, and so on.

The systems have now been enhanced with the launch of what proprietor David Lewis-Pryce reckons is the 'first winchester-disk portable' in the world.

This is no light-weight: the basic Zita portable requires you to lift 36lb weight and the hard disk version is even heavier. However it does pack away into a single case, small enough to put in front of you on the tube, and compact enough to hold in one hand long enough to push open the door with the other.

Its advantages over the Osborne — apart from its UK origins — are the bigger screen (nine inches) with 80 columns display and much bigger disk capacity. It can be cheaper, too, but not for the same amount of software.

Franchising arrives

First British Computerland store — no, not the old Byte Shop group, but the new US-based ComputerLand group — has opened in Southampton.

It is an expensive store. First, the group had to pay Comart group close to £70,000 for the name, after several years' wait and legal proceedings.

Second, the chain is a franchise, not a corporate-owned one. You can start up a ComputerLand store if you pay enough. In the case of the Southampton store, the Sperrings Group is spending £2 million and will use that money to open 11 different ComputerLand stores in 'selected southern and Midland locations'. Some of that money goes on stock but some goes straight to ComputerLand to finance central services — and central profits, too.

At press time, that store was the only one we knew for sure would get the DEC range of Rainbow and Professional models — one day. Details from the energetic publicity agents, Rayner, on (0703) 332829.

Directory

A directory of microcomputer software has been compiled by staff from Sunderland Polytechnic.

It has taken them a year to put it all together — not just lists of program names but details of what system the program runs on (and how big it must be) and who sells it and what the dealer's address is.

Copies are available from the Department of Mathematics and Computer Studies, Sunderland Polytechnic. Cost is £3.00 and cheques should be made out to the Borough of Sunderland. I can't vouch for it, however, since by press time I still hadn't seen a copy.

Good news

Two bits of good news from Welsh manufacturer Dragon Data, which produces the Dragon 32.

First, the company is not going 'down the tubes' with the failure of Mettoy (which at press time seemed to me to be likely) because it has been bought out.

Second, the designers are planning to release reasonably priced disk drives early next year and also predict that the problems with display on many colour televisions will be overcome before February.

The machine is tremendously successful: from the launch in August to mid-November, it sold 12,000 units. Predictions were that, by Christmas, twice as many would have become the proud possesions of home users.

This makes it very hard not to recommend the machine as a serious choice. The power of its internal processor is comparable to (or greater than) some '16-bit' chips.

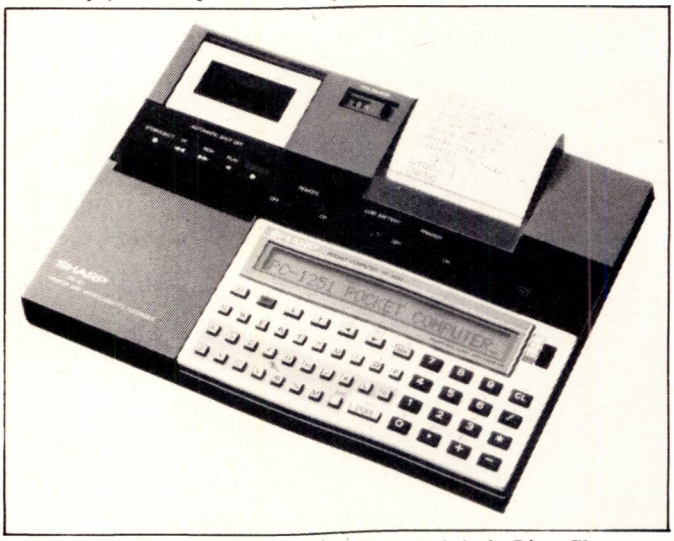
Financially, the company now has the backing of Prutech, the venture capital arm of the Pru. There is also some money from the Welsh Development Agency, rounding off a busy month for that body (it also sank a quarter of a million pounds into Torch, when that company bought Arfon).

Arfon, for those who don't have VIC 20s, is the company which sells a case for the VIC which expands memory and allows several other add-ons to be plugged in simultaneously.

False impressions

Hardly a day goes by, you may think, without some newspaper or journal showing a picture of some disabled human being helped by a computer. Surely, you say, it is ridiculous to suggest that this sort of thing needs more publicity — every time some picture editor wants to run a 'technology' story with a 'human touch' out comes the automatic Braille reader, or the talking wheel-chair. But the impression is false.

The British Medical Associa-



Look carefully at this Epson HX-20, because it isn't. It's a Sharp PC1251 in an integrated tape cassette and printer module. Sharp will be showing the machine at the Which Computer? Show in January (National Exhibition Centre, 18-21 Jan) together with a colour printer which will be launched in summer.

Still Need Convincing?

SOFTWARE FACTSHEET	
Product: **CARDBOX**	Type: **CardIndex**
Retail Price: **£155**	Machine: **CP/M & MP/M**
File Size: CP/M **8MB** MP/M **16MB**	Records: **65,500** maximum
Record Size: **1404** ch maximum	Fields: **26** maximum
Field Size: **1404** ch maximum	Index Limits: **None**
Notes: Allows **complex searching** using up to **99** separate criteria. **Widely available** from **distributors** in USA, [illegible] Australia. Published by Caxton Software Ltd of London.	

The Critics Don't....

"Cardbox is your familiar, tried and trusted card index...with most of the features you have always wanted on your manual card index but couldn't have, because of the limitations of pieces of card."

"Cardbox...succeeds extremely well. Its facilities for indexing and searching are good and very fast...the user image of the screen displays and the documentation are in the main excellent."

Personal Computer World, August 1982

"The interesting thing...is the display...Cardbox enables you to draw a form on the screen complete with headings."

"Cardbox is an excellent database manager...its versatility...and its ease of operation make it a useful program for home or business."

InfoWorld, September 13, 1982

InfoWorld
Software Report Card

Cardbox

	Poor	Fair	Good	Excellent
Performance	☐	☐	☐	☒
Documentation	☐	☐	☐	☒
Ease of Use	☐	☐	☐	☒
Error Handling	☐	☐	☐	☒

Anyone can use Cardbox. It's a simple yet powerful electronic card indexing system. Easy to learn and easy to use, Cardbox is bringing real computer power to hundreds of new users.

Put yourself in a user's shoes:

- You wouldn't have to change your present working methods or think in computer terms. Cardbox talks to you in plain English.
- If you can do it with a card index you can do it better with Cardbox thanks to its sophisticated automatic cross-indexing.
- Up to 65,500 'cards' can be stored and they can be displayed, printed or passed to other programs in any number of alternative formats.
- Groups of 'cards' can be selected by any word in any field. Your choice can be refined by using up to 99 words in a single search.
- Information is easily added, changed, duplicated or deleted.

These are just a few of the reasons why the top British and American micro journals are convinced Cardbox is the ideal card index for CP/M users.

Cardbox - the ideal card index system for CP/M users

Caxton Software Ltd, 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

Caxton products are available from leading microcomputer suppliers in the UK.

CP/M, MP/M are trademarks of Digital Research Inc.

I am an ☐ End User ☐ Dealer ☐ Distributor/OEM

Please send further information. Business Card attached ☐

Please send _____ copies @ £157 + VAT (includes P+P)

A cheque for _____ is enclosed.

Caxton

PRESS RELEASE OF THE YEAR AWARD

Every day we receive up to 50 press releases at PCW. *Something like half of these go straight in the bin, either because they're nothing to do with micros or because they're plain boring. Occasionally, though, one appears which is either so ludicrously wild in its claims, or so riddled with errors, or so arcane in subject matter that it deserves to be considered for some sort of award. We're proud to announce, then, the* PCW *Press Release of the Year Award for 1982. There have been quite a few contenders during the year but we feel that Mitsubishi Electric Corporation wins hands down. The prize is the dream of every PR man: a verbatim reprint of the entire press release. So here goes:*

Mitsubishi Electric develops pattern recognition software for sorting fish and cucumbers.

Mitsubishi Electric Corporation has developed Melsort pattern recognition software which promises to have wide application in the automated sorting and grading of commodities at the manufacturing and distributing stages. The microcomputer-operated Melsort system can recognise commodities by identifying their images with memorised key diagrammatic features.

One appliction is the fish sorting and grading system developed jointly with Mitsubishi Kakoki Kaisha Ltd. It recognises sardines, herring, anchovies and a variety of mackerel by shape while grading them into three sizes — small, medium and large. The task of fish sorting which used to require skilled human labour is now done automatically, based on information regarding five to 10 selected diagrammatic elements such as length, width, snout shape, etc.

The system typically consists of a supplying unit, lighting unit, line sensor (TV camera), picture processing unit, conveyor and sorter which are controlled from the central control monitor linked to the data processing unit.

Fish first go through light to activate the line sensor which transmits diagrammatic information to the picture processing unit for identification and sorting. Fish up to 500mm in length and 150mm in width can be handled at a speed of about 14,400 per hour.

Melsort is also used in a cucumber sorting and grading system which Mitsubishi Electric is marketing to save time and labour in this hitherto tedious task. It sorts and grades cucumbers according to thickness, length and curvature and shape, which are appreciated by Japanese customers. The system has gained wide acceptance (in Japan), among agricultural co-operatives in particular.

tion is now trying to collect information on how information technology can help the disabled and this is being done not because the BMA hasn't heard of all the work going on but because it *has* heard of it, and is worried.

The trouble is that many people are all doing the same thing. Disabled people, especially teenagers, are publicity shy, and it really isn't easy to persuade them to pose before their cameras. People working to help them tend to work alone, without knowing what else has been done before in the same field.

'The primary aim of our conference, to be held in Spring 1983, is to plan how the effort in this field can be co-ordinated,' the BMA said recently. Its Under Secretary, Dr John Dawson, said: 'Realising the improvements in the life of a disabled person by use of information technology, requires aggressive and successful management at national level.'

When a crippled child gets an automatic wheelchair that can climb stairs, it shouldn't be news. It should be an everyday occurrence.

The BMA wants to hear from organisations and individuals who are using micro-electronics to help disabled people. Research papers are being prepared to form a basis for discussion by participants.

The number to contact the BMA on (if you know of a project to help the disabled) is 01-387 4499.

NEC price cut

NEC has knocked 13 percent off the prices of its PC8000 range of micros and peripherals and has ended its distribution agreement with IBR, the company announced recently.

Despite being the biggest-selling micro in Japan, the PC8000 hasn't done too well in Britain — under 2000 systems have been sold here in the last two years, in fact, which, as NEC pointed out, is 'a morning's production run at the factory'.

One of the reasons for the machine's poor performance in the UK marketplace was its relatively high price, partly due to its being modified to include a £ sign on the keyboard. Now, although the 'official' price has been reduced, it's likely that dealers will start to discount the machines even further, an attitude which NEC seems interested in encouraging — or at least in not discouraging.

However, there's still no sign of the company's 16-bit micro appearing here, even though it has been on sale in Japan for a time. NEC in the UK is still assessing it and does not expect it to be on sale for some months yet.
Peter Rodwell

CP/M here — official!

At last, CP/M has officially come to Britain with the opening of a UK and Scandinavian head office in Newbury.

The company announced this at the same time as it revealed that there would be a new form of CP/M — not available on more than a couple of machines yet — which avoided several of the more gross limitations of all the predecessors.

The big assumption of all previous versions of CP/M was that some people would be sitting in front of a keyboard, but would have no screen in front of them.

Instead they would have a slow printer — a teletypewriter.

So if you typed a line, and got it wrong, you had to type it again. The fact that most users didn't have a printer, and had a computer quite capable of moving the printing 'cursor' up a line, and editing it, didn't matter, because the software had to work for the users with a printing terminal.

The fact that the printer was slow meant that programs were limited to displaying as little information as possible when waiting for user commands.

If the machine says:
'We have now reached the point in the program where we require a decision from you.

Would you like
a) to repeat the last command?
b) to try something different?
c) to stop using the program?
or
d) to change some of the data used last time?'
it is quite easy to understand what to do — but it drives the man in front of the printer mad with impatience. He knows full well he wants a) because he always does it. But he has to wait the best part of a minute, while the printer clacks away in front of him.

So the system says something enlightening like:
A>
and you go and check what the manual says to do next (if you can find the right place in the manual).

The new version of CP/M, CP/M Plus, will avoid this, and all the other related insults to machine manners, because you will be able to edit lines on CP/M screens just as if they were PET screens.

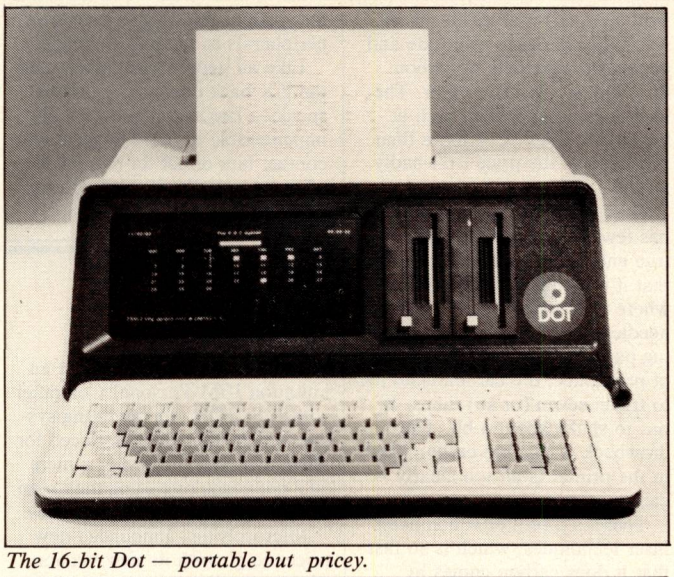
There are lots of other enhancements and changes. For instance, it will be possible to change disks without getting a rude BDOS Error announcement. For instance, CP/M will suddenly be



Caxton Software has hit on a novel approach to packaging its products with this 'record sleeve' containing a disk for its latest product. Called Touch'n'Go, it's a program for teaching managers, office workers and others who aren't professional typists how to type on a computer keyboard. Calling it a 'typing tutor' scarcely does it justice: it took one Stan Harcourt over 20 years to develop and it can turn a two-fingered keytapper 'into a 10-fingered keyboard master in 24 hours' says Caxton.

Well, we've all been trying it out on and off here at PCW *and it's certainly good. One of the nicest things about it is that you get to type real words as you learn instead of 'dfglkj' or 'swxjin' as you have to with other courses. All the instructions you need to start are printed on the sleeve (you type 'T' to run it rather than a whole name because you haven't yet learned to type!) and further instructions are contained within the program.*

Oh, and it costs just £25 and runs on any CP/M machine. More from Caxton on 01-379 6502.
Peter Rodwell



The 16-bit Dot — portable but pricey.

able to control more disk space than eight megabytes, and more memory space than 64 kbytes.

For details, contact Digital Research on its new UK phone number of — ah, what a pity. No phone yet. Ring Belgium, then, and talk to Jim Porzak at Vector. The number is 32 (16) 202496.

Lynx in the chains

There is no reason I can think of to pretend that I thought the Camputers Lynx would ever make it: it is starting to look as if I may have made a grave error of misjudgement.

The £215 machine has been adopted by Dixons, by Laskys, and (to me even more impressive) by the Spectrum voluntary retail chain.

All three organisations went on record as saying that they expected to start getting machines on December 10, and to sell a lot of them.

Still no sign of one here: but we think you can expect to see a review soon.

The machine is a colour CP/M micro — it doesn't do CP/M yet, of course, because it still has no disks. It has its own Basic, it has expandable memory, and one day, it will have software.

There are well over 100 dealers around the country.

16-bit portability

One of the more interesting machines launched at Comdex Europe in Amsterdam this November was a 16-bit portable computer, called the Dot. Claiming complete software compatibility with the IBM Personal Computer and the DEC Rainbow, the Dot is 8088-based to allow it to run MS-DOS software but comes with an optional Z80 add-on to allow users access to CP/M-80 packages too.

The Dot contains up to 704 kbytes of RAM and 24k of user-programmable ROM and has up to two Sony 3½in disk drives, capacity 278k each. As if this wasn't enough to make it unique already, the Dot also contains a built-in 80-column thermal printer which can print out anything displayed on the screen, including high-resolution graphics. Options include a built-in modem and an 8087 arithmetic processor.

The snag, though, is the price: an estimated £2300 for the basic system, comprising CPU with 32k of RAM, bit-mapped graphics, keyboard, a single disk drive and two expansion slots. Manufacturer Computer Devices Inc maintains, however, that it's not competing at the Osborne end of the market; the machine is intended mainly for desk-top use, it says, where its main advantage is the small amount of space it occupies. More from Computer Devices' European office at 108, Place des Moires, 91000 Evry, France, tel: (6) 079 0077.

Peter Rodwell

Legal matters

Atari says it is suing Commodore for ripping off the Pac-Man game, and selling it as Jelly Monsters. Commodore says that Atari has lost a similar lawsuit in Hong Kong, and as a result has withdrawn from this one. Atari says no, it hasn't withdrawn, it has just 'stood over its application for a temporary injunction, but obtained an order for a speedy trial'. Commodore says it will be pressing for costs.

When we know more, we'll tell you. I can't help feeling a touch ironical about the wording of Atari's press release, however.

The release itself refers to the 'substantial commitment to the development and marketing of new and original software' — which is very true and valid —and says that it will 'continue to enforce its rights against those who would seek to misappropriate the fruits of Atari's labours,' which is a matter for the courts to settle.

The irony of this case is the fact that Pac-Man is not a program which Atari wrote. It happens to be one they bought from a Japanese company.

Hand-held hand-outs

A possible £100 million is to go to London's shy or proud and needy under a new scheme based on hand-held micros.

The micros will be used by welfare visitors on their rounds to spot eligibility for welfare benefits.

A possible £100 million currently goes unclaimed in London.

The Greater London Council (GLC) is budgeting around £300,000 for a system based on devices like the Tandy, Sharp, Newbrain and Epson.

'The scheme, expected to be underway next spring, will reach people who would never dream of asking for any financial assistance,' says the GLC.

'Every day thousands of people are being means-tested for specific things, but the task of calculating their eligibility for any welfare benefits is very complicated.

'The new system will prompt welfare visitors to ask a series of questions leading to an automatic on-the-spot assessment of eligibility.'

Precisely which machine will be used has yet to be decided, but it will have to include a small display and printer.

A parallel project involves communicating via existing terminals in Citizens Advice Bureaux to a central database at the GLC for textual information on legal advice about welfare benefits.

Jane Bird

Final act in Sirius drama

Sirius superstar Chuck Peddle flew into London in November for a lightning press conference to explain the mystery surrounding the rumoured takeover of his company, Sirius Technology, by the US Victor organisation.

The sequence of rumours went something like this: first, it was whispered that Sirius had taken over Victor. Then UK Victor 9000 distributors DRG issued a press release claiming that Victor had taken over Sirius and from now on we'd only see the Victor name on the company's products.

ACT, the British distributors for the Sirius 1, seemed as much in the dark as anyone — and nobody could get any information at all from Sirius in the States. Confusion was compounded at Compex Europe in Amsterdam where the large Victor stand was populated with Sirius-style machines with a Victor label in which the 'o' in Victor was composed of the Sirius logo!

Here, then, is the (abbreviated)



No, he is not synthesising music: he is 'blowing' EPROMs — storing other people's code into semi-permanent memory chips.

He works for Dialogue in Camberley, who will blow EPROMs free, if you buy them from them. Details on 0276 682001.



The more observant of our readers may have noticed something different about this month's PCW. *What we've done is to change over to phototypesetting, in the form of a brand-new, computerised Itek machine. Our dear old IBM golfball machines have been put out to pasture on a much less onerous task of setting* Private Eye.

This doesn't mean, of course, that we'll now see fewer errors in PCW — *it's just that they'll be* high technology *errors. Pic shows our typesetter, the glamorous Ms Jane Hamnell, trying to get Space Invaders running on the Itek.*

official story from Chuck Peddle. Back in October 1980 he and a colleague decided to go into microcomputer manufacture. They did a deal with Victor Business Products (an offshoot of the Walter Kidde organisation in the US) under which Chuck's company, Sirius Technology Systems, would manufacture the machine we know as the Sirius 1, and Victor — a well-established office equipment company specialising in desk-top calculators but looking for a micro to add to its range — would market it throughout the US and abroad through its subsidiary companies. Victor would have the machine exclusively in America but Sirius remained free to market it under its own name elsewhere. In return, Victor injected a large amount of capital in Sirius.

For various reasons the Sirius machine got off the ground in Europe (through ACT, which still sells more of them than anyone else) before the Victor version was out in the States. With the Sirius selling well in Europe, Victor surprised us all by launching its machine over here too. Much to ACT's obvious annoyance, it appeared in this country through DRG. But as this was perfectly in order according to the Victor/Sirius agreement, there was little anyone could do except call each other rude names.

Earlier this year, though, two things happened which caused all the confusion. A company in the US called Sirius Software initiated legal action to prevent Sirius using the word 'Sirius' in its name. And Sirius (that's Chuck Peddle's Sirius) decided to buy out Victor's share. Sirius Systems lost the court case (despite desperately buying up a small, long-established but bankrupt company called Sirius to try to establish prior use!) and had to find itself a new name. As it was taking over the Victor Business Systems empire anyway, 'Victor' seemed an obvious choice so Victor it became, with a new logo incorporating the old Sirius logo.

However, there's a final twist. Although the new Victor company can't use the Sirius name in the US, it can elsewhere and, as the machine is firmly established in Europe as the Sirius, that's how it will continue to be known over here. But established distributors and dealers of the Victor 9000 will also continue to sell that machine, although don't expect Sirius and Victor people to be any friendlier just because of the takeover. And don't expect them to indulge in a price war, either: that will be very firmly stamped on by the new Victor company.

Peter Rodwell

Novel printer

Olivetti has found a new way to become newsworthy — by producing a new printer with a completely new way of printing. It involves shooting black sparks at white paper.

Most printers hit a piece of paper with an inky ribbon, pressed onto it either by a lump of metal in the shape of a letter, or else with sharp needles which repeatedly slam into it.

Some printers use the needle method but instead of hitting the paper in the right place, they burn the paper. To work properly, this method needs heat-sensitive paper. Don't leave it in the sun after printing ...

Olivetti has hit upon the idea of using a graphite electrode and instead of writing on the paper (as with a pencil) it electrifies it. A spark flies between electrode and paper and a particle of carbon flies with it, onto the paper. The idea is exciting enough and, at £400 plus VAT (£14 more than the Epson), the price isn't badly wrong.

Olivetti claims that the printer has fewer moving parts, which is true enough, but omits the fact that it only has one electrode. So where your impact matrix (those needles) with seven or nine moving parts has to travel down a line of print once, the carbon head has to travel seven (or so) times. It has to shake about a bit. The drawback is that the carbon used in the printer is all too clearly carbon.

There is a printer which uses laser techniques, which is so fast that it does carbon copies by printing the same page twice and you don't notice the difference. 'Every copy a top copy,' somebody said once. The Olivetti has every copy a carbon copy.

One of the first companies to adopt the new printer is Acorn.

Olivetti is on 01-785 6666.

List service

You have just finished writing that immortal Spectrum program, which is not only going to make you rich but also famous. You plug in your ZX printer, LLIST it and then send it in to *PCW*.

You pop the silver paper into the letter-box and it pops straight out again, with a little note saying: 'This letterbox is not programmed to receive any more ZX printer listings for *PCW* because the line of unread listings (mostly unreadable) now stretches back from Evelyn House to here.'

Don't panic! Send the cassette to LE Listings, 1 Leswin Road, N16, with £2, and they will print it out on plain paper (missing out only the underscore, user-definable graphics and block graphics).

Stephen Adams, who runs the service, also sells various adaptors to make the ZX81 look like a Spectrum and vice versa, so that people can plug in their own peripherals to the new machine.

Like all people who understand the ZX back connector, Adams speaks a language almost totally impenetrable to me: I suggest you contact him direct for details of what he sells. It all seems pretty cheap.

Assorted op-systems

Anybody planning to sell you an imitation IBM Personal Computer with MS-DOS, the operating system which Microsoft produced for IBM, can plan on paying a mere $19 per copy, providing they plan to sell more than 5000 machines.

Microsoft has announced new prices to go with its new version of the operating system, which is expected 'soon'.

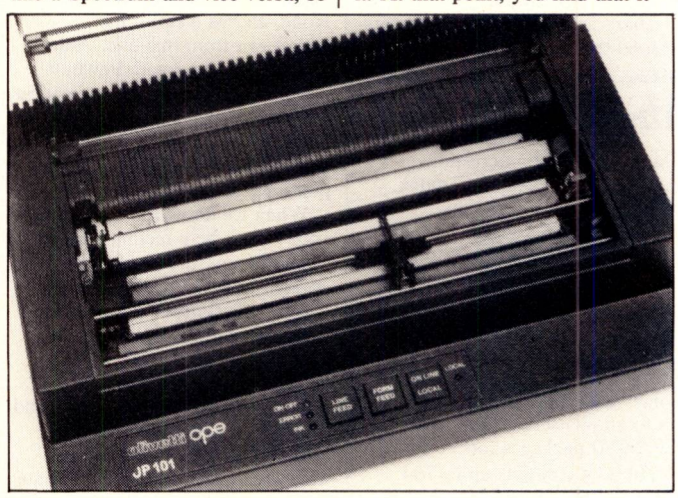
MS-DOS 2.0 'offers a number of new and enhanced features,' the company says.

User friendliness is provided by a 'visual shell, and help facility' — that's to say, a menu of common commands and an explanation of them if you panic and type a question mark.

The new software should run a bit faster, too, because Microsoft has taken a little of the computer's main memory over and uses it to store data coming off disk. The assumption is that you are very likely, having read one sector, to want the next, so MS-DOS 2.0 reads in the whole track and your second access comes direct from memory.

Most interesting, however, is the sign of a response to Digital Research's Concurrent CP/M-86. So far, DR has offered this on the IBM PC and very few other systems. There are several reasons for the slowness of the response: first and foremost, people don't understand what it is.

Once you have understood that Concurrent CP/M-86 lets you switch happily between Supercalc and Wordstar and your electronic mail system without loading and unloading files, you tend to want it. At that point, you find that it



Shooting sparks: Olivetti's new printer.



The hard disk in front of the Apple is actually a disk and tape system. When you start to worry about the disk crashing and tearing your data into a finely separated stream of oxide, you read it all off onto the tape, and store the tape in a cupboard somewhere.

The difference between this one and other types of tape dump is that this one checks the data as it goes out — it has a tape read head behind the tape write head, and makes sure that what was written is what it wrote. If not, it marks it dud, and repeats the block.

You get it from Hal Computers, on Farnborough (0252) 517171.

takes up an extra 91 kbytes on the Sirius 1.

So there is no panic for Microsoft in producing its multi-tasking system, which (it adds mysteriously) is written in 'C'.

The only reason there is any mystery about this, is that 'C' is what Unix is written in and, of course, Microsoft does have a Unix-type operating system called Xenix. Microsoft now has a European office: details on 04427 75091.

Where's the action?

There is an 'adventure' type game for women, if they have a ZX81. It is called 'Love' and I haven't the nerve to try it out. All the action happens at a 'Zany Houseparty' and I just can't face another.

Normally, it is nice to see people advertise in *PCW*: on this occasion, however, it is necessary. John Noyce has written a superbly grovelling letter, with my address most efficiently printed on the top in the space where such things should be found.

But until he adds his own address, just above that, we won't know where to send our £5.95, will we?

Another 'portable'

Somebody at MicroAPL with a sense of humour has decided to put a handle on that company's enormous, specialised, expensive personal minicomputer and describe this as a 'challenge to Osbourne'.

Osbourne, I assume, is a manufacturer of computers which are rather more expensive and specialised than Osborne CP/M micros. They are presumably quivering in their teak-lined boardroom.

Not that the Scorpion isn't an impressive-looking machine. And, at the price, it even seems quite reasonable value for what it is.

It is just that with a 16-bit 68000 super-chip inside, the highly specialised APL language for programming in, no packaged software and a price tag of £6000 (plus VAT) or more, it does seem to be in a difference world from Osborne. Even if it does come in a box with a handle. We can presumably expect a Porsche with pedals and a chain as a 'rival to the bicycle' any day now. Details on 01-834 2687.

Apple picks up

Apple has done pretty well in the last six months as it prepares to sell off the last of the Apple II machines and launch the smaller version with fewer chips, the Revision E version.

By bringing down the price of a disk system, the company has had its best quarter ever, winding up at the end of its financial year with a 74 percent net increase in sales. That's a very great deal more than was on the cards in June, Apple's worst month for ages, before the coupon offer.

In the UK, the boss, Peter Cobb, is convinced that somebody else has suffered. 'We want to know whose lunch we've eaten,' was the way he put it, talking to the trade paper *MicroScope*.

Some manufacturers at the upper price end of the micro market (competing with minicomputers) did have a lean time, but they aren't really competing with Apple directly.

It seems likely that Apple did well because many new machines were announced, and were very effective in whetting buyers' appetites — but didn't appear.

Commodore certainly isn't the company to suffer — though its PET range didn't boom — because its VIC has been enormously successful (see story elsewhere). In the third week of November, it reported a total of 20,000 machines shipped in the UK, at prices down to £130 through some chains, and even as little as £115 through some discount warehouses.

Disk delver

This is going to hurt so grit your teeth: if you want to see what's on a disk, you need a program called Watson.

I warned you.

It costs £35 and it does things like dump memory to screen, disassemble text, look though disks. It works with the Inspector, which Vergecourt has already launched. Details on (0268) 728484.

Multiplan here

Rivals to Visicalc still appear: Microsoft's Multiplan has now hit the UK at £169. Its unusual feature is the escape from grid references ('go to square AA 43') with ordinary words being used as labels. Formulae can be entered in slightly less mathematical form, therefore — reference to 'profit = sales – costs' would actually link the right fields together. Dealer in the UK is Pete and Pam Computers, on (0706) 227011.

Another Visicalc improvement is the one which you get from using the Apple III rather than the II — but not everybody with an Apple II is daft enough to want the III.

Vergecourt has produced a big-memory board and Visicalc expansion system for Apple II users, which (they say) provides 'a whole series of extra commands which speed up the production of presentation quality management reports. These include', they add, 'many of the long awaited format features found in Visicorp's Visicalc Advanced Version, which is currently only available on the Apple III.' Details here on (0268) 728484.

Forth spreading

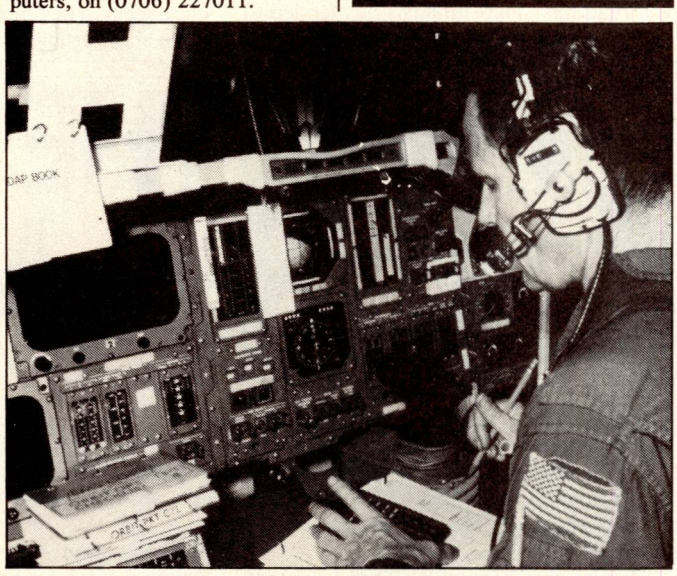
Oric, one of the many Christmas Bargain machines still not available at the time of writing (but expected in days rather than weeks, of course) has been given an extra programming language. So has the BBC microcomputer.

This one is obviously designed to take some of the wind out of the sales of the Jupiter Ace, which comes with Forth.

Forth is now available, on a free audio cassette, with every full-size Oric — the one costing £169. Or it will be, when the Oric is available.

The BBC Microcomputer gets its Forth from Level 9 Computing in High Wycombe. This isn't free, but, at £15 including a 70-page manual, it can't be exploitation.

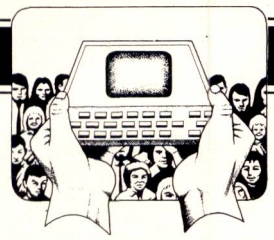
Details from Oric on (0990) 27641, and from Level 9 on (0494) 26871.



All that is missing from this Space Shuttle simulator is the green face of the astronaut. He is practising using his Hewlett-Packard programmable HP-41C calculator which had been pre-programmed 'to help with several duties, including manual manoeuvring of the space-craft in an emergency, and calculation and adjustment of the shuttle's centre of gravity prior to re-entry.' A shame one of their guys got so seasick (space-sick, then) they had to come down early — not the sort of emergency the calculator was programmed to deal with, I suppose.

CTUK! NEWS

Maggie Burton brings you all the latest news.



The good news this month is the birth of a new 'Town. David (or myself — neither of us can remember which) sent some guidelines to Peter Stone of Wolverhampton recently. He's just written back to say that his (or their) 'Town started in October at the Polytechnic in Wolverhampton. They meet on Friday evenings during term time from 6pm until 9pm in the Computing and Maths department, so that's where you'll find them if you're in Wolverhampton and you feel like paying them a visit.

There's plenty of hardware there and technically knowledgeable people on hand to provide help and advice. The computers are: 16 TRS-80s running disk systems, a PET, a BBC model B and an RML 380Z.

On top of all that hardware CT Wolverhampton provides a self-teaching Basic course and a large room for those who want to add their own micros to the already quite impressive list. Anyone who wants to know more should contact either Peter Stone or Mr P Strangman during 'normal working hours' at the Computing & Maths Dept., the Polytechnic, Wulfruna Street, Wolverhampton WV1 1LY. The phone number is Wolverhampton 27371 ext 145. We wish them all the best for the 'Town and other wise and hope to bring you more news on what they're up to in future.

CT Worcester has a new 'manager', as Tony Cartmell has stood down but will be helping out whenever he can. The new man-on-the-spot is Clive Watson — he's also manager of the local Tandy store, where the 'Town will now be based.

They've had a bit of a break recently, but should have started up again by the time you read this. The emphasis has tended to be on TRS-80s, mostly because that's what's in the shop — but they hold an open house for people with other micros.

Clive Watson's put forward a really interesting idea which should be given a bit of fresh air. This is a regular session on making and testing modems, accoustic couplers and other communications devices and, when the products of such labours have been thoroughly tested, linking up with other CTs. This is very much a future proposal and not one that is just about to come to fruition. Who knows — perhaps there'll be a CTUK! bulletin board in operation one of these days. Any volunteers?

Anyone in Worcester wanting to contact Clive and hear more about his 'Town can reach him on Worcester (0905) 28985 or write to him at the Tandy Store, 8 St Nicholas Street, Worcester.

Pam Pollicott of ComputerTown Ruislip recently appeared in print. She's assistant librarian at Ruislip Library and she wrote about Ruislip's ComputerDay and about local 'Towns in general in *Service Point,* the journal of the branch and mobile libraries group of the Library Association (phew!). That's good publicity for CTUK! on the library front because the day was a great success and this is self-evident in what Pam says: 'With winter grasping us all by our collars at the moment there probably won't be any ComputerDays going for a while, but I had the idea of a computer carol singing session — five or six little loudspeakers all chiming "Once in Royal David's City", etc, could be made into quite a show if you think about it ...'

A letter arrived from ComputerTown Kaltenkirchen in Germany not long ago. They seem to be running a flourishing outfit and a short article was enclosed but that'll have to be translated from German before a fuller report can be given on what they're up to. Nevertheless, at the last meeting before the letter from Peter Bendall (who runs the 'Town) arrived, they had 80 visitors and eight computers. They run meetings in their local school under the sponsorship of something called 'The People's High School' which runs evening classes. Apparently it's difficult for individuals to secure the use of a room. Hopefully, by the time next month comes round we'll have more to tell you about what they're up to.

That round up CTUK! News for this month. It only remains to say 'Merry Christmas and Happy New Year' to everyone reading this; we hope Computer Town UK! will keep spreading and flourishing in 1983. **END**

Computer Town UK! is an ever-growing network of computer literacy centres where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. Computer Towns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU. Remember to enclose an A4 SAE for your reply. Please don't telephone *PCW* for information as CTUK! is entirely a spare-time activity.



THE PCW £5000 MANHUNT

The hunt is over and our man has been found. Congratulations to Stan Higgins from Malvern in Worcestershire who was the first person to ring in with the correct solution.

Despite our mammoth efforts to ensure that all copies of the December issue arrived at the same time, some subscription copies slipped the net and arrived early. So we have decided to run a compensatory competition for all those of you who rang in and left the correct answer on the Ansaphone before Friday 26 November. Details of this will be sent to you by post shortly.

And for all of you who want to know, here are the correct answers:-

Puzzle 1 (September): 66266 and 8
Puzzle 2 (October): 358926471 and 2
Puzzle 3 (November): 44744 and 7
N (Nineteen digit number):
6626635892647144744
N^3: 290990844869903112884951885
059487344774291087207667382784

The three single digit answers appear in N^3 where underlined. Reading to the left from that place, the next 35 digits form the key to the cipher. Decipher by writing the alphabet, space and the digits 0 to 9 in a circle. Each digit of the key is an anticlockwise displacement of the cipher digit. This gives the plain text:-

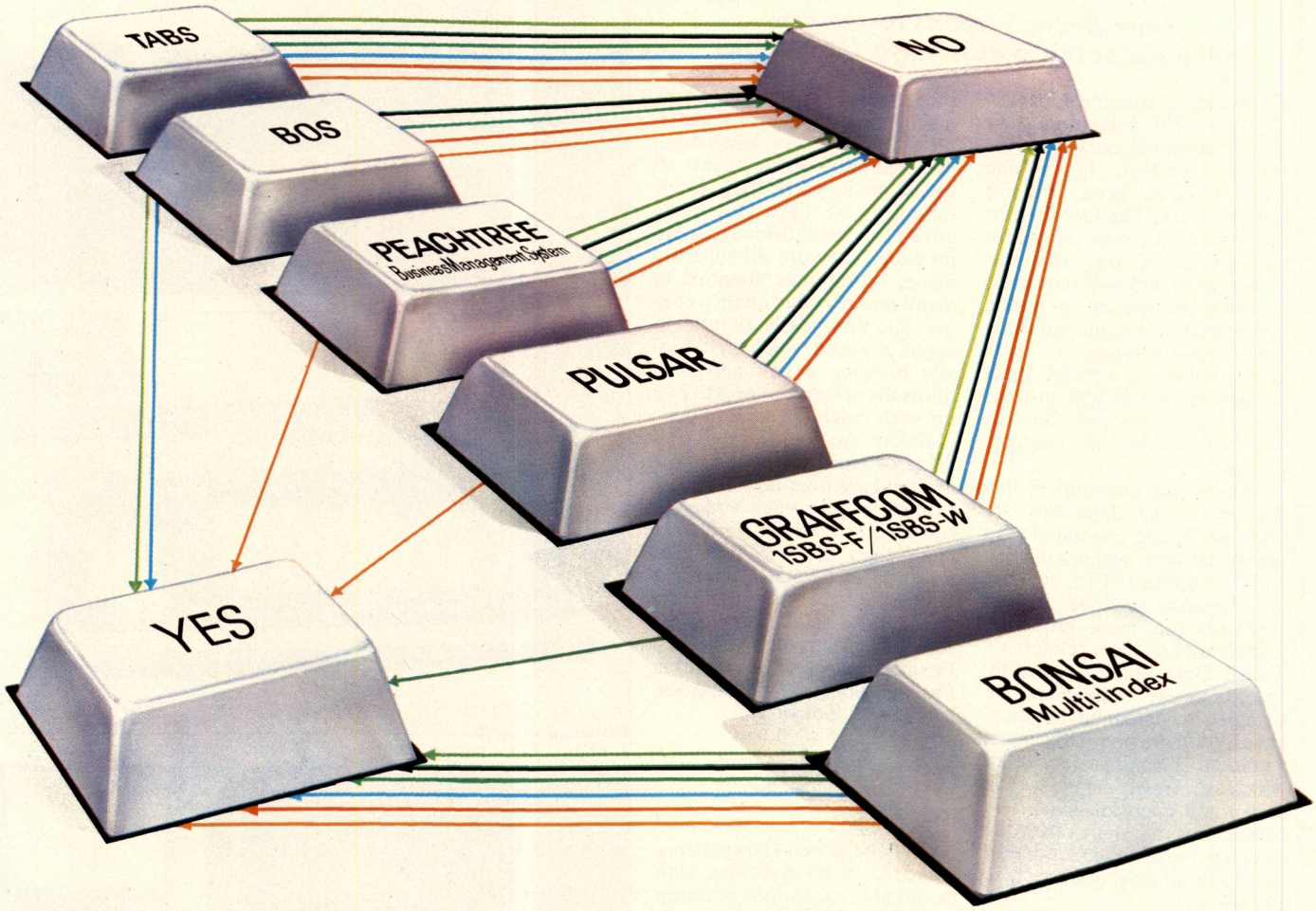
BRIGADIER BUMPER HARRIS
01-636 6423

Easy, wasn't it?

END

Multi-Index from Bonsai.

The first Integrated Accounting Software for micros designed for real world business.



Multi-Index is a new generation of sophisticated Accounting Software. A completely integrated system written entirely in RM/COBOL, a professional business oriented language. It makes systems written in BASIC look pretty basic.

Multi-Index consists of seven fully integrated modules: Sales, Purchase, VAT and Nominal Ledgers, Stock Control, Order Entry/Invoicing and Sales Analysis, with several additional modules to be released soon. Multi-Index provides the ultimate combination of sophistication and ease-of-use. Entirely menu driven, easy to follow screen displays lead inexperienced operators step by step through all procedures so Multi-Index is quick and painless to learn.

Multi-Index presents features up to now only available on mainframes. Features like:

→ Up to 13 open accounting periods with full detail accessible throughout the year.

→ A financial statement report generator producing *all* statements including Sources & Applications of Funds, Balance Sheet, P & L and supporting schedules to *your own format.*

→ Multiple-location stock control among unlimited branches with full stock transfer support.

→ Access to customers, suppliers and stock items by name if the account or stock number is not known.

→ Flexible price discount schedules, plus automatic calculation of salesmen's commissions, settlement discounts and finance charges.

→ No time-consuming sorts anywhere in the system.

Feature for feature Multi-Index beats all other micro accounting packages hands down. It is available *now* for many 8, 16 and 32-bit microcomputers running CP/M-80, CP/M-86, MS-DOS and Unix including the latest hardware like the IBM Personal Computer. Multi-Index also takes full advantage of developments such as colour displays and true multi-user file sharing.

To arrange a demonstration, or to receive our comprehensive information pack and details of our next seminar, give us a ring or return the coupon.

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112-116 New Oxford Street, London WC1A 1HJ.
(01) 580-0902.

Please (Tick as appropriate) ☐ Contact me to arrange a Multi-Index demonstration. ☐ Send me your Multi-Index information pack. ☐ Send details of your next Multi-Index seminar. ☐ Send information on the RM/COBOL programming language.

Name

Company

Position

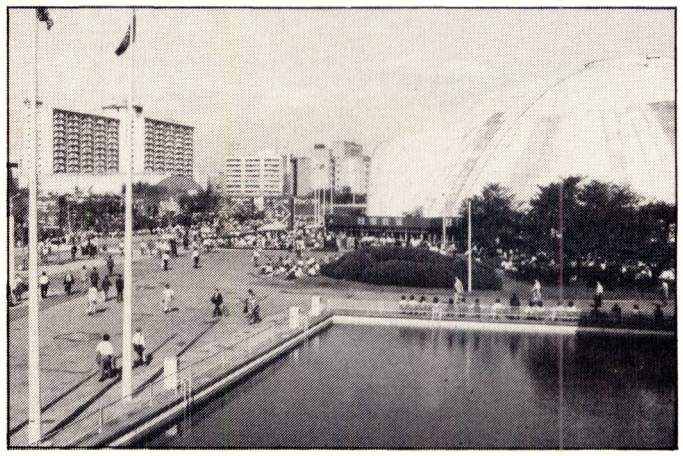
Address

Phone

OEM and Dealer Enquiries Invited.

INVASION LAUNCHED IN TOKYO

Peter Rodwell reports on the new products at this year's Tokyo Data Show.



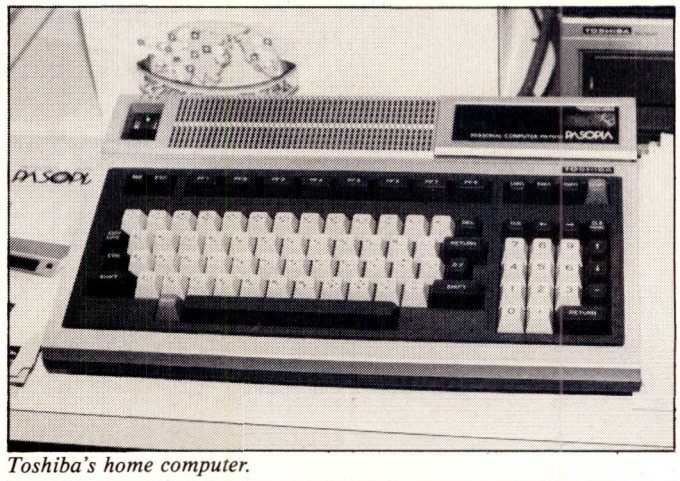
Expectations that the Japanese would do with computers what they've already done with motor-cycles, cameras, hi-fi's and watches have been rife for several years. The fact that, so far, we haven't seen our micro industry going the way our motor-cycle and hi-fi industries went has encouraged not a little complacency in some quarters: many people seem to think there's something different about computers which will prevent the Japanese from flooding us with shiploads of low-cost micros.

Meanwhile, oblivious to this difference, the Japanese are mass-producing computers on nearly the same scale as they do audio equipment, TVs, etc, and are preparing to flood us with shiploads (or, more probably, planeloads) of them. October's Tokyo Data Show — roughly the Japanese equivalent of Compec in content but larger — gave a good preview of the latest Japanese machines, most of which are already selling well in Japan and many of which will be reaching our shores over the next few months (in fact one or two have already been seen in Europe).

The outstanding trend at the show was for 16-bit micros, most of them at least software-compatible with the IBM Personal Computer and some hardware-compatible as well. The 'mainstream' trend was for 8088 and 8086-based machines, typically with at least 128K of RAM, twin disks, good quality keyboard and medium-to-high resolution graphics displays.

Although, in a certain sense, the new wave of Japanese machines are much of a sameness and scarcely innovative, two features about them all struck me as particularly interesting: as we have long since grown to expect from Japanese products, they are all superbly made, with minute attention to detail and rigorous quality control; and they nearly all retail in Japan at prices which are typically between a half and two-thirds the price we expect to pay for such machines in Europe.

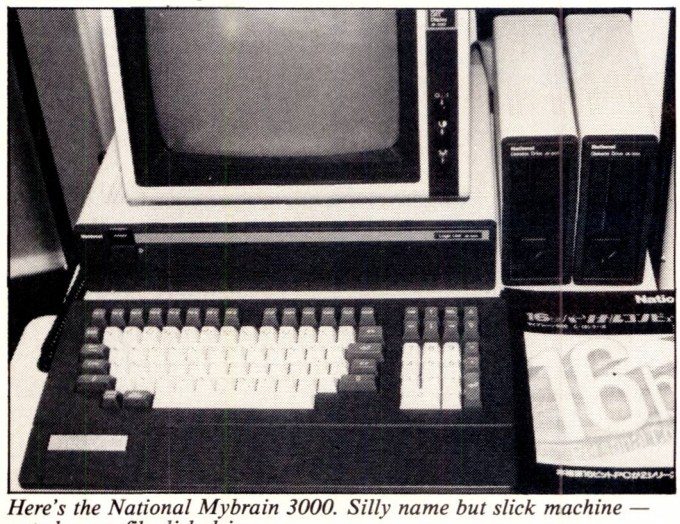
Before we look at the products, a word about the show itself: it lasts four days, had 127 exhibitors this year and was confidently expected to attract more than the 139,100 who attended last year. The 1983 Data Show will be from 18 to 21 October; for details, contact the Japan Electronic Industry Development Association, Kikai Shinko Building, 3-5-8 Shibakoen, Minato-ku, Tokyo 105.



Toshiba's home computer.

New 16-bit micros

Nearly all the well-known names launched 16-bit machines, with the notable exceptions of Sharp and Casio. NEC seemed to offer best value for money with its PC-9800, which starts at 298,000 yen, say £650. For this you get a system based on NEC's equivalent of the 8086 with 128 kbytes of RAM (expandable to 640 kbytes) and a bumper 96k of ROM containing N88-Basic and the system monitor. The display gives 25 lines of 80 characters in text mode and three pages of 640 x 400 dots or six pages or 640 x 200 dots monochrome graphics. Colour graphics are also available — 640 x 400 dots in eight colours. The PC-9800 runs both CP/M-86 and MS-DOS.

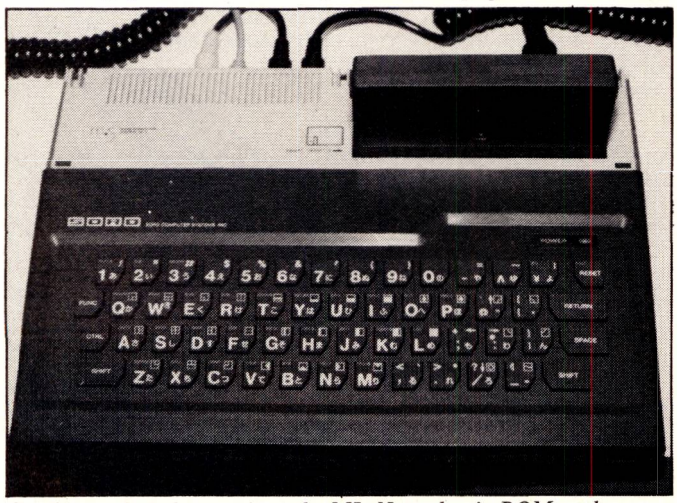


Here's the National Mybrain 3000. Silly name but slick machine — note low-profile disk drives.

National (Matsushita) launched a micro — ludicrously named the Mybrain 3000 — which is very similar to the NEC in many respects: 640 x 400 dot resolution in eight colours, MS-DOS and CP/M-86, but 8088 instead of 8086. It comes with 96k of RAM as standard (expandable to 224k), 16k ROM and 32k of video RAM. The machine sells from 532,700 yen (£1100) for a monochrome display and a single 5¼in, 160k disk to 865,700 (£1900) for the model with twin 8in 1.2 Mb disks. I particularly liked the machine's keyboard, which felt good and is a rather sexy twin-tone job: white for the main keys, olive green for the control and function keys.

Definitely outside the mainstream is Chuo Electronics, which rather bravely opted for the Zilog Z8001 CPU and Unix as the basis for a pretty smart business system housed in an all-in-one box and with a 20 Mbyte hard disk as an optional extra.

Sord launched two interesting



Sord's neat little home micro, the M5. Note plug-in ROM pack (16k).

new systems. Well, actually, the M343 16-bitter wasn't totally new but was making its first big appearance in public. And very nice it is too, with full colour, high resolution graphics and 256k RAM (expandable to 768k) and twin floppy disks. However, it's certainly not cheap (by Japanese standards): 1,300,000 yen or about £2800.

Toshiba caused a big stir with the Pasopia 16 — a neat, 8088-based machine running MS-DOS — version 1 was on show but version 2 is promised for production machines. The machine comes as a 'mainframe' box with two built-in double-sided, double-density disk drives and separate keyboard. The basic version comes with 192 kbytes of RAM, expandable to 512k. Basic video display is 80 x 25 lines of text using just 4k of video RAM but this, too, can be expanded to four pages of 640 x 500 dot graphics in 16 colours, using a massive 512 kbytes (yes, half a megabyte) of video RAM! The Pasopia starts at 398,000 yen (£870) and Toshiba is planning a 100,000-units production run over the next three years.

8-bit micros

Although the 16-bit machines grabbed a lot of attention, the 8-bit world is by no means dead; the Tokyo show reassured me that my private conviction about 8-bit machines is true: there's a lot of useful software around for these machines and their performance is certainly adequate for many business applications. Thus there's still a place for them and what's happening is that — as I suspected — we're either getting more for our money, or paying less or, in some cases, both.

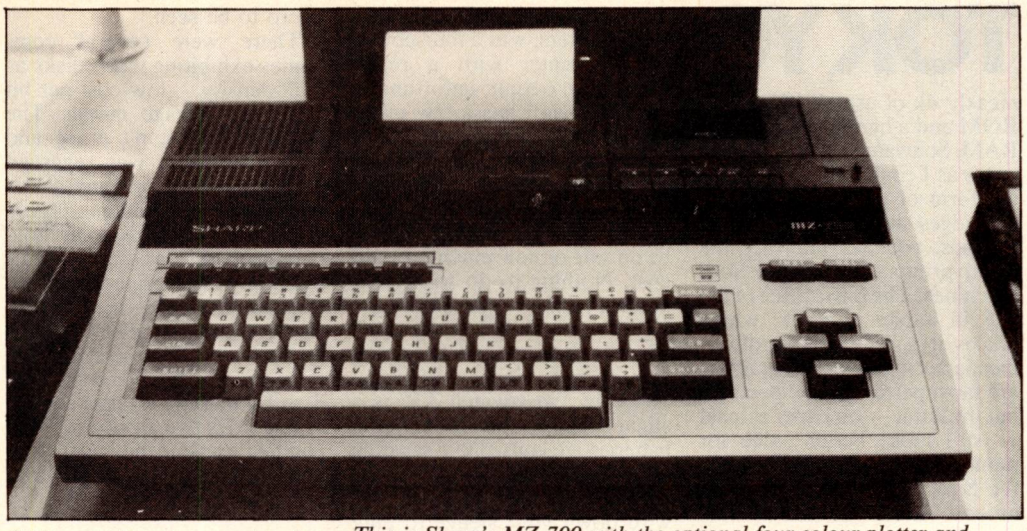
Take, for example, Sharp's new MZ-3500. It's a smart-looking beast which departs from Sharp's usual all-in-one configuration by coming in the 'standard' (for everyone else, nearly) three-box layout: keyboard, screen and 'mainframe' housing the disks and electronics. Inside are two Z80s (one for processing, one for I/O) plus a separate dedicated processor for the keyboard. The entry level machine has 64k of RAM, internally expandable to 128k and there's provision for taking this to 256k with an external add-on. Its display system seems a typical piece of Sharp complexity (or ingenuity?): three kbytes of character video RAM, 2k for kanji (Chinese) characters and 96k of graphics RAM. And there's more: the machine has provision for up to 32 kbytes of program ROM (presumably a Basic interpreter and some sort of operating system) and an incredible megabyte of kanji generator ROM, which probably won't be in much demand if/when the machine goes on sale here! How those poor little Z80s cope with all this, heaven knowns, but the graphics demo at the show looked acceptably quick and slick. Starting price in Japan is 320,000 yen, say £700.

Sharp also showed its MZ-2000, a very similar machine to the MZ-80B in specification and selling for 218,000 yen (£470). And the company also introduced its PC-1251, a tiny hand-held machine with Basic, very similar to the PC-1211 but considerably smaller — doubtless Dick 'Hand-held' Pountain will be telling you more about this in the next month or so.

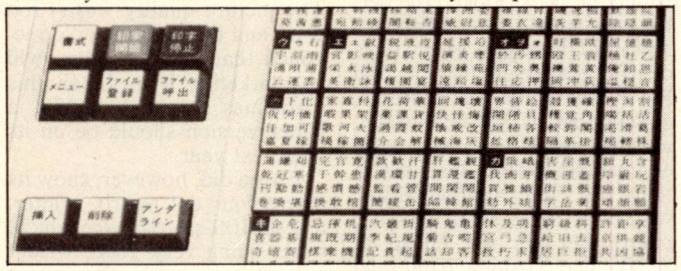
The Sharp machine which I liked best was the MZ-700, a small home-hobby machine with 64k of RAM and a Z80, with colour TV output and sound, and software-compatible with the MZ-80K/A machines. You can upgrade the machine to include a larger version of the incredibly neat four-colour plotter used in the PC-1500 and add a tape recorder as well. Both of these slot into the main unit and the result is a very useful, neat little system indeed. Japanese prices are £170 for the basic unit and £279 with plotter and recorder.

Epson launched its HX-20 portable (see Benchtest in last month's *PCW*) and a range of peripherals which included a rather nice acoustic coupler, a 5¼in disk drive and a TV interface. Epson was also doing interesting things with its range of printers — but see the 'Peripherals' section below. In addition, Epson showed a very neat 8-bit desk-top machine which can interface to an HX-20 for up- and down-loading and generally communicating. We should be seeing this machine in Britain sometime in '83.

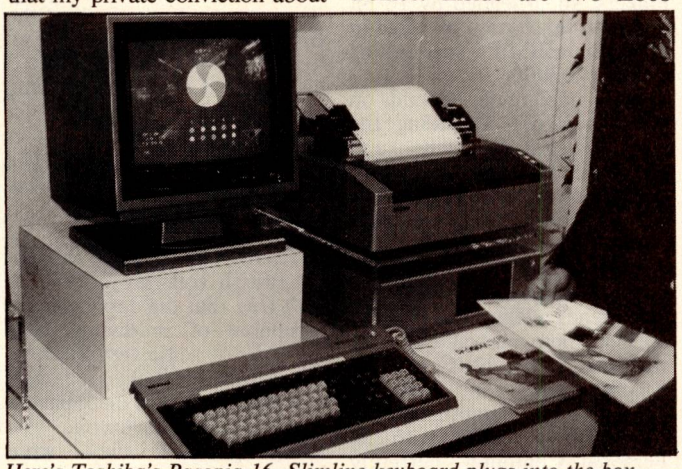
Back on the Sord stand, a 12-deep crowd was jammed around a couple of tables showing the Sord M5, a tiny games machine in the Sinclair Spectrum mould (although Sord prefers to describe it as being suitable for 'studies, household accounts, playing intellectual games and for data processing and correspondence'). This all strikes me as a little ambitious but it's a very nice machine with excellent colour graphics (including sprites on 16 planes) and a good range of peripherals including 'joypads' (actually sort of flattened games paddles). Inside you get a rather



This is Sharp's MZ-700 with the optional four-colour plotter and cassette deck. It's software-compatable with the MZ-80K/A machines, has 64k RAM as standard and colour ouptut to a TV set. Currently the machine is under consideration by Sharp UK.



Eat your heart out, Uncle Clive! This Japanese word processor managed to squeeze 12 functions from each key!



Here's Toshiba's Pasopia 16. Slimline keyboard plugs into the box under the printer which houses electronics and disk drives.



16 bits from NEC in the shape of the PC-9800 system. Expect it here next year some time.

TOKYO

measly 4k of user RAM, 8k of ROM and a handy 16k of video RAM. Software — mostly games, as far as I could see — comes in the form of plug-in 16k ROM cartridges and, apart from the joypads, you can interface the M5 to printers and to other Sord machines. The basic price of the M5 in Japan is £105, which places it a little awkwardly in the market in Europe: its graphics are far superior to the Spectrum but the latter — on paper at least — still looks better value for money, allowing for the fact that the Sord will probably sell for around £150 or so in this country.

NEC and Toshiba both came up with hand-held machines, of which the NEC looked the better buy, with a nicer keyboard and an LCD display of two lines of 40 characters, both upper and lower case. It has 20k of ROM, expandable to 32k externally, and 8k of RAM, externally expandable to 16k. Best news is that it's software-compatible with NEC's PC-8001 desk-top micro, but it's not cheap at £130. The Toshiba hand-held has a single-line display of only 24 characters and, it seemed, was less powerful and versatile than the NEC while selling at almost the same price — £120.

Finally in this section, there's Casio's 8-bit desk top machine, on which I have virtually no information other than it seems to run CP/M and I found it on sale in Tokyo computer shops for £600 or so for the basic unit.

Peripherals

Epson proved that printers can be as exciting as computers by showing an ink-jet printer with a very high-quality printout indeed. Not exhibited at the show, but demonstrated privately at Epson's headquarters, was a four-colour ink-jet printer with a really impressive output; unfortunately, Epson still has a few problems to iron out (mainly with the jets getting clogged with ink, the universal problem with these printers) and nobody was able to say when the machine would be on sale or how much it would cost. Nothing to do with computers (yet) but at the same time I got to see Seiko's wristwatch TV, which uses an LCD display just over an inch diagonally. Actually, 'wristwatch TV' is a slight misnomer as the tuner and batteries are housed in a separate unit, about the size and shape of a Sony Walkman, and you run a wire down your sleeve to plug into the watch. Yes, it does function as a watch too, using a smaller display above the screen. The picture quality wasn't too good and the Seiko people reckoned that, although they will be marketing it in Japan this Christmas for about £250, a better version should be on its way next year.

Epson did, however, show its four-colour dot matrix printer, an MX100-sized device which, while being very good, wasn't quite the same as the ink-jet machine. Over on Canon stand, they were into lasers in a big way and had several 'desk-top' laser printers eating up paper at a frightening speed. 'Desk-top' here seemed to mean 'the same size as a desk top' rather than something you'd actually stick on your desk and still have room to eat your sandwiches. The smallest laser printer was about the size of a medium-sized photocopier, in fact.

Elsewhere, we had a plethora of disk drives — hard and floppy — including the Hitachi micro-floppies but excluding the Sony variety; oddly, Sony had only a medium-sized stand devoted exclusively to Tektronics graphics displays but not even a hint of a micro to be seen.

There were several companies exhibiting video disks as high-density, low-cost-per-bit computer storage media. The fact that you can't erase and over-write them was regarded as unimportant by many of the technical people manning these stands: if a single disk can hold two gigabytes or so and costs a fraction of the price of a hard disk pack, so the theory goes, well you can just afford to keep on writing stuff to it instead of overwriting. If the disk ever does fill up (and it takes a lot of typing to fill two gigabytes) then you just transfer the latest copy of your data to a new disk and throw the old one away.!



Sord's 16-bitter shows off its graphics.

Pricing

In general, computers in Japan seem to retail at between 50 and 60 per cent of British prices. (But so do cars and hi-fis and lots of other things except — annoyingly — cameras). I should stress that the prices I've quoted here are Japanese retail prices and if and when these machines appear here, they'll be somewhat more expensive — but not much. Most people at the show were talking about a 30 to 50 percent price markup on Japanese retail prices, and most seemed certain that by mid-1983 Europe would be receiving its first big assault from the Japanese micro makers, spearheaded by 16-bit desktop machines of slightly better than IBM PC spec selling at under £2000.

How much under depends on several factors, including the quantity being shipped here and how much the importers/distributors think they can slap on to allow for the unfortunate tradition of over-pricing which ails the British micro scene. It also depends on the reactions of people already selling this type of machine there, particularly ACT with the Sirius, DEC with its Rainbow and — by that time and by far the potentially most significant — IBM with its Personal Computer, currently rumoured to be launched in the UK in January. Certainly there's no way that IBM could sell at the prices currently being demanded by 'unofficial' importers of the IBM, and certainly all three could probably compete with £2000 machines, or add a few facilities and aim upmarket a bit.

But the Japanese manufacturers about to launch here are very big companies which could withstand a price war and probably win, bearing in mind that volume sales is what makes them tick, not low quantities with high mark-ups. It's more than probable that, without actually collaborating as such, they'll all pitch in at around the same price level, undercutting existing machines by a small amount and prepared to drop a lot lower if the competition gets tough. But it'll only take one of them to step out of line and pitch a few hundred pounds lower for things to take off in a big way. . .

The implications for the British micro industry are vast and are either good or bad, depending on who you are. I think British hardware manufacturers are likely to be hardest hit. In general, with the shining exception of Clive Sinclair, we've been a pretty conventional lot, both technically and in business strategies. We churn out fairly uninteresting but overpriced machines which we insist on building on a cottage industry basis, frequently tailored at enormous hidden cost to the individual customer. We might be able to get away with this when it comes to shoes, shotguns and cars, but it's out of place in the micro world. The days of the hand-crafted British micro are definitely numbered (about 150-odd, I estimate) unless a remarkable amount of finger-extracting and getting-together of acts takes place.

I predict that we shall soon hear the awful sound of British micro makers bleating for trade barriers to stop the flood of Japanese micros which are putting them out of business. The Government, still only vaguely aware of the existence of micros, will of course do nothing. It's not entirely the fault of the British manufacturers, of course: to compete with the Japs they'd need a lot of capital and raising that in Britain is, to put it mildly, almost impossible. The sad fact is that, as with the motorcycle and hi-fi industries, by the time anyone notices it will be too late.

There is good news, though, for British software houses. It isn't true that the Japanese are incapable of producing software; I saw some very interesting packages in Tokyo, but they were all designed for the Japanese home market. Everyone was admitting that they were better at producing hardware and everyone was stating firmly that they would look for locally-produced software in each of their export markets. British software is very highly regarded and — as some people in the trade already know — various Japanese companies are already sniffing out good British products for their forthcoming machines. Sadly, not a single British company exhibited in Tokyo, although two or three American ones were there. The Japanese micro invasion has already started in a quiet way and we'll be seeing a lot more of it over the next six months. Let's hope our software houses are on the ball ...

END

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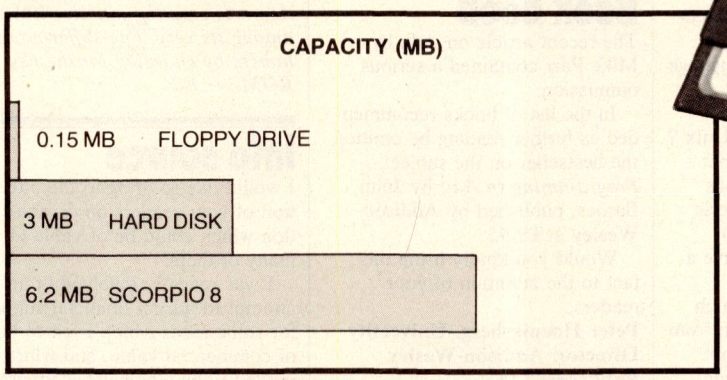

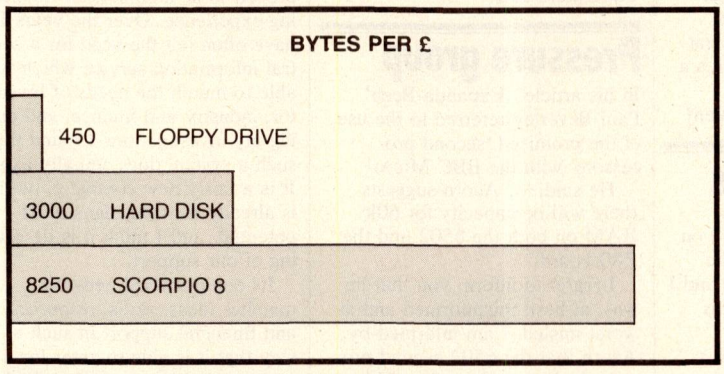

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COMMUNICATIONS





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

Handling charges

Recently I had to return a mains filter to the suppliers (Display Electronics) because it was not what was expected, although it may have matched the ad.

After 14 weeks' delay, four phone calls and various excuses, I received a credit note, the first acknowledgement of the safely-returned item, which showed that, as expected, I had paid postage both ways but also approximately 10 percent 'handling charge'. As the 14 weeks delay convinced me I would not buy there again, I succeeded in obtaining a cash refund.

On only one other occasion have I needed to return goods — to Lasky's and they returned my money in full, including postage on the goods one way!

In view of this and the 14 weeks' delay in refunding my money, I feel the 'handling charge' is a liberty. Is it common practice?

W George, Harlow, Essex

The Sale of Goods Act states that if an article is not suitable for the purpose for which it has been sold, the buyer is entitled to a full refund — not a credit note, not a partial refund with 'handling charges' deducted, but a full refund.

However, there are limitations to this. If the equipment you received matched what was advertised, then I'm afraid you are at fault for ordering something which wasn't what you required; caveat emptor still applies in these cases and Display Electronics would then have been under no obligation to give you a refund. In this case, the deduction of a 'handling charge' for dealing with your mistake is reasonable — after all, they have to pay somebody to do the paperwork. Taking 14 weeks to respond is not good enough but is, unfortunately, par for the course.

On a general note, the micro industry as a whole seems to consider itself magically exempt from the Sale of Goods Act. I experienced this a couple of years ago when a very large supplier sold me some faulty equipment. Getting my money back cost me £90 in solicitor's bills and the cheque only arrived on the day before we were due in court. If you do buy goods which don't perform as advertised, you are covered by the Sale of Goods Act. It doesn't matter whether you're buying by mail order or over the counter and the 'as advertised' bit includes what the salesman tells you verbally (although he can always deny having said that, so get it in writing if a lot of money is involved). But always read adverts very carefully and check that you're certain that the advertised goods are exactly what you want before you send off your money. — Ed.

Quick Beeb

I have just received my BBC Computer Model B in three weeks and five days. Is this a record?

D.A.P. Mitchell, Northolt, Middx

No — it's a computer — Ed

Cheap C

I was interested to read in November's 'Braindump' references to the C programming language. Yes it is a nice language but compilers do not start at £400! True, a complete implementation of C under Unix 7 will cost around that figure but there are a number of versions (with some of the more esoteric features missing, admittedly) available for much less. I have a BD Software C compiler (available from Lifeboat) which cost £60. The main omission from this is that floating point is not directly implemented, although there is a package of routines which goes some way to alleviating the problem. Otherwise, it's a lovely piece of software.

Robin Jones, Folkestone, Kent

Beeb characters

I read with interest Mr Whitworth's letter (October *PCW*) on my character generator for the BBC Computer (July *PCW*) and I would like to thank him for his criticism.

When my friend received his Model A in February we both saw the usefulness of a character generator. The program was written in the first week of ownership and at the time there was only the Provisional Guide to refer to (as far as I know).

In answer to the question about the use of Mode 6, it was the only mode in which we could display the characters defined and fit the program in on a Model A. I didn't use the cursor keys for the simple reason that the Provisional Guide didn't tell me how to and it was rather low on my priorities (getting it working was my main priority). The COLOUR query is simple to answer: I wasn't sure of the use of COLOUR at the time and, looking back, I don't know why I did that either!

After seeing the program printed out on paper I must say that I'm not too impressed with its general structure and can think of various improvements (using *SPOOL for saving the characters, for instance).

Finally, my thanks to Mr Whitworth and Mr Clayton ('TJ's Workshop' October *PCW*). Apologies to all those who typed it in and were screaming 'inefficient idiot' while doing so.

Mark Howlett, Braintree, Essex

Book boob

The recent article on Ada by Mike Parr contained a serious ommission.

In the list of books recommended as further reading he omitted the bestseller on the subject — *Programming in Ada* by John Barnes, published by Addison-Wesley at £9.95.

Would you kindly bring this fact to the attention of your readers.

Peter Hoenigsberg, University Director, Addison-Wesley Publishers Ltd

Pressure group

In his article, 'Expanda-Beeb' Paul Beverley referred to the use of the promised 'second processors' with the BBC Micro.

He said, '... Acorn suggests there will be capacity for 60k RAM on both the 6502 and the Z80 board.'

I regret to inform you that he was, at best, misinformed and at worst misled. I am informed by Acorn that the 6502 second processor will have less than 30k of user-RAM as it will have to cross-load both the MOS and the language ROMs. I understand that the position will be slightly better for the Z80 board as it will have an on-board interpreter.

I have not been able to get a straight answer to the question of how user-RAM is affected by additional language ROMs in the host processor. You may be able to fare better.

Personally, I am sick of the reluctance of Acorn to face up to its responsibilities, particularly as regards the OS 0.1 MOS ROM that is fitted to my machine. Had I known that I would be expected to pay extra for a machine that performs in accordance with its published specification, I would have been extremely wary. Had I known that the machine would not be expandable in the manner publicised, I would definitely not have purchased. May I suggest that other users who feel similarly contact me with a view to some concerted effort to change Acorn's attitude.

Richard Bean, 81 Himley Green, Linslade, Leighton Buzzard, Beds LU7 7QA

I have a feeling that the ROM matter may be covered by the Sale of Goods Act. Certainly Acorn is creating massive ill-will among its very long-suffering customers by charging for the new ROM. — Ed

Info source

I would like to bring to the attention of your readers an organisation which could be of value to many of them.

I was recently involved in an attempt to attract financial support for some ideas which I felt to be of commercial value, and which proved to be a somewhat frustrating experience. Over the years I have often felt the need for a central information service which is able to match the needs of inventor, industry and finance, and during my investigations I found that such a system does actually exist. It is a fairly new company, but it is already showing signs of its potential, and I think it is deserving of our support.

Its computerised network matches ideas, skills, resources and financial support in such a way that it is able to cater for a variety of different needs, whether an amateur inventor, a large manufacturer or an investor looking for wider areas of commerce. I believe it to be an impressive use of computer data systems which I whole-heartedly endorse.

Membership fees are extremely reasonable, and I would suggest

that anyone who is interested in putting ideas into action get in touch with them as I did. They are extremely helpful about sending information about their service to anyone who contacts them.

The company is IREX, Snow House, 103 Southwark Street, London SE1 0JF. The telephone number is 01-633 0424.

Michael Harris, London E2

Tapebox tip

A quick tip for owners of Sinclair Spectrum machines.

Being small and relatively flat I find there is a tendency to stack things on top of it. I'm not certain that this is entirely a good thing so I started looking for a suitable case.

My eyes lit on a Sony U-Matic cassette case of the square, 'opens-like-a-book' variety. Provided that you install the Spectrum with the back of the machine towards the 'spine' of the 'book', the machine fits like a glove. You now have a neat rectangular container that will stack flat or will fit in a book case if needed.

I realise that not many people will have access to such cases but it is more than likely that some of the specialist audio-visual aids people or even your local video shop may be able to provide an empty library case at a reasonable cost.

For those who don't know, the U-Matic is a sort of higher quality cassette recorder, used semi-professionally or even for low-quality broadcast uses.

I should add that one or two internal obstructions need to be removed with a large sharp knife; these are two round bosses that fit the hubs of the cassette and also two angled flaps about 2in x 1in near the 'spine' of the box.

Who knows, someone may even paint coloured stripes on these boxes and sell them as Spectrum containers.

Finally, I don't think that the more modern AGFA case will do; it looks more stylish and has a better lock on it — but I haven't tried this type.

Peter Dunkley, Guildford, Surrey

Home computer software

I am writing to express my concern at a trend I have noticed in the attitude of software houses that specialise in programs for home computers.

It seems to me that as soon as a new home computer appears on the market the machines previously supported with software are ditched in a frantic re-writing of a lot of existing software to meet the demands from new owners.

My point is that although software houses continue to sell the software for existing machines they do not continue to develop programs to make use of all the add-on products such as memory, disk drives, toolkit ROMs, and sound boards, etc. Here they miss an opportunity to link up with the suppliers of these products so that each can benefit. The old cliche of 'software sells hardware' is more true now than ever due to the market moving away from the electronics hobbyist to the family entertainment setting.

A typical case is the Atom computer. This machine, now being up-staged by new machines, has an amazing list of add-on facilities which are not actively being supported. Where are the colour programs for the new colour board? Where are the disk programs? Where are the programs that take advantage of the huge add-on memory that is available? Why, for example, are the manufacturers not commissioning software to be sold with these products? A few duplicated sheets of suitable routines is not good enough.

I realise that the original surge in software sales is no longer there but I would have thought that steady sales would continue especially if stimulated with new software. Presumably the thousands of Atom machines are still out there. I have not seen breakers yards full of abandoned home computers. This may apply to other machines such as the Sharp MZ80K, Nascom, ZX80, ZX81 and others.

I hope that if you puplish this letter it will encourage some response from the software houses if only in defence. If the software industry is solely dedicated to the support of new machines I see that this young industry will be badly damaged when computer owners in general realise that they will be continually under pressure to buy a new machine. Imagine the situation in the hi-fi market if all new records could only be played on new equipment straight from the factory.

John Ferguson, Chelmsford, Essex

P for Pathetic?

I was interested to read the Benchmark article 'The Ultimate Test' in the October *PCW*. It confirms my view that 'P is anything but Perfect' due to its being excruciatingly slow. I use a UK-produced Pascal compiler called PRO Pascal written by Prospero Software which just beats the best of the compilers (of any language on an 8-bit machine) listed in the original *Byte* article. The 10 iterations time on a 4MHz Z80 system for the standard Pascal version of the published benchmark was just less than the 14 seconds of the *Byte* best. Using non-standard features the time is 121.7 seconds. This is more than 20 times as fast as the UCSD p-code version running on a similar machine according to *Byte* while the standard version is nearly 20 times faster than the version using only standard Pascal cited in the *PCW* article.

The faults with p-code are shared nearly equally between the compilation and the interpretation of it on the host machine as can be seen by considering the times given in the original article for the Pascal Microengine which has p-code as its machine code. It is 4.5 times as slow as the best (8-bit machine) listed even though it is nominally a 16-bit machine. This indicates that the compilation to p-code itself is a source of inefficiency as no interpretation is involved in this case.

I accept that the UCSD operating system is a pleasure to use but heaven preserve us from their compilers. It appears to me that the portability provided by p-code is dearly bought and the only beneficiaries are Softech.

One further point may be gained from the original article in that it provides a time for Z80 assembly language implementation of the benchmark which is only 1.7 times as fast as the PRO Pascal indicating that there is little room for further improvement with the Z80.

Timings for PRO Pascal were obtained on two Apple systems and they were confirmed by Prospero Software (with whom I have no other relationship that that of a well pleased customer) on a 4MHz system.

The first used a Microsoft Softcard. (The Z80 runs at 2.041 MHz with this card) and an Axlon Ramdisk. The Axlon was configured as a single 320k drive allowing an automatic compile and link for the PRO-Pascal system. Drive time is negligible with this arrangement.

The second used an Appli-Card with the Z80 running at 6MHz which of course gave me times half as fast again which I scaled down for comparisons. As I am not yet able to link the Appli-Card system to the Axlon due to all too typical manual problems, I used Apple drives. It appears to me that a moderately enhanced Apple II and a good compiler of standard Pascal (probably with the addition of an overlaying linker) provides a setup that is hard to beat.

John Crookes, Univ of Lancaster, Lancaster

Cheaper clock

I read with interest your article 'Clock it to me'; October/November 1982 but then I looked at the price of £36 just for the parts minus battery. I take it, therefore, that Bruce Marriott is not aware of the clock-calendar card for the Apple II (soon to be released for the BBC it is rumoured) marketed by Namal Associates in Cambridge.

The card uses the now well established MC 146818 from Motorola (which was briefly mentioned by Mr Marriott) which is second sourced by Hitachi and has the following features:

1) Day light savings, eg, it automatically corrects for British Summer Time.
2) Alarm function which will cause an interruption to the CPU when an alarm time occurs.
3) Has a full year counter to 99 years.
4) Can work in BCD or Binary.
5) Has a square wave output which can be used as a very accurate programmable function generator.
6) Has 12 or 24 hour format.

This board sells for around the £70 mark which is much less than the £149 quoted by Mr Marriott for the standard Apple board. The Namal board also contains a battery *as standard* and a 4k (2732) operating system on the card! A kit of parts (although not sold yet) has been quoted at being around the £40 mark, which makes Mr Marriott's £36 look a bit expensive.

Mr Marriott also said that the MSM5832 is rather difficult to get hold of. For the interests of the experimenter, the 146818 is readily available from: Namal Components, Radio Resistor (part of the electrocomponents group, ever heard of RS?) and the Hitachi version is available from Impulse Electronics and probably ITT Meridian.

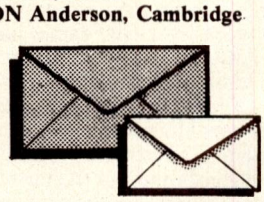
May I also take this opportunity to draw to your attention the clock calendar board using the 58174 which is sold by Computech Systems for £80. I agree with Mr Marriott about this chip and this makes the Computech board very suspect.

Never mind, maybe Mr Marriott's article was a long time getting to print and the prices have dropped since it was written.

For further information, contact the following:

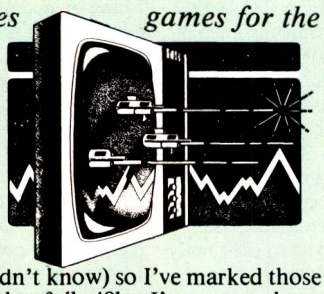
Namal Associates, Gatehouse, 25 Gwydir Street, Cambridge.
Radio Resistor Co, St Martins Way Industrial Estate, Cambridge Road, Bedford.
Impulse Electronics Ltd, Croudace House, Caterham, Surrey.
ITT Meridian, West Road, Harlow, Essex.

DN Anderson, Cambridge



SCREENPLAY

Dick Olney investigates games for the ZX Spectrum

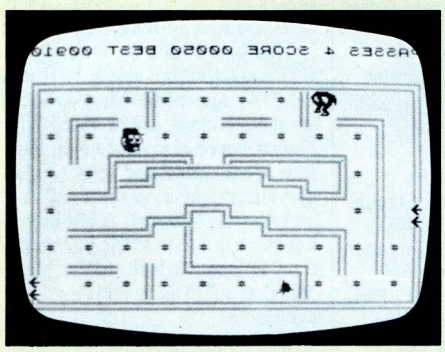


When David Tebbutt Benchtested the ZX Spectrum in June 1982 he proclaimed it the best value for money around and, despite the flurry of price drops in home computers over the past few months, there's no doubt that this low-cost colour computer still deserves that title. Like the ZX81 the Spectrum is not particularly impressive to look at, being only slightly bigger than its predecessor but offering a more substantial button keyboard. Since no joysticks are currently available, this keyboard is used for all the games, and works quite well despite the rubbery texture.

I used a 48k machine which (as I'm sure nearly everybody in the western world is aware!) costs £175 including VAT. Many of the games will run on a 16k machine (£125 if you didn't know) so I've marked those that need the full 48k. I've covered a wide selection of software including some of Sinclair's own label Psion and ICL games.

As yet there is not much of a selection of games around for the machine, with a sizeable portion of it being old favourites. The Spectrum itself impressed me, although few of the games I saw seemed to make very good use of the facilities it offers. To be fair I may have jumped the gun, and I will be interested to see if enough good games software becomes available to make it worth giving this machine a second look. I do know that Psion is planning a flight simulator and a sequel to Hungry Horace (see review), both of which should be available by the time you read this, but unfortunately neither were available for review at the time of writing.

Sinclair label games are available on mail order through the usual channels and Quicksilva and Bug-Byte games are on general sale. Simon Hessel Software can be found at 15 Lytham Court, Cardwell Crescent, Sunninghill, Berks, and Impact Software at 70 Redford Avenue, Edinburgh.



Game: **Hungry Horace**
Supplier: **Sinclair – Psion**
Price: **£5.95**

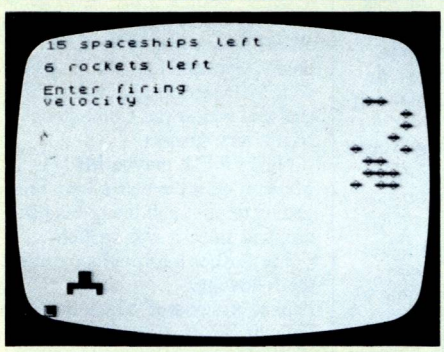
Question — when is a Pacman derivative not a Pacman rip-off? Answer – when it's Hungry Horace. Yes folks, with a stroke of genius Psion has managed to produce a game which should satisfy the most painful Pacman craving, yet march proudly through Atari's legal net. The scenario is a town park where an endearing little character is intent upon eating up all the flowers (this is not a game with a social conscience!). You control his movement using the 'Q' and 'Z' keys for up/down, and 'I' and 'P' for left/right. This arrangement works very well, making the game a joy to play.

The park is divided into four sections, each of which consists of a 'maze' of paths, bridges and tunnels. In each section there is a one-way gate to the next frame through which you can move at any time. Horace is chased by between one and three park keepers, who will throw him out of the park if they catch him (quite right too!). Occasionally one of them will drop his lunch of a cherry or a strawberry, which Horace may then eat to supplement his flower gobbling. If he is caught three times the game ends.

To help Hungry Horace on his campaign of destruction there is one alarm bell situated in each section of the park. When this is rung the park keepers panic (their hair stands on end) and Horace can throw them out of the park, though only for a few seconds. The game, of course, gets progressively harder (though not faster) mainly due to an increased awareness of Horace's position among the keepers. Indeed, because of the layout, in some places it can get almost impossible to continue since the keepers make an immediate beeline for you, which is very frustrating.

This game is destined to be a big success among Spectrum users of all ages. The graphics are excellent, and there are some interesting, if rather limited, sound effects. The noise when Horace gets caught could, with a lot of imagination, sound like a gruff 'get out of here' shouted by an angry and highly inarticulate official. Strongly recommended and well worth the money.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: **Games 1; Pastimes 2; Games 3; Games 4**
Supplier: **Sinclair – ICL**
Price: **£4.95**

What on earth do these people think they are doing? It was understandable when games were in their infancy for Sinclair to produce their trivial games packages for the ZX81, whose potential in this respect was limited, anyway, but now that they have a full colour graphics 16k machine such behaviour is inexcusable. Each tape contains a selection of four diversions, any of which should put the new user off video games for life. Let me explain.

Games 1 starts with 'Martian Knock Out'. You are presented with a huddle of green lines and circles in the top right hand corner representing the Martian fleet, and a simple 'missile launcher' which moves around the bottom left. The idea is to key in the velocity of your missile (a number between 10 and 60) so that it will hit the maximum number of enemy spacecraft. After each launch the program re-positions your base whilst the attacking fleet remain static. A game consists of 15 missiles.

Second on the agenda is 'Racetrack'. The track is marked by a multi-coloured boundary which uses standard Sinclair graphics symbols. It races up the screen (there are nine speeds to choose from) while, using the '5' and '8' keys, you attempt to steer a little car through it – the car incidentally remains on the same horizontal level. This is a fairly standard idea, and would be quite fun to play except the moving track soon starts to hurt the eyes and make them water.

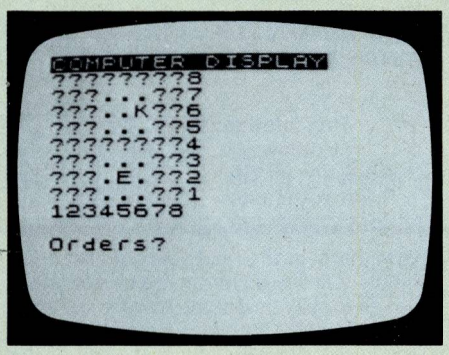
The third game on Games 1 is called 'Labyrinth' and is a simple maze game. Using the cursor keys you move an 'o' into a maze inhabited by three asterisks (which march across the entrances) with a view to reaching the dollar sign in the centre without being caught. You have a limited number of moves determined by your 'water supply'. The asterisk guards only move when you do and will only patrol a predefined corridor. This is probably the best game on the tape, but it is hardly mind-boggling.

The fourth and final game on this tape is 'Skittles'. The bowling lane appears at the top of the screen with a square (!?) block of thirty skittles on the left and your ball (the square) on the right. You position the ball vertically using the '5' and '8' cursor keys and bowl it with '0'. Not the most stimulating of tasks I think you'll agree.

The tapes continue in this vein. Pastimes 2 has a reasonable 'Mastermind' program called 'Secret Code', in which the player can allow the computer between four and eight valid numbers; a strange game called 'Mindboggling', which presents you with 16 random letters with the idea that players compete to see who can make the most words; a version of the well known cub scout game 'Kim' in which 20 random characters are displayed, one is removed when 'Enter' is pressed, and you must guess which one it was; and, finally, a magic square program which acts just like the fairground novelties except that you decide the final pattern.

Games 3 and 4 contain much the same sort of stuff as Games 1, so don't be misled by names like 'Journey into Danger' and 'Escape from Jupiter'. None of these tapes even gives a taste of the Spectrum's capabilities, though you can list them, which might be a useful exercise to help you understand some fundamental programming techniques (why not just list them in the Basic manual or use them as part of a teaching course?). This sort of thing only encourages those Philistines who see home computers as a passing fad with no real usefulness or lasting qualities. Using a machine like the Spectrum for such programs is like warming your feet with a nuclear reactor – both Sinclair and ICL should be ashamed of themselves.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: Startrek
Supplier: Impact Software
Price: £5.00

Since playing Startrek was the first contact I really had with computers, I'm always interested when new versions of the game are produced. The most successful version to date is, of course, Atari's ever popular Star Raiders, which manages to incorporate some nice real-time graphics. Impact Software has been much less adventurous with this very traditional interpretation for the ZX Spectrum.

The galaxy consists of a disappointingly diminutive eight by eight grid, and can be displayed to show the whereabouts (if known) of the Enterprise, Klingons and empty quadrants (but not Starbases). This map is updated when you perform a long range scan, which uses the standard format of three numbers for each neighbouring quadrant to represent Klingons, Starbases and stars. I'm not sure why they've bothered to include the number of stars, since in this version of Startrek, unlike most others, they do not restrict movement and are immune to torpedo fire.

As versions of Startrek go, this one can best be described as barely adequate. The presentation is entirely standard with no extra sophistications and none of the interjected comments from Mr. Spock or Scotty that experienced Trekkers have come to expect. No use is made of the Spectrum's graphics or colour facilities and the only significant sound effect is a brief rendition of the Startrek theme tune during warp drive relocation. Despite its limitations, however, this program does retain some of the attraction of the original Startrek, and for Spectrum owners unfamiliar with the game it could well prove to be a good buy.

Presentation:
Complexity:
Addictive quality:
Value for money:



Game: The Quest (48k only)
Supplier: Impact Software
Price: £5

The colourful picture which introduces this game looked extremely promising. Unfortunately that is the only colour or graphics used, and the 'full sound effects' mentioned on the product list I was sent are in fact fairly trivial. The claim that The Quest is 'one of the most exciting adventure games currently available' is similarly exaggerated – but then I suppose if all games publishers were completely honest I'd be out of a job!

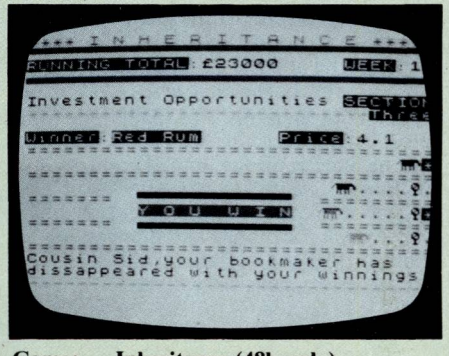
The idea in this game is to move around a 60 x 25 grid (giving 1500 rooms) searching for the Holy Grail. These rooms may contain jewels, monsters, elixirs or any one of a number of useful artefacts. Upon entering a room you are given the option to display your current status, take an elixir, move, or quit the game. The status report gives your current levels of food, drink, strength, stamina, dexterity and intelligence, and if any one of these drops to zero you will die. An elixir will restore the chosen factor to one hundred per cent. The report also includes other information such as the number of arrows, elixirs and gold pieces in your possession, as well as the number of moves you've had and the time taken to do it.

The movement option always allows you to go north, south, east or west unless you are at the top or bottom of the grid (the sides link with each other). You also get the opportunity to shine your lamp in any of these directions to receive advance warning of the contents of any adjacent room. The lamp does however, run out eventually, so you should use it fairly sparingly. If you move into a room occupied by a monster, you will be given the chance to use any of the weapons or spells in your possession to attack it, or to retreat. The choice of weapon does, of course, depend on the type of monster (curiously the only one I was able to bribe was the rat!).

In one of the rooms you'll come across a trader, from whom you can purchase any number of weapons, elixirs or spells – depending on your current wealth. It is essential to find this room, since many of the monsters can only be killed by weapons available exclusively from the trader. There are some other interesting rooms, but on the whole the game involves searching as much of the maze as possible, collecting useful artefacts and avoiding monsters (unless well-armed) with no clues as to the whereabouts of the elusive Grail.

Unlike many adventures this one reconfigures the room on each run, which means its attraction may prove more lasting. On the other hand, the massive size of the maze cannot disguise the lack of complexity. Certainly you'll need to learn which weapons are effective on the various monsters, but on the whole there is little in the way of real brainteasers. You could almost certainly get your fiver's worth out of this game, but I'm sure that most experienced adventurers would find it a little dull.

Presentation:
Complexity:
Value for money:



Game: Inheritance (48k only)
Supplier: Simon Hessel Software
Price: £5.95

This must be one of the most extensive and complex management games I've seen, with two discrete sections, both of which would take a lot of time and effort to master. In the first section you must prove your financial acumen by turning £10,000 into £100,000 in 26 turns (weeks) and thus become the beneficiary of Great Uncle Arbuthnott's inheritance. Each turn comprises three sections. First you can invest in the stock market by buying shares in any of six major industries, for which current prices are displayed. Next you may make a similar investment in the metal market, and again there are six choices. When these two sections have been completed all stock and metal prices are updated with an analysis of your gains and losses.

Your turn culminates in an opportunity to gamble on the horses or at blackjack. The horse race includes five horses, and you are allowed to back any number of them. Sometimes the odds will make it worthwhile backing four of the horses and thus be almost certain to come out winning, but if you win too much it will be stolen by your dishonest cousins. The race itself is run before your eyes and in one of several simple graphics frames in the game. The blackjack (pontoon) is less interesting than the races, and the program rarely churns out a winner, making it easy to lose a lot of money, although you do

only get the chance to play one hand.

I'm assured that experienced players find this first part easy, but I failed to get the hang of it even when provided with a few handy hints. The whole thing seems interminably slow, and with your capital – though easy to lose – making only small increases each turn. If, however, you do manage to make the hundred grand (or find the right statement to GOTO) you'll receive the inheritance, which turns out to be a soft drinks factory.

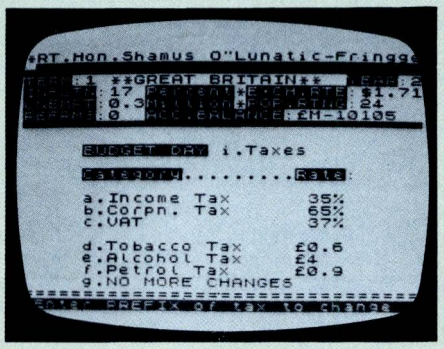
Having found the secret formula (a simple task involving only patience) you set off to the Bango Island to buy Bango fruits – more graphics – and you must negotiate the cheapest price for this vital ingredient. This concluded, you set about managing the factory in an attempt to make your million.

Running the soft drinks factory involves three main decisions – the weekly production, number of advertising entries placed and the selling price of your product. To help you with this you are given a market forecast at the beginning of each turn. The idea is to build up stock for an excellent market forecast, then advertise extensively and hence sell all your stock at maximum price. As your capital builds up you may be hit by strikes, frauds and advertising rate increases, and you will eventually be given the chance to extend the factory for greater production capability.

The second part of the game is faster moving than the first, but will still often involve long waits for 'excellent' weeks to come along before you seem to make much headway. The game is well presented throughout with a colourful menu format.

There is no doubt that this is a must for management game enthusiasts with plenty of patience, but less determined players may find their interest waning after a short time. If you do like this sort of thing and need something to while away the cold winter nights this is one of the best games in terms of value for money that you'll find.

Presentation:
Complexity:
Addictive quality:
Value for money:



Game: **Great Britain Limited (48k only)**
Supplier: **Simon Hessel Software**
Price: **£5.95**

I'm assured that the 16k ZX81 version of this is number 10 in the ZX software library Top 20 (out of 200 titles). It's a colourful and sophisticated management game that gives you the chance to play at being Prime Minister of our sceptred isle. The idea, of course, is to stay in power for as long as possible, which means ending each five-year term in as popular a state as possible among your decidedly fickle electorate.

To start the game you key in your name (or any other suitably silly title) and then choose which party you represent – Labour, Conservative, Liberal or Social Democrat. This is not a decision to be taken lightly – I found for instance that a Labour government always started on a much worse footing than the rest, particularly Tory. When the preliminaries have been completed you are presented with a rundown of the current state of affairs.

Although Simon Hessel does stress that this is a game and not a simulation, plenty of variables are taken into consideration – inflation and unemployment being the key elements. Each year begins with these two factors being updated, along with the exchange rate, your popularity rating and the balance of the national account; their movement depending on your performance in the previous year. There are three ways in which you can control these figures.

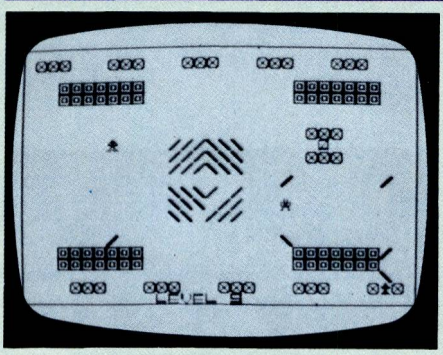
Firstly you must set the levels of income tax, corporation tax and VAT, and also of excise duties on tobacco, alcohol and petrol. These will not only determine your total income at the end of the year, but will also have significant effects on unemployment, inflation, and your popularity rating.

Next you must set the levels of social benefits, including child allowance, pensions and unemployment benefits. The populace are particularly sensitive to any of these, especially pensions falling behind inflation, so great care must be taken, particularly in the final years of each term. Finally you are given the opportunity to plough money into some worthy cause in the hope that a social reform will be recognised. Occasionally at the end of the year, news flashes will appear on the screen concerning riots or party revolts which may force you to revise your policies.

After five years an election takes place, at which point you may be given the chance to outline your manifesto for the following term. This involves apportioning 1000 points between four areas of social concern: inflation, unemployment, overseas aid and law and order. Then you sit and watch as the results clock up.

As I've said, Simon Hessel impressed upon me that this is a game and *not* a simulation. Any student of economics or political science would no doubt be appalled by the simple model GB Ltd uses. Nevertheless, as a game, it's got great potential, and should be sophsicated enough to hold most people's interest. Incidentally, it's also available for the BBC micro as well as the ZX81 and Spectrum.

Presentation:
Complexity:
Addictive quality:
Value for money:



Game: **Superdeflex (48k only)**
Supplier: **Llamasoft**
Price: **£4.95**

The first of Jeff Minter's offerings for the Spectrum (I'm assured that there are others on the way), Superdeflex starts its loading procedure with the warning that anybody making an illicit copy will be 'hung, drawn and quartered'. His worries stem from the fact that, unlike most of the other games I looked at, the 'Break' key is not disenabled during this program, making listing or copying the program a simple operation.

The game is not entirely unlike a type of computer pinball, except that instead of a ball bouncing around the screen there is 'Sid the silly space invader'. You use the 'n' and 'm' keys to place a '/' or '\' in front of Sid and hence change his direction by 90 degrees. These deflectors flip over when Sid hits them so that a \ turns into a / and vice versa. The idea, therefore, is to control Sid's movement so as to bounce him onto a prescribed target, while avoiding the various obstructions placed in his path.

There are nine levels of play, with an increasing number of hazards. Black boxes are merely barriers which Sid bounces off harmlessly, whilst red boxes represent deadly land mines. At the higher levels bunches of coloured deflectors appear, behaving just like those which you place yourself, and these serve to add to the general confusion. The most lethal hazard pitted agaianst you is the laser beam. This fires between two tiny markers at the top and bottom of the screen (the markers are set up afresh just before each blast) and will disintegrate Sid if it hits him. Finally the most difficult frames includes 'Grud the Droid' who races Sid to the target. If he reaches it first, or if Sid bounces into him, a life is lost.

Each game consists of four lives, and you are given the choice of which level to start on. To complete a level you must hit ten targets (they only appear one at a time) and the layout remains the same except for the position of these targets. If you place too many deflectors it can become almost impossible to control Sid, and for this reason placing 10 deflectors without hitting a target invokes one of the most endearing features of the game; a giant llama strolls across the screen, clearing it completely, and the game is then reset as if you had just begun that level.

Although this is probably one of the most original arcade type games I've seen on the Spectrum, the limited controls and tediously slow action (it is after all in ZX Basic!) make it rather dull. Nevertheless, good value for money and a refreshing change from the endless Invaders-Asteroids-Pacman derivatives.

Presentation:
Use of graphics:
Addictive quality:
Value for money:

INTERNAL MEMO



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MICRO CHESS

This month sees the start of a regular new chess column. Tony Harrington kicks off with a look at the latest dedicated chess computer from SciSys.

THE NEW CHAMPIONS

This is the start of a regular monthly column on computer chess. I will be concentrating, at least for the first few months, on dedicated chess computers — the kind you can go into a games shop and buy for anything from £35 to £400 — and the companies that make them.

Computer chess is still new enough for a question like 'Who is Fidelity?' (or SciSys, or Hegener and Glazer) — to name but three of the leading suppliers of dedicated chess computers — to need an answer. More importantly, computer chess, by its very nature, involves a fairly unique meeting point between the separate areas of business, computers and chess. So this question gives one an ideal way of tackling all three areas simultaneously.

This doesn't mean that the technical issues — like how you go about programming your own personal computer to play chess — will be entirely neglected. But for the first few months we'll be looking at what is around and how the machines available perform. Computer chess tournaments are becoming increasingly frequent and we'll be keeping an eye on the results of such competitions. There will also be a games section, where in future issues annotations be done by international master David Levy.

Levy is well known in chess playing circles for his bet a decade ago that no computer would be produced for ten years that would be able to beat him. He was right, but he himself admits that the time is approaching when the gap between experienced players like himself and computers will close. As a founder and director of Intelligent Software which specialises in writing chess programs he himself is working to make that prediction come true.

This first column is about SciSys, the London-based supplier, and looks at its Chess Champion Mark V and the new, soon-to-be-released Mark VI. The decision to start with this particular supplier is arbitrary — both the founder, Eric Winkler, and the UK director, Andrew Page, happened to be on hand — and it doesn't mean that I think it is the best supplier around.

Eric Winkler came into the chess computer business four years ago, almost in spite of himself. His background is in physics and one thing he is not is a chess player. Winkler was working in a trading company and had done some electronics research when he was approached by Peter Auger (who now runs a rival chess computer company, called Novac). 'Auger came to my office and said, "Eric, build me a chess computer." And he sent round a microchip as an example of what could provide the means for constructing one,' Winkler remembered. This was in early 1978.

The technological challenge interested him, and when Auger assured him that he (Auger) would find someone to program the computer once it was built, the whole project began to take shape. During the short period when Winkler and Auger were partners three versions of their particular machine were produced. Then Winkler left, in late 1979, to set up his own company SciSys.

His chess computers are unique (we think, though things happen too quickly in this market so someone else may be doing this too by the time we go to press!) in that they use a liquid crystal display (LCD). The machines are assembled in Hong Kong and, in the early days, SciSys ran into production difficulties training assembly workers to meet the demanding tolerance levels demanded by the technology. Users complained about faulty machines and the LCD display seemed to be an unnecessary complication. (It has definite advantages, though, as we will see.)

SciSys set up a London office in November 1980 and Andrew Page was appointed to control European operations outside of Germany (which has its own office). Chess computers are now big business, and Page estimates that the UK office turnover this year will be around two million dollars.

Now that the production problems have been solved the advantages of an LCD chessboard display can be appreciated. The obvious comparison is with the various 'sensor-board' machines (such as Fidelity's Chess Challenger 9), which actually give you a chess board and pieces. There the moves are indicated by LEDs which light up on the square of the piece the machine intends to move, and on the square it wants to move the piece to. The LCD display gives you an animated two-dimensional, pictorial chessboard. So from the start you don't have the satisfaction of actually holding a chess piece in your hand. (SciSys, incidentally, has a sensor board machine in its range, but this machine has a different development history and a different programmer.)

For many chess players the absence of a 'real' chess board is a disadvantage, not an advantage. They like the familiarity of board and pieces and the illusion that one is playing a 'normal' game. I like the display, not least because I combine chess with TV watching and the LCD display means I don't have to worry about chess pieces falling off the board if it tilts out of kilter while my attention's on the screen rather than the game.

More seriously, the LCD display comes into its own if one considers the replay feature. Here again, the comparison is with sensor board machines. Many sensor board machines have a replay function, but it is fairly tedious and involves the player following an endless series of LEDs lighting up square after square, replaying the move sequences.

The LCD board on the other hand simply provides a movie-like rerun of the game. The player doesn't have anything to do except concentrate on the game as it unfolds on the board. As a teaching device, it is hard to beat. I've played dozens of games on it and it's a marvellous way of finding out where you or the computer lost the initiative, or went astray in the opening, middle-game or end-game.

Another advantage of the LCD display is that it enables a range of comments and a two-ply analysis to be displayed. (A ply, for the uninitiated, is a single move by one player.) What the analysis entails can be seen by looking at the demonstration game, where we play the Mark V against the Mark VI, and give the analyses provided by both after each move.

For those who feel that all these advantages don't outweigh the disadvantage of not having a physical, solid chessboard to play on, SciSys is about to introduce a sensor-board which can be added to the Mark VI. It is not

```
1   e4 d5
2   Nc3 Nf6
3   Bb5 c6
4   Bd3 Bg4
5   Nf3 ...    (Mk.5; b8d7, o-o  +001)
    ... e5     (Mk.6; e4d5,c6d6 +001)
6   0-0 ...    (Mk.5; b8d7,e4d5 +001)
    ... Nxd4   (Mk.6; c3e4,d5e4 +003)
7   Nxe4 ...   (Mk.5; d5e4,d3e4 -000)
    ... d5e4   (Mk.6; d3e4,f7f5 +000)
8   Bxe4 ...   (Mk.5; f7f5,e4d3 -012)
    ... f5     (Mk.6; e4d3,e5e4 +015)
9   Bxf5...    (Mk.5; gf4, f3e5 -011)
    ... BxB    (Mk.6; f3e5,b8d7 +007)
10  Nxe5...    (Mk.5; b8d7,d2d4 -011)
    ... Be7    (Mk.6; d1f3,g7g6 +010)
11  d4  ...    (Mk.5; b8d7,e5c4 -011)
    ... 0-0    (Mk.6; f1e1,b8d7 +013)
12  Be3 ...    (Mk.5; b8d7,e5c4 -012)
    ... Nd7    (Mk.6; e5d7,d8d7 +010)
```

```
13 Nc4  ...   (Mk.5; d8c7,d1e2 -011)
   ... Qc7   (Mk.6; f1e1,a8e8 +011)
14 Qd2  ...   (Mk.5; a8e8,a1e1 -012)
   ... Be6   (Mk.6; d2c3,a8e8 +013)
15 Qa5  ...   (Mk.5; c7a5,c4a5 -011)
   ... b6    (Mk.6; a5c3,a8e8 +010)
16 Qc3  ...   (Mk.5; a8e8,c4d2 -012)
   ... Rf5   (Mk.6; f1e1,a8e8 +010)
17 h3   ...   (Mk.5; a8f8,c4d2 -012)
   ... Raf8  (Mk.6; f1e1,d7f6 +013)
18 g4   ...   (Mk.5; f5f3,c4c5 -011)
   ... Rf3!  (Mk.6; g1g2,e6d5 +018)
19 Ne5  ...   (Mk.5; d7e5,d4e5 -012)
   ... Nxe5  (Mk.6; d4e5,f3h3 +016)
20 dxe5 ...   (Mk.5; f3h3,f1e1 -021)
   ... Rxh3  (Mk.6; f1e1,e6d5 +018)
21 b4   ...   (Mk.5; g8h8,c3d4 -016)
   ... Rf4   (Mk.6; g1g2,f4g4 +040)
22 Rb1  ...   (Mk.5; offered to resign)
   ... Rxg4+ (Mk.6: g1f1,e6a2 +050)
23 Kf1  ...   (MK.5; Comment; Only one move)
   ... Bc4+  (Mk.6; f1e1,h3h1 +059)
24 Ke1  ...   (Mk.5; h3h1,e1d2 -063)
   ... Rh1+  (Mk.6; e1d2,c7d7 +098)
25 Kd2  ...   (Mk.5; Comment; Only one move)
   ... Qd7+  (Mk.6; e3d4,e7g5 +114)
26 Qd3  ...   (Mk.5; c4d3,b1h1 -103)
   ... BxQ   (Mk.6; b1h1,d3e4 +087)
27 RxR  ...   (Mk.5; e7b4,d2c1 -104)
   ... Be4+  (Mk.6; d2e2,e4h1 +102)
28 Ke2  ...   (Mk.5; e4h1,a1h1 -103)
   ... BxR   (Mk.6; a1h1,d7f5 +100)
29 RxB  ...   (Mk.5; e7b4,h1d1 -103)
   ... Bb4   (Mk.6; a2a3,b4a4 +110)
30 Rd1  ...   (Mk.5; d7e6,d1d8 -112)
   ... Qf5   (Mk.6; d1d8,g8f7 +108)
31  c3  ...   (Mk.5; f5c2,d1d2 -112)
   ... Bxc3  (Mk.6; d1d8,g8f7 +113)
32 Rd8+ ..    (Mk.5; g8f7,d8d6 -112)
   ... Kf7   (Mk.6; f2f4,f5c2 +117)
33 Rd3  ...   (Mk.5; c3e5,f2f3 -126)
   ... Bxe5  (Mk.6; a2a3,c6c5 +126)
34 Rd8  ...   (Mk.5; c6c5,d8d5 -129)
   ... Ra4   (Mk.6; d8d2,e5c3 +132)
35 Rd2  ...   (Mk.5; c6c5,f2f3 -129)
   ... Bc3   (Mk.6; d2d8,a4a2 +142)
36 Rd6  ...   (Mk.5; a4a2,e2f1 -140)
   ... Rxa2  (Mk.6; e3d2,a2d2 +149)
37 Bd2  ...   (Mk.5; c3d2,d6d2 -195)
   ... BxB   (Mk.6; d6d2,f5e4 +206)
38 Kf1  ...   (Mk.5; f5h3,f1e2 -225)
   ... Bb4   (Mk.6; d6d7,f5d7 +223)
39 Rd7  ...   (Mk.5; f7e6,d7d2 -236)
   ... QXR   (Mk.6: F!G!,D&G$ +999)
40 Kg2  ...   (Mk.5; Comment; Forced Move)
   ... Qg4+  (Mk.6; Comment; Mate in 5)
41 Kh1  ...   (Mk.5; Comment; Forced Move)
   ... Qh3+  (Mk.6; Comment; Mate in 1)
42 Kg1  ...   (Mk.5; Comment; Forced Move)
   ... Ra1 Checkmate.
```

my intention here to offer a duplication of the SciSys product catalogue. Those who want to know more about the sensor board or other chess computers in the SciSys range will get all the information they need from SciSys.

I had some fun with the computer's rather attractive habit of rating the current position on a scale of +999 to -999. It takes a pawn as being valued at 9, and bases its assessment of where it stands on the likelihood of it winning material. My finding was that so long as no one was material down, the computer tended to fancy its own game, even if one had some fiendish combination in mind.

The playing strength is in the region of 1750, though it will play a lot worse and a fair bit better than that on occasion. My own playing level is around 1900, but I found that if I didn't pay attention, or let the position slide, the program was perfectly capable of crushing me. (With the one proviso that it doesn't really know too much about endgames. Programmers find the algorithms at this point of the game incredibly tricky. Rook and pawn endings baffle masters, and the computer can be excused the odd positional blunder here.)

The 'levels' of play are set by defining the number of seconds (on average) the machine has for its move. This is extremely flexible. You can instruct it to play at whatever average number of seconds a move you fancy, and there is an elaborate facility to set up a series of eight different tournament time controls. There is also a problem solving facility which Page claims once found a solution to a complex problem quicker than the UK's grandmaster, John Nunn.

The actual lay-out of the machine was designed by Ian Sinclair, brother to Clive, and from an engineering point of view there is only one flaw. The elegant keys tend to stick from time to time, which produces an error message on the screen. I soon learned not to put my finger on the key centre but instead to press the left or right hand edge down, which got rid of the problem. According to Andrew Page, this is something that SciSys is working on.

The Mark V has been selling at £275, but the price of the new Mark VI (which is simply a new module inserted into the Mark V chassis) has been cut to £199 — as have all the Mark V machines.

Game Corner

It is perhaps appropriate that the first game should be one between the Mark V module and the new Mark VI, designed by Intelligent Software. When I spoke to him Page wasn't sure if 'improvements' made to the Mark V version actually meant that the Mark VI would beat it in practice. (One of the maddening things about writing chess programs is that everything is so interrelated that an 'improvement' in one area can actually cause weaknesses in other algorithms that go to make up the program.)

In fact the Mark VI won handsomely in the only game I set up between them, as you will see. The analysis is more or less self explanatory. After each move, I give the analysis produced by the machine that has just played. So 5)Nf3... (Mk 5; b8d7, 0-0 +001) means that the Mark V expects its opponent to develop its queen's knight to d7. It doesn't, of course, because it already has a neat combination in mind (so to speak). One of the interesting features is how the Mk.5 gradually increases its negative assessment of its position as the game proceeds. Note, too, that the two programs differ quite often in their predictions about their opponent's likely next move (ie, the move they each consider the 'best'). END

EXPERT SYSTEMS

Robin Webster investigates the 'expert system', which offers advice plus an intelligible explanation of its decisions.

Normally, if you ask the question 'why' too many times you'll get a slap around the face — expert systems, though, are much more polite.

Whatever the field of expertise in which an expert system is supposed to operate, it can, on demand, provide the user with a justification of any conclusion it comes to.

It all has to do with the following premise: human experts use sets of knowledge-based rules to solve problems — discover these rules, code them up in a form that can be understood by a computer, and you have a machine that can act as a consultant — or at least as an intelligent reference tool.

But whereas the human consultant cannot always explain why he/she made a particular decision, the expert system can be asked to explain itself in a form intelligible to humans. Generally, this will be achieved by having the system display or print out the selection of rules it used in making a particular decision. Sometimes it is also valuable to ask it for the rules it considered, but rejected, during a session.

The trend is to predict that one day there will be hand-held expert systems which can be used in the office or home to work out tax or accounting problems or to care for your car or houseplants.

Right now, that's not feasible — although there are some micro-expert systems running on machines such as the Sirius, IBM Personal Computer and the Sage II (the second part of this article will look at a couple of packages in detail).

Application areas can be large or small, trivial or dramatic.

On the large and dramatic side there is one US-developed system called Prospector, which is designed to be of use in geological exploration. Last year, Prospector came into the limelight because it made a prediction that stopped more than a few geologists in their tracks.

Prospector was given the same field study data about an area in Washington State in the US as that used by experts employed by a mining company and came up with the conclusion that there were deposits of a metal ore called molybdenum over an extended region. The geologists disagreed and said the molybdenum was present in a much more restricted area.

Shortly after exploratory drilling had commenced, Prospector was found to be correct.

To explain why it's so difficult to put really useful expert systems onto micros, it should be made clear that Prospector is written in a dialect of Lisp called Interlisp and program listings run to more than 300 pages of source code. The whole thing needs a Digital Equipment mainframe to turn it over.

Faced with this, most micros would curl up and die.

There are some hopeful signs, however. What about a Sinclair ZX81 being turned into a medical expert system? Some UK practitioners of homeopathy (the technique of taking minute doses of poisons as a cure or prevention of ills) have already taken the mail-order machine and PROMmed it full of homeopathic wisdom in the form of knowledge-based rules. No longer able to play ZX Invaders, the reworked machine is committed to being a homeopathic advisor.

The bigger Sinclair Spectrum looks like it will suffer a similar fate since somebody else is developing a version of the Prolog language (the UK equivalent of Lisp) for the machine.

On the grand scale, companies such as IBM, DEC, Texas Instruments, and Fairchild have all set up special groups to carry out research in the US. In the UK, Unilever, ICL, ICI and even the Department of Health are taking an active interest.

The DHSS intends to use expert systems in its social security offices: members of the public will be able to find out what they are entitled to in the way of payments and how they can make sure they get them.

A far different project is a joint venture between Stanford University and IBM in the US called Dart — for 'Diagnosis, Assistance, Reference Tool'. The Dart project team is attempting to tackle the thorny problem of how to give a computer some knowledge about its own functions — its physiology, so to speak. The next step is to then give it the ability to reason about that physiology.

'If I ask a computer how it is expected to work I want to get an answer somewhat like the answer I would get from the designer of that system,' said Mike Genesereth, who is participating in the Dart project for Stanford. 'What is the expected behaviour of the system and why is it expected?

'To achieve this goal, we have a knowledge base in which we write down assertions about the structure of the machine — very high level assertions such as what the CPU does. Once we have that design model built in, we make a set of rules that access it and take a fault as input . . . We get it to do some reasoning about that fault and then conclude which part is suspect."

Another implication of this work is that it becomes feasible to develop intelligent operating system interfaces, as Genesereth explains.

'We are finding that as computers become more and more complicated they become more difficult to use, so, apart from the Dart project, we are working on ways in which it will be easier for users to get access to systems. The idea is to have what we are calling an "intelligent agent" in each machine, one that knows about its machine and how to achieve a user's goals.'

Heurisko is a fairly recent expert system developed by Doug Lenat, another Stanford man who regularly consults on expert systems for Rand and Xerox.

Lenat has applied Heurisko to two very different problems — the design of 3D semiconductors and playing a sophisticated war-game.

Earlier this year, Heurisko was set the task of seeing whether or not it could come up with a successful method of designing chips in three dimensions instead of just the usual two dimensions. According to Lenat, the results surprised even him.

'The system is based on an earlier expert system that I developed called AM,' he said. 'AM was designed to take fundamental mathematical ideas and go off by itself to see if it could discover new rules. It really worked quite well for a time, but it began to get interested in really trivial things and wouldn't let go — it essentially ran out of steam. With Heurisko I've made some changes so that this kind of thing can't happen.

'About six months ago Heurisko came up with a discovery that looked promising in terms of 3D chip design. Just as the fundamental device in 2D chips is the gate, which handles one function at a time, Heurisko found another device structure that could simultaneously handle the two functions AND/OR.'

Lenat wouldn't give full details of the device, but said that the 3D design work was proceeding under the name XMOS (Cross MOS) because of the shape of the new computing device.

'The rules responsible for Heurisko's discovery are only at an elementary maths level,' said Menat. 'In fact, the one that provided the new design essentially said "If you have a device that works well, make it more symmetrical and see what happens."

What is even more interesting, claims Lenat, is that the integrated expert working on the 3D project took the new design away and actually fabricated a working example

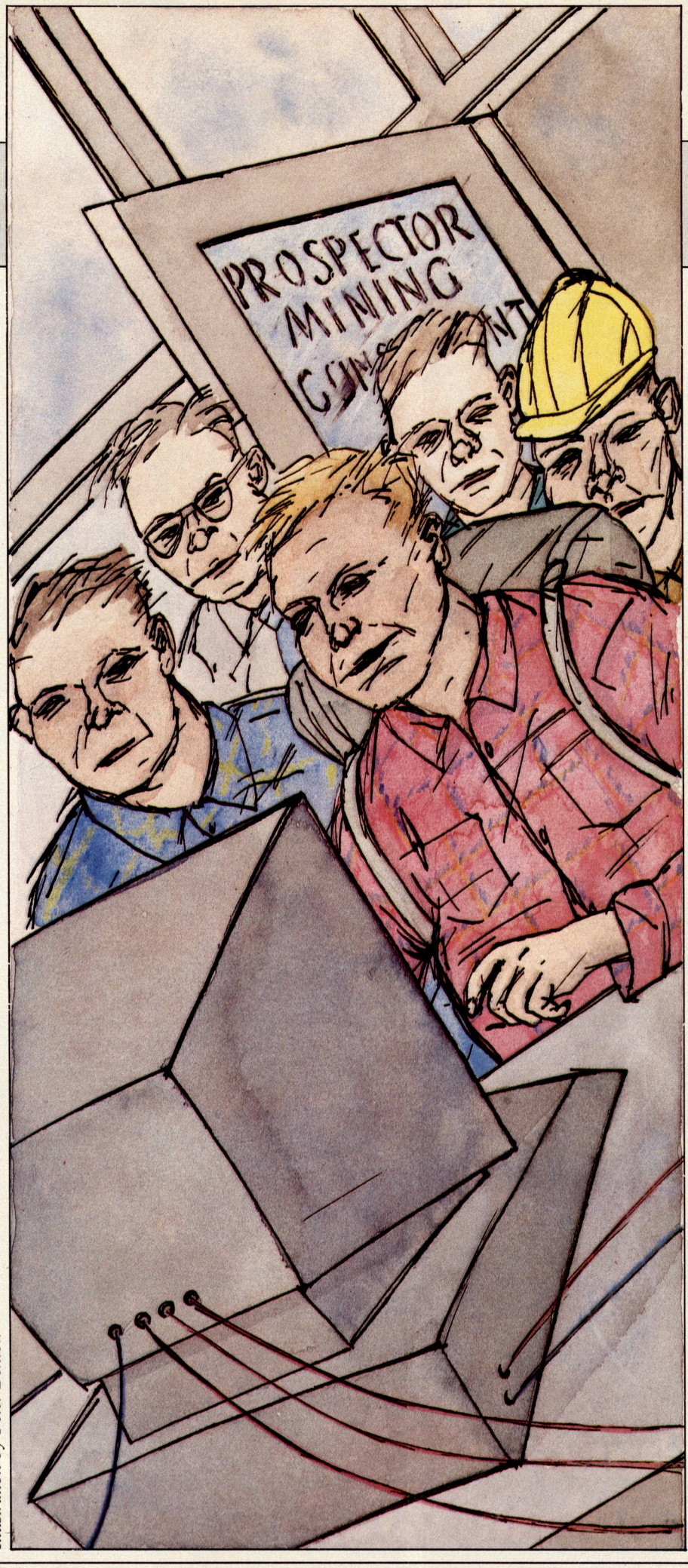


Illustration by Peter Benton

in six months. It is said to be no larger than a conventional 2D gate, but since it is somehow able to compute both the AND/OR functions simultaneously (one pre sumes not on the same piece of data) less devices are needed per chip, and 3D chips should prove to be very compact if they are ever produced commercially.

Apart from such practical pursuits, Lenat has also used Heurisko to help make him something of a war-game champion. For the last two years, he has entered and won the Trillion Credit Squadron competition organised in the US by the Game Designers Workshop.

Essentially, competitors must design a fleet of sea and spacegoing ships that are invincible. The rules for the game run to several books published by the organisers. Each fleet designer has a theoretical limit of a Trillion Credits to fund his work.

Lenat has applied Heurisko's technique — ie taking a given design and 'mutating' it in all manner of ways — to the war-game.

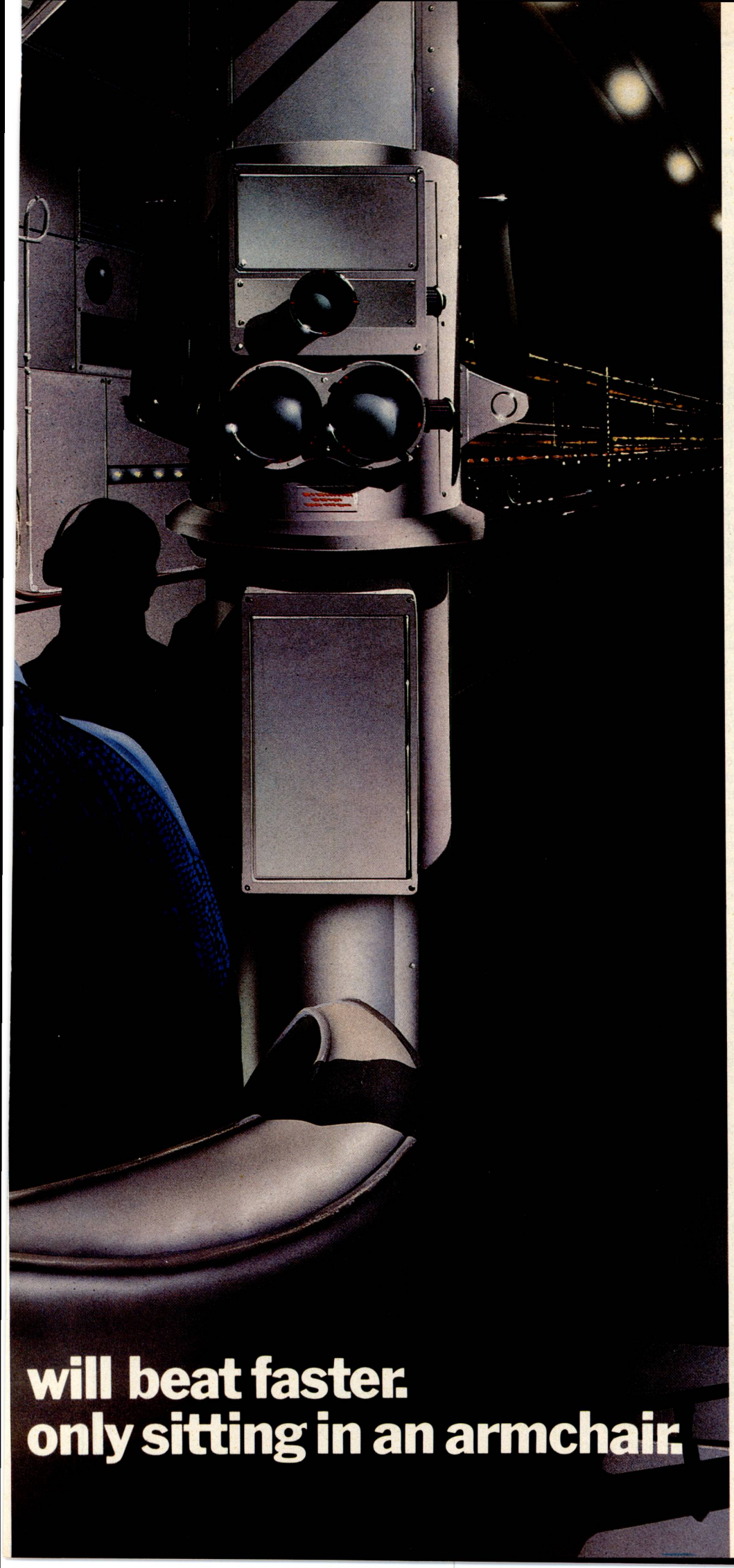
'The resolution of any confrontation between fleets can be worked out fairly easily,' said Lenat, 'but the rules of design are very, very detailed. For example, there are maybe 100 to 200 ships of all types in the fleet and any design must take account of 100 or so different parameters. For example, if you want to increase the power of a particular engine, you have to be aware that it will be more expensive and that you may have to strengthen many other related parts of the ship. Or maybe you want to have thicker armour plating than usual — this will obviously increase the weight and result in a slower, less manoeuverable ship.'

After hundreds of hours of computer resource time, Lenat managed to give Heurisko the rules of the game in a form it could use. For many nights he simply set the system loose on design work and came in the next morning to look at the results.

'The key thing is that Heurisko is able to mutate a design by making a large collection of small changes to a ship and then assessing the quality of that new design,' he said. 'I've won the competition for the last two years and hope to do so again in 1983, but it is probably going to get harder. It is becoming clearer that more and more computer science people are getting involved, and expert system techniques are ideal for this environment.'

END

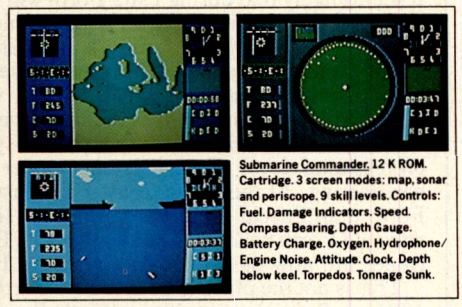

Your hands will sweat. Your heart
Your oxygen might run out. And you're still



will beat faster. only sitting in an armchair.

At seventy fathoms the only light comes from your Sonar, steadily tracking the advancing enemy fleet.

Suddenly they're above, dropping depth charges. You could dive. But how close is the sea bed? You could attack. But how many torpedos are left? And your oxygen. Isn't it dangerously low?



Submarine Commander. 12 K ROM. Cartridge. 3 screen modes: map, sonar and periscope. 9 skill levels. Controls: Fuel. Damage Indicators. Speed. Compass Bearing. Depth Gauge. Battery Charge. Oxygen. Hydrophone/ Engine Noise. Attitude. Clock. Depth below keel. Torpedos. Tonnage Sunk.

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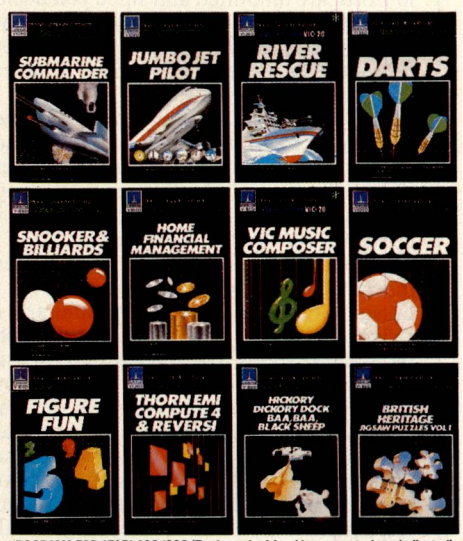


PROGRAMS FOR ATARI 400/800 (Trademark of Atari Inc. except where indicated).
*PROGRAMS FOR COMMODORE VIC 20 (Trademark of Commodore International).

Available from all branches of Laskys (Nationwide), Micro C at Currys, and all other leading Computer software outlets.

FORTH BENCHMARKS

PCW already has a set of Benchmark programs for the Basic and Pascal languages. As Forth is becoming more widespread on personal computers Dick Pountain has produced an equivalent Benchmark set, the first results of which are printed here.

It seems likely that during 1983 Forth will finally emerge from the shadows and take its place as a major microcomputer language. The evidence for this assertion is not hard to find: during 1982 Forth systems at reasonable prices have become available for most of the popular low priced micros, while the Jupiter Ace, reviewed in this issue, makes the language available to beginners for less than the price of many software systems. The number of professional level Forth systems under CP/M is now quite bewildering. At the West Coast Faire last year there were more Forth than Pascal products on display. IBM has commissioned and sold Forth developed software for its PC while Atari's arcade games are now developed in a graphics Forth.

This is not the place to go into how Forth works (see *PCW* Dec 1981 or Brodie's magnificent book *Starting Forth).* Nor am I going to oversell Forth as the universal panacea for programming problems as has, unfortunately, been done so often before.

After a year of working in Forth I have formed a somewhat more realistic opinion of its capabilities and shortcomings; suffice it to say that I remain impressed enough to use it whenever appropriate for serious programming tasks and to offer these Benchmarks for evaluating Forth systems.

Forth is definitely not a suitable replacement for Basic as a beginner's language, anymore than an AC Cobra is a suitable car for learner drivers. Logo is a much better bet to take on this role. What Forth does offer, as a second language, is a complete programming environment which offers more control over the computer than any other interactive system which is currently available. Notice the word interactive; the main rival to Forth for flexibility and power in systems programming is C (and its progenitor BCPL). C offers advantages over Forth in that it produces stand-alone machine code modules which can be linked to programs produced by other compilers, whereas Forth generally requires run time support from a Forth interpreter. C-produced code will usually run slightly faster, too. But C is not interactive; it is a compiler in the old Fortran tradition (and even slower to compile) and thus goes against the grain of the microcomputer philosophy. For large projects by professional programmers this doesn't matter, but for we mortals the interactive 'suck-it-and-see' approach is what makes programming bearable.

Forth is not only interactive; it is more interactive than any other language in existence. How else can you sit at a terminal and work in any number base you desire at a keystroke, dump blocks of memory, mix Assembler in with your high level code, manipulate any object from a bit up to an array or file without ever leaving the system? And it's structured, too. One myth which circulates about Forth is that the code is always unreadable; the truth is that it can be as readable as you want to make it. The commenting facilities in Forth are unlimited and since you decide word names (up to 31 characters on my system) it is your responsibility to make them intelligible. One day soon I intend to publish in *PCW* a fairly heavyweight piece of Forth code I have produced which is certainly as readable as Pascal.

Anyway, on to the Benchmarks. Since Forth is an extensible language it presents some problems in choosing the level at which to write Benchmark programs. In order to produce programs which stand a chance of running on all systems it is necessary to restrict the functions tested to the 'core' words which are mainly control constructs or stack manipulation words. I have not tested any lower, byte level, words as these tend to be almost 'naked' machine instructions and one ends up Benchmarking the processor not the implementation. Similarly high level structures like strings and arrays are excluded because they are not implemented on many systems. Floating point extensions are becoming more widespread and could be a candidate for future addition.

Even having decided to stick to core words there were problems over standards. There are two major variants of the Forth core, the Forth Inc version and the Forth 79 Standard plus lots of 'eccentric' versions such as Transforth and Stackworks Forth. The differences are usually only a matter of names; there are equivalent words in most systems but they may be called by different names. I have chosen (with one exception) to go for Forth 79 Standard words in these programs as this gives compatibility with most fig-Forth systems. The fact that my own system is 79 Standard of course didn't influence me at all.

The exception I mentioned is the word SP! which removes all the contents of the data stack. This isn't required in the standard though it is in fact implemented in a lot of 79 systems. The reason it's required is as follows. *PCW's* other Benchmarks, the Basic and Pascal, are analytical in the sense that by subtracting the timings of successive tests one can isolate the time due to a given instruction (not completely true for the arithmetic functions). We feel that this is a desirable feature which is why we haven't adopted catch-all tests such as Eratosthenes Sieve. (For a full account of Benchmarks see *PCW* Nov.)

Forth is so fast that most of the programs test 100,000 iterations (and that is barely sufficient for 'magnifier'). No Forth system in the world can hold 100,000 items on its stack and so the stack has to be cleared if we are to get a direct timing for any word which leaves a result on the stack. Hence SP! is required. I have deliberately placed it in 'magnifier' which is meant to be subtracted from the other timings as a constant overhead (thanks to Chris Sadler's Pascal BMs for the idea). If you want to run the BMs on your system and don't have SP! or an equivalent, you must write one; it hardly matters whether it's in machine code or high-level as it's part of the overhead. I had to write SP! for two of the systems timed here, PicoFORTH and GraFORTH. PicoFORTH keeps the stack pointer in a processor register; the definition in 8080 code is:-

```
CODE (SP!) H POP SPHL NEXT JMP
  : SP! S0 @ 2 - (SP!) ;
```

The word S0, which is present in most systems is a variable holding the address of the stack base; many systems also have SP@ which fetches the address of the stack top.

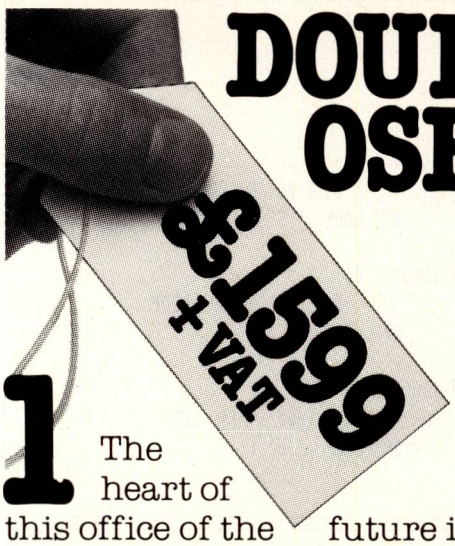
GraFORTH uses RAM locations and has the unForthlike PEEK and POKE so

```
: SP! 7680 156 POKEW ;
```

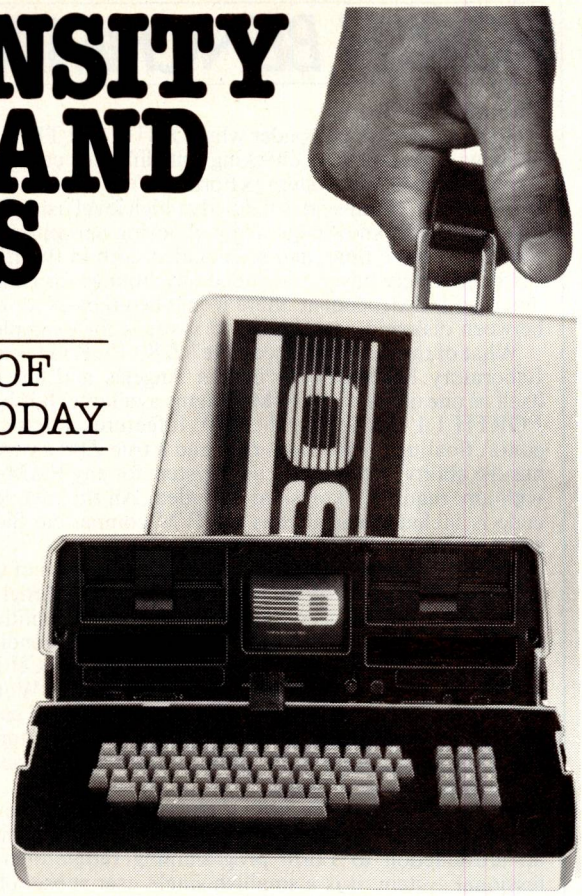
```
Block 8001
  0 ( PCW Forth Benchmarks - Dick Pountain 10th Nov 1982)
  1
  2  FORTH DEFINITIONS   DECIMAL
  3
  4 : magnifier  ." S" 10001 1 DO
  5                        SP! LOOP ." E" ;
  6
  7 : do-loop    ." S" 10001 1 DO
  8                           11 1 DO LOOP
  9                        SP! LOOP ." E" ;
 10
 11 : literal    ." S" 10001 1 DO
 12                           11 1 DO  9  LOOP
 13                        SP! LOOP ." E" ;
 14                                                          -->
 15
```

```
Block 8002
  0 ( Benchmarks 2)
  1
  2  VARIABLE V
  3
  4 : variable        ." S" 10001 1 DO
  5                                  11 1 DO  V  LOOP
  6                               SP! LOOP ." E" ;
  7
  8 : literal-store   ." S" 10001 1 DO
  9                                  11 1 DO  9  V !  LOOP
 10                               SP! LOOP ." E" ;
 11
 12 : variable-fetch  ." S" 10001 1 DO
 13                                  11 1 DO  V @  LOOP
 14                               SP! LOOP ." E" ;
 15                                                          -->
```

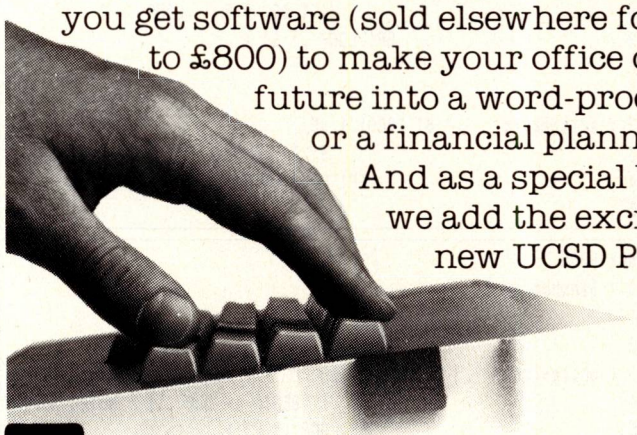
DOUBLE DENSITY OSBORNE AND PRAXIS



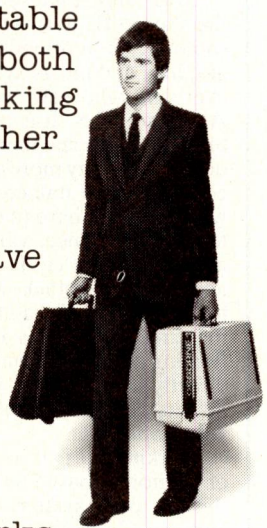
THE OFFICE OF THE FUTURE TODAY



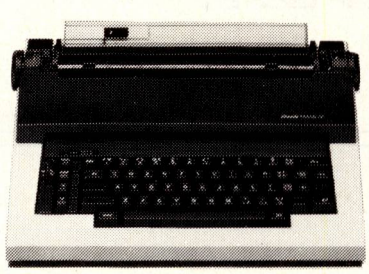
1 The heart of this office of the future is the powerful new "double density" Osborne 1 portable computer with 64k memory, two 200k disc drives and built-in monitor. The Osborne is linked to an Olivetti Praxis 30 11cps daisy-wheel printer/typewriter for printing your work superbly. In addition you get software (sold elsewhere for up to £800) to make your office of the future into a word-processor or a financial planner. And as a special bonus we add the exciting new UCSD Pascal.

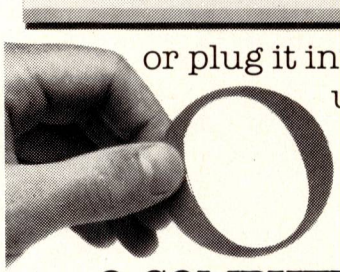


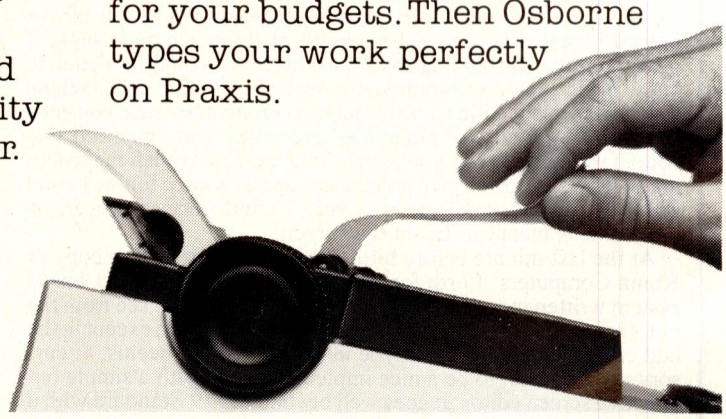
2 Your Osborne and Praxis are a remarkable combination. The machines are so portable you can carry them both home instead of working late. Plug them together slip the Wordstar/Mailmerge disc into the drive and you have a word-processor with twice the capacity of earlier Osbornes. Change discs for Supercalc and you have the power of a dozen clerks for your budgets. Then Osborne types your work perfectly on Praxis.



3 The Olivetti Praxis 30 is a new style electronic typewriter with its own memory, automatic erase, and a double keyboard which gives you 14 extra characters. Use your Praxis on its own as a prestige easy-to-use typewriter, or plug it into your Osborne and use it as a high quality computer printer.







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FORTH BENCHMARKS

does the trick here.

Some readers may wonder why TEST> and TEST< are both included. When I was checking out different candidates I discovered that on my system (xForth 1.2) a > test is 50% slower than a < test, because it is defined at high level using <. I thought this was useful knowledge as by choosing appropriate logic it is possible to save time, and so included both in the BMs.

I deliberately haven't included any timings for compilation as this is so I/O dependent; there would be no basis for comparison between disk and cassette based systems for example.

What of the systems timed here? Z-80 FORTH is a product of Laboratory Microsystems in Los Angeles and has established itself as one of the best CP/M systems available. It is based on fig-FORTH 1.1 recoded for the Z80. It features a first class screen editor, floating point extensions, and a true Z80 assembler and it has the ability to generate a new system for any RAM size of host with any required extensions included. All the high level source code is included and it uses a CP/M-compatible file format to store screens.

xForth is a British product from AIM Research of Cambridge, and also runs under CP/M. It has a 79 Standard kernel with lots of very advanced extensions. In particular, it has facilities for modular programming with local variables, run-time conditionals and conditional assembly (8080 assembler), and full CP/M file handling capabilities which can access, for instance, Wordstar files. Floating point and sequential files (with pipes and spooling) are available as extras. It has an even better screen editor than Z-80 FORTH which includes a global search-and-replace and user configurable control codes.

PicoFORTH is a 'kosher' product from Forth Inc, itself, distributed in the UK by Computer Solutions of Chertsey. Meant as an introduction to Forth programming rather than as a professional system, it is a smallish single-user subset of their multitasking polyFORTH. An 8080 assembler is provided but only the original Forth line editor which is rather spartan compared to the editors on the other systems tested. Although it boots from CP/M it does not use CP/M compatible files but 'pure' Forth blocks. This means you cannot, for instance, copy files with PIP nor interface with CP/M via system calls.

GraFORTH is a special graphics language, based on Forth, for the Apple II; it is written by Paul Lutus of Applewriter fame (notoriety?). It provides some very nice features for animated 3D graphics and music synthesizing. The demo programs impressed everyone who saw them, even given the limited resolution of Apple graphics. It is possible to draw a wire-frame picture using turtle graphics and then animate it by scaling, rotation and translation without any more drawing at all. As a Forth system it is rather eccentric with numerous wilful deviations from Forth practice which make it hard to come to or go from this to a 'standard' system. For instance, variables are handled in a Basic-like assignment statement eg, L 1 + -> L and put their value rather than address on the stack when called (which is why I have no timing for 'variable'). The editor is based on the Apple Basic editor using the same ESC codes and line numbers; it is quite nice to use. No floating point or assembler is included. Unusually GraFORTH is directly threaded – ie, it compiles 6502 code rather than pointers into its headers; the effect on the time for 'dictionary-search' is very noticeable.

Working Forth is a teaching system from Mountain View Press of California based on standard fig-FORTH. Like picoFORTH, this is a 'pure' system which doesn't use CP/M files. It has a large number of screens of teaching-machine type instruction which have the nice feature that the student can come out into Forth and do exercises and then easily start at the point he/she left off (or indeed repeat a lesson). The quality of the teaching is high, if perhaps rather forbidding the total novice; it would be better to know Basic and best to know some Assembler before approaching it. It represents terrific value for money, though, because you get a full Forth system with assembler and editor (an enhanced line editor) which will keep you happy long after you finish the teaching course. They even give you the assembler source for the kernel on disk. The documentation is very rudimentary, however, as most of it is meant to be on the screen.

At the last minute before hitting the press I received a copy of Kuma Computers' Forth for the Sirius 1. This is a fig-1.1 based system written in genuine 8088 code, and as you will see from the timings it is indeed quicker than a 4MHz Z80 version except in the odd case of 'increment' (maybe in high-level?). It seems, at cursory aquaintance, to be a nice implementation, with a simple but effective screen editor. It goes well beyond the 79 Standard with a large part of the Reference Word-set included. It comes with

```
Block 8003
 0 ( Benchmarks 3)
 1
 2 9 CONSTANT K
 3
 4 : constant   ." S" 10001 1 DO
 5                          11 1 DO  K  LOOP
 6                     SP! LOOP ." E" ;
 7
 8 : dup        ." S" 10001 1 DO
 9                          11 1 DO  9 DUP  LOOP
10                     SP! LOOP ." E" ;
11
12 : increment  ." S" 10001 1 DO
13                          11 1 DO  9 1+  LOOP
14                     SP! LOOP ." E" ;
15                                                  -->
```

```
Block 8004
 0 ( Benchmarks 4)
 1
 2 : test>      ." S" 10001 1 DO
 3                          11 1 DO  9 9 >  LOOP
 4                     SP! LOOP ." E" ;
 5
 6
 7 : test<      ." S" 10001 1 DO
 8                          11 1 DO  9 9 <  LOOP
 9                     SP! LOOP ." E" ;
10
11
12 : arithmetic    ." S" 10001 1 DO
13                           9  2 / 3 * 4 + 5 -
14                      SP! LOOP ." E" ;
15                                                  -->
```

```
Block 8005
 0 ( Benchmarks 5)
 1
 2
 3 : while-loop   ." S" 10001 1 DO
 4                           1  BEGIN 1+ DUP  11 < WHILE REPEAT
 5                      SP! LOOP ." E" ;
 6
 7
 8
 9 : until-loop   ." S" 10001 1 DO
10                          20  BEGIN 1- DUP  11 < UNTIL
11                      SP! LOOP ." E" ;
12
13
14
15                                                  -->
```

```
Block 8006
 0 ( Benchmarks 6)
 1
 2 : ten ;
 3 : nine  ten ;
 4 : eight  nine ;
 5 : seven  eight ;
 6 : six  seven ;
 7 : five  six ;
 8 : four  five ;
 9 : three  four ;
10 : two  three ;
11 : one  two ;
12
13 : dictionary-search  ." S" 10001 1 DO
14                                 one
15                            SP! LOOP ." E" ;          -->
```

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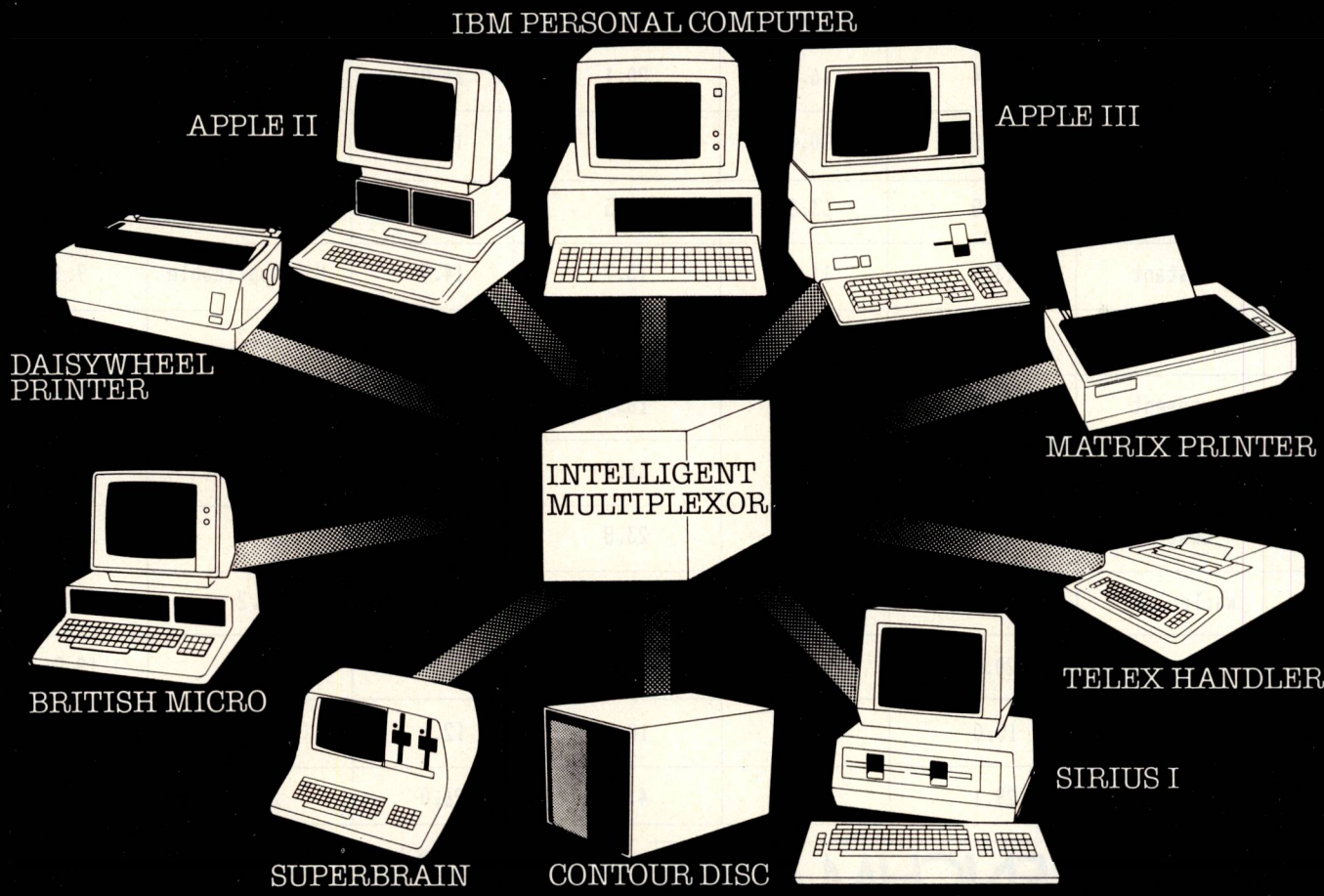

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System	Z-80 FORTH v 1.14	xForth v 1.2	Working Forth v 2.5	picoFORTH	GraFORTH	Kuma Forth
Host machine	Transam Tuscan 4Mhz Z80	Sharp MZ80B 4Mhz Z80	Transam Tuscan 4Mhz Z80	Superbrain 4Mhz Z80	Apple II Euro+ 1Mhz 6502	Sirius 1 5Mhz 8088
Operating System	CP/M 2.2	CP/M 2.2	CP/M 2.2	CP/M 2.2	DOS 3.3	CP/M 86
magnifier	1.3	1.2	1.4	3.6	4.3	1.0
do-loop	9.5	8.6	10.1	11.4	18.0	6.5
literal	13.2	11.4	13.7	14.7	26.5	8.9
literal-store	19.4	16.4	20.1	21.0	27.9	13.7
variable	12.2	10.6	12.9	14.1	Not applicable	8.7
variable-fetch	15.8	13.6	16.5	17.7	26.8	11.5
constant	13.0	11.2	13.7	14.9	Not applicable	9.1
dup	16.4	14.0	17.0	18.4	30.7	11.5
increment	16.2	13.8	16.9	17.8	41.4	19.5
test>	21.4	28.0	36.2	22.9	52.1	23.3
test<	21.4	18.3	23.8	22.7	51.7	15.3
while-loop	22.5	18.9	25.4	24.2	56.2	25.9
until-loop	20.4	16.8	22.9	21.7	54.7	18.9
dictionary-search	10.0	8.0	10.3	12.1	5.3	6.3
arithmetic	29.1	21.0	41.3	26.0	25.7	23.5

FORTH BENCHMARKS

floating point but no assembler, and does not have full CP/M86 file compatibility though you can read a CP/M86 file into RAM at a chosen address using a routine called READFILE. It has a reasonable manual and user guide which is short on low-level information, however.

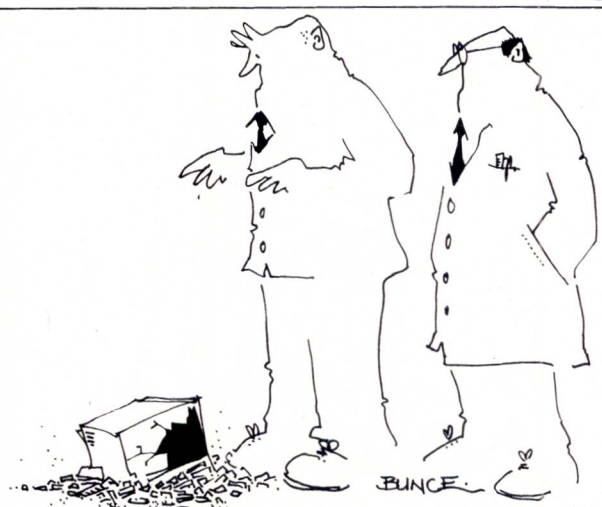
What is my overall impression of the products? As far as speed is concerned the Z80 systems were not far apart as you can see from the table. The 6502 system was slower overall than I would have expected. My money is already on the table as I am an xForth licence holder (and extremely happy with it). Z-80 FORTH runs it pretty close and is now on sale in this country, I believe. The ability to work on CP/M files from either of these is of inestimable value to me; I can write utilities such as word count programs to work on Wordstar or Cardbox files without having to buy a CP/M Basic or resort to assembler. These two also have excellent documentation which allows you to probe as deep as you will into the system.

I hope that any Forth using readers will run the Benchmarks and send in their timings so that I can print updates on an annual basis as Chris does with the Pascal. Please specify what processor and clock-rate if you do this. Any suggestions for improvements or modifications will also be welcome.

Addresses of suppliers

AIM Research, 20 Montague Road, Cambridge – xForth.
Laboratory Microsystems, 4147 Beethoven St., Los Angeles, CA. 90066 – Z-80 FORTH.
Mountain View Press Inc., PO Box 4656, Mountain View, CA 94040 – Working Forth.
Computer Solutions Ltd, Treway House, Hanworth Lane, Chertsey, Surrey – picoFORTH.
Insoft, 10175 Barbur Blvd, Suite 202B, Portland, Oregon, OR 97219 – GraFORTH.
Kuma Computer Ltd., 11 York Road, Maidenhead, Berks –Kuma FORTH.

END



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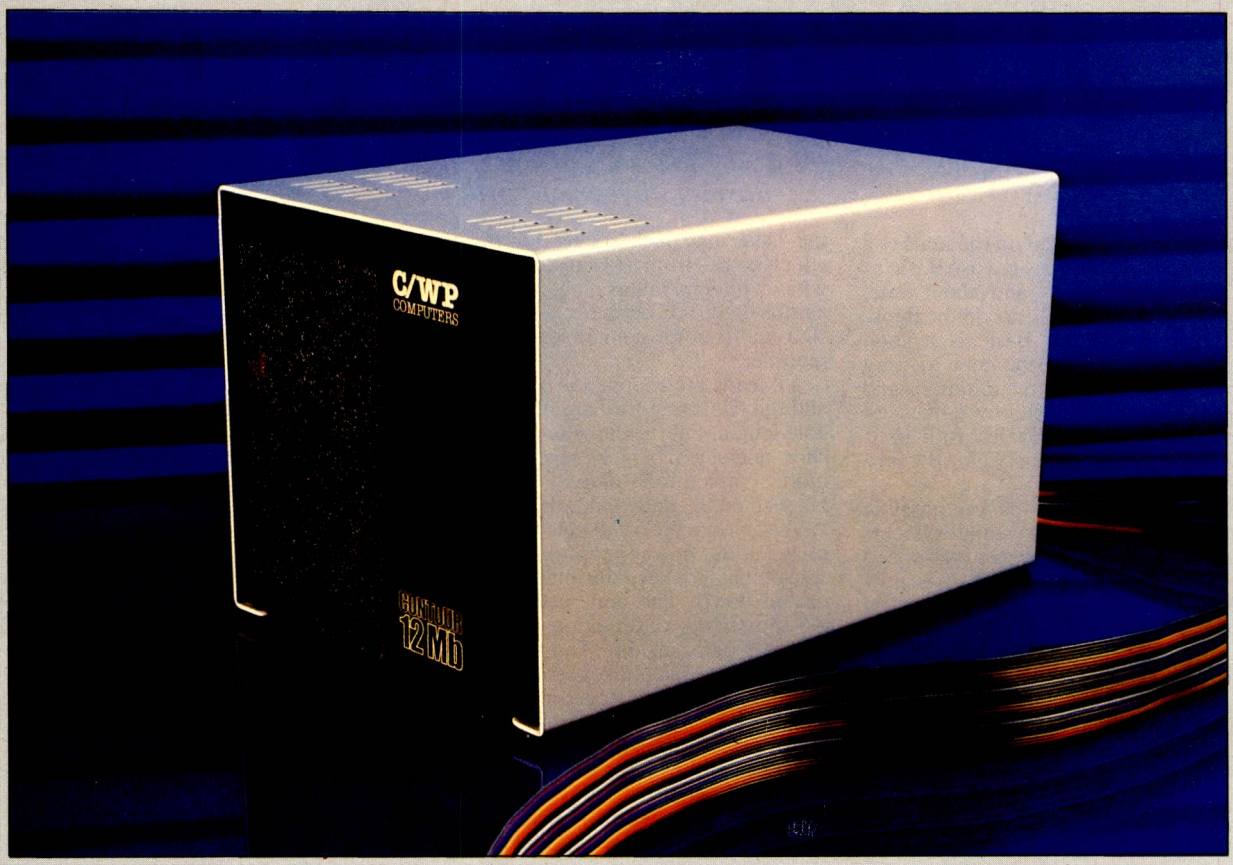

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BENCHTEST

JUPITER ACE

The fastest micro computer in the universe? Mike Curtis investigates a new British micro that spurns Basic in favour of Forth

At last there has appeared on the market a small computer which does not use Basic as its principal language — and about time, too, as many people will no doubt think. There is no doubt that Basic is a good language for absolute beginners to play about with, but it has severe limitations and most people would soon outgrow it if it were not for the rash of 'super-Basics' with limitless features which only really hide the problem rather than solve it.

Forth has long been touted as a possible alternative to Basic for very small systems because of its compactness and high speed of execution; but although Forth is now available for many machines no one up until now has taken the plunge and produced a machine for the mass market which has Forth as its main — and indeed its only — language.

This ground-breaking machine is the Jupiter Ace and it comes as a surprise to those of us who have been waiting for a Forth machine: for a start it is a much smaller machine than I would have anticipated, priced to put it in direct competition with the Sinclairs, Acorns and other giants of the mass market; and secondly it uses the Z80 which, excellent chip though it may be in other ways, is less suitable for a Forth machine than say a 6809. However, the Ace is certainly an interesting machine with many features to recommend it both to absolute beginners and Forth enthusiasts.

Hardware

The Ace has the look of a ZX80 about it: a small white plastic case measuring 210cm by 190cm and a rubber keyboard, each key having a number of symbols on it. The Sinclair background of the designers shows through in a number of other ways too. There are two edge connectors at the back of the case, one of which looks just like a Sinclair interface but isn't quite; in fact the same signals appear on this connector as do on a ZX81 or Spectrum but they are not quite in the same order so you cannot plug in extra memory and the printer straight away: however, an adaptor between the two would be easy enough to make and doubtless one will be appearing soon. There are four sockets around the side of the case: one jack socket for the power which comes from a separate power supply with an integral mains plug, one phono socket for the UHF output to a normal television and two for connection to a cassette recorder.

All leads are supplied — the power lead and the television lead are of quite reasonable length, but the cassette leads are a bit short and use only jack plugs instead of the more common DIN plugs. The sockets are labelled on the underside which means that anybody (like me) who gets worried about plugging the power supply into the wrong socket has to keep turning the machine upside down. The underneath also holds the interesting observation 'No user serviceable parts inside'. The user is clearly not intended to venture inside this machine, for the case is held together by a sort of plastic rivet which needs the application of pincers to remove.

The insides of the Ace are very much as you might expect: there is a single board, the front half of which is taken up by the keyboard. The rubber sheet which forms the keyboard lies loose on the board, and when a key is pressed the part of the rubber under the key moves down to make a contact on the board. It may be simple but it is hardly elegant. I have been told that the design has been improved to overcome the tipping problem, but it still does not impress me very much. I think I would prefer to pay the extra and get a machine with a proper keyboard. TheZ80 processor sits at the back left hand side of the board with 8K of ROM in two chips next to it, and the loudspeaker. The rest of the board is taken up with discrete logic TTL; no ULAs and so hopefully no delays! The design again is reminiscent of the ZX80. The board itself is not of the highest quality but it looks well put together; it will need to be strong because the case itself is quite flimsy.

There is no on/off switch — the power plug being simply removed and inserted to perform this function. When the plug is inserted and the television tuned in then you are rewarded by a black screen with a small rectangular cursor at the bottom left hand corner, a refreshing change from the usual blowing of horns (and own trumpets) so beloved of many manufacturers.

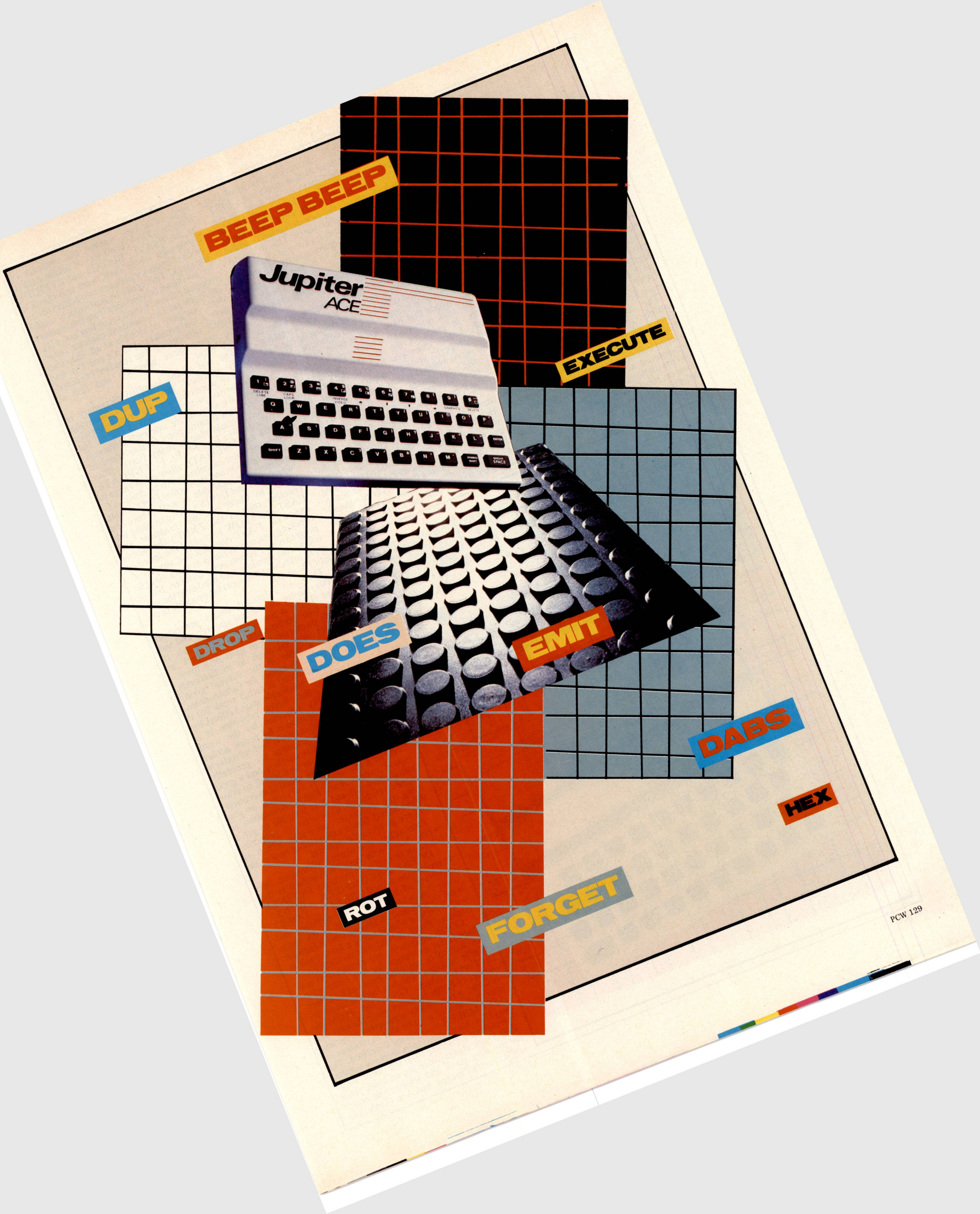
A good approach to any new Forth system is to get it to 'VLIST' all the words in the dictionary, which breaks the ice by filling the screen with characters; it worked normally on the Ace.

The first noticeable thing about actually using the Ace is that the keyboard could take a lot of getting used to; each key needs a firm push in the centre otherwise it is liable to tip sideways and not make contact. There are both lower and upper case letters available, and most keys also have a symbol on them; there is a normal shift key on the lower left hand side which gives upper case letters but also gives some control functions when used on the top row of numeric keys. For example, shift-0 is to delete the previous character, shift-9 switches to graphics mode, shift-5 to 8 are the four cursor controls, shift-4 inverts the video, shift-2 is CAPS LOCK and shift-1 deletes an entire line.

The second shift key on the right hand side is labelled 'symbol shift' and is used to obtain the mathematical and punctuation symbols on most keys. All keys are the same size except for the space which is double sized and in the extreme bottom right hand corner; shift space acts as a BREAK in most circumstances. The display is black and white giving 24 lines each of 32 characters. It is not a particularly good display (but reasonable for this price of machine), having no proper descenders on lower case letters, for example. All commands are entered on the bottom line of the display, and on pressing return they are moved to the next available line at the top of the screen and then executed. Ace Forth does not distinguish between upper and lower case for commands, all words being converted to upper case before incorporation into the dictionary, though they are distinguished in anything that is not a dictionary name — ie, string input.

Software

The list of words produced by the VLIST command shows a fairly normal Forth basic dictionary with one or two omissions and one or two additions to the 79-Standard. The one major departure from any other Forth system I have ever used is


BEEP BEEP
Jupiter
ACE
EXECUTE
DUP
DROP
DOES
EMIT
DABS
HEX
ROT
FORGET

JUPITER ACE

the way of entering and editing source code. Normal Forth systems are 'screens' which are 1 K blocks of memory normally held on disk and transferred into a buffer when needed: a vocabulary of editor commands is used to manipulate text on these screens while they are in memory — for example to write Forth code which can be saved on the disk or loaded into the dictionary. A sort of virtual memory is used, where the system will decide whether a given screen is in memory, and fetch it from disk if it is not. This has always been a difficulty with cassette-based Forth systems; how to duplicate this system? It has normally been resolved by the use of a number of buffers in RAM as a pseudo-disk whose contents could be written to or read from tape.

The Ace uses a different technique entirely; incorporated into the basic dictionary are three words LIST, EDIT and REDEFINE which use a powerful decompiler to edit source code. Forth definitions are entered at the keyboard and entered into the dictionary immediately; this can be done on most Forth systems but that new definition is not normally accessible anymore except to execute it or forget it. The Ace, however, can access any word that has been defined in this direct way; LIST will list the definition of the word on the screen, EDIT will make it available for editing using the cursor keys. As soon as enter is pressed the new definition is added to the top of the dictionary. This of course leaves you with an extra copy of your word but the use of the command REDEFINE causes the new copy to be put back to the previous position in the dictionary with the rest of the dictionary being adjusted accordingly.

The same edit mode is entered if there is an error in a word definition. An interesting side effect of this form of editing is that it is possible to make forward definitions, using words that have not yet been defined; the trick is to use an arbitrary predefined word in place of the yet-to-be-defined word. Later, when you have defined this word properly, you can return to the higher level word which is meant to use it and insert it in the appropriate place. REDEFINE will now move this high level word back, pointing forward for one of its components.

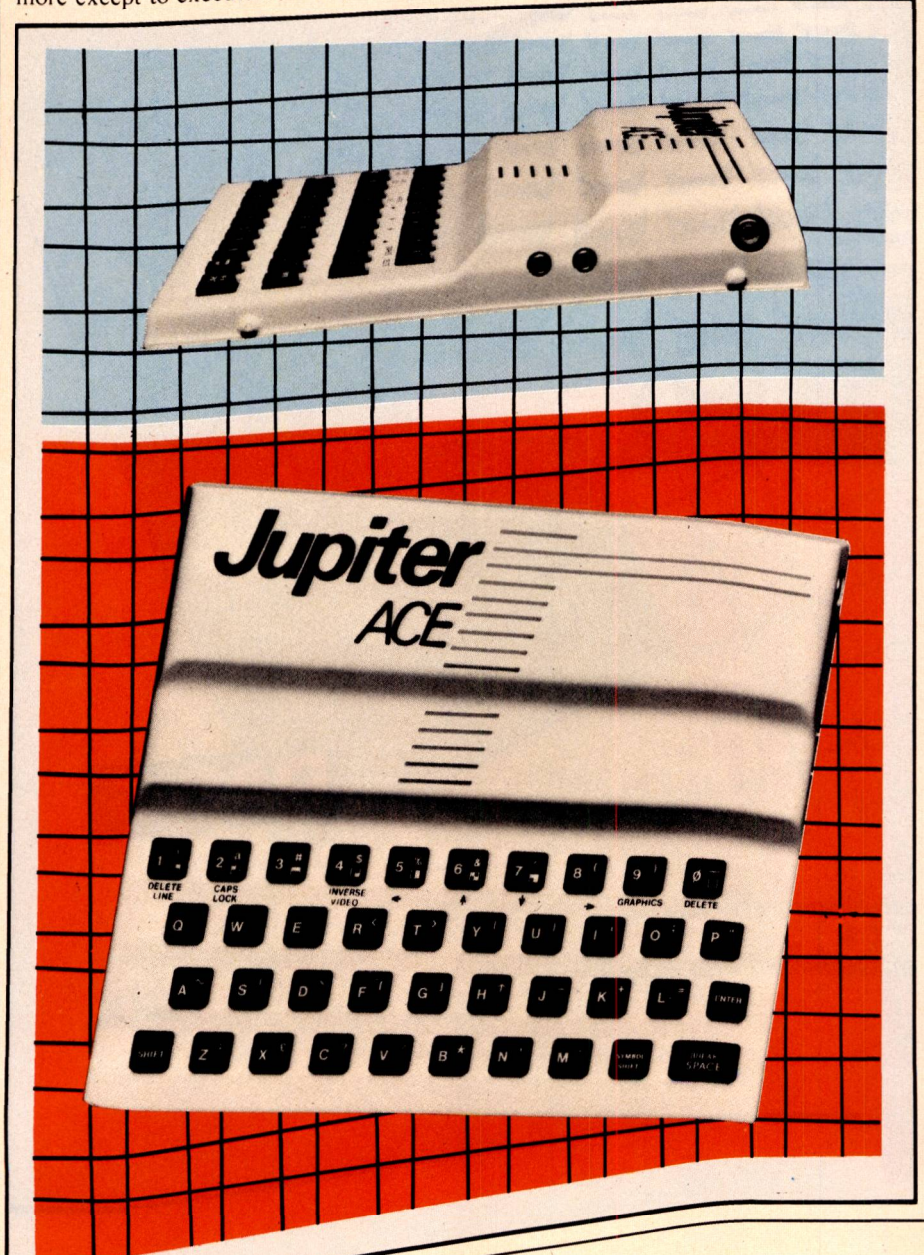
The problem of saving to tape is overcome in two ways: the entire RAM dictionary (that is, excluding the predefined words in ROM) can be saved to tape using the SAVE command, and these tapes can then be loaded using the LOAD command to be added onto the dictionary. There is also a VERIFY command to check the contents of a tape against the contents of memory. The second way of saving data is by the BSAVE, BLOAD and BVERIFY commands which save, load and check a block of memory between two addresses on the stack. This could be particularly useful for saving screen pictures from the memory mapped screen. I tried recording and playing back on two standard cassette recorders; one gave no trouble at all, the other gave a few problems but it's one I've had trouble with before. The standard of recording seems quite adequate and fast at 1200 baud.

The rest of the supplied dictionary is fairly standard (see the accompanying table of words for a more comprehensive comparison with 79-Standard Forth), but there are some more interesting features. There is a floating point facility supplied, which should placate many Forth critics. Words F+, F−, F*, F/, F., FNEGATE, INT and FNEGATE allow a full range of floating point calculations to be done to 6-digit precision and the normal Forth double numbers are available as well. There are words VIS and INVIS which can cause the screen to blank out and reappear and (another relic of the ZX80?) the words FAST and SLOW to control the speed of execution. FAST does not use any error-checking procedures (such as stack size) so programs run appreciably quicker, but of course this should not be used until the program is known to be working properly in the SLOW mode.

There is a limited sound generation facility using an internal speaker, and the word BEEP is provided to control this. It takes two parameters off the stack to specify pitch (period in units of 8 microseconds) and duration in milliseconds. There is a table in the manual giving appropriate pitch values for various notes. The sound produced is rather weak but it could produce reasonable sound effects for games. The other major provision is a graphics facility provided by the word PLOT. The resolution is 64 pixels across by 46 down, which is hardly high by today's standards but the graphics are generally easy to use; it is quite painless and a good exercise to define your own words to draw lines or shapes, and the speed of execution, even in slow mode, is very good as you would expect from Forth. Animation is straightforward and it is possible to get a higher resolution if desired by programming the character generator which is RAM-based. Some examples of how to do this are given in the manual.

One other noteworthy difference between Ace Forth and 79-Standard is the provison of two constructions DEFINER .....DOES> and COMPILER.....RUNS> to replace the normal CREATE.....DOES> construction to define new defining and compiling words. They work in the same way, though, and so anyone who is familiar with Forth or who is using a book such as *Starting Forth* should find no difficulty.

CODE definitions are provided to produce faster execution for hex instructions (or decimal or any other base) as no assembler is included, which is fairly unusual for a Forth system. Given the extensible nature of Forth, however, once the user has become a reasonably competent programmer they should soon be able to produce an ASSEMBLER vocabulary if desired. The way that this Forth system works is another interesting departure from the norm. Most Z80 Forth systems use the machine stack for the data stack and arrange the return stack by other means, but Ace Forth does



the opposite. Indeed the data stack is not in a fixed position at all but remains at 12 bytes up from the current top of the dictionary, the ROM part of the dictionary occupying the bottom 8k on the memory map. The return stack is placed via a system variable at the top of available memory and grows downwards, the dictionary and data stack growing up to meet it. The 3k or so of space that is available for this is available for this is much more usable than you would expect because of the compact nature of Forth, but it is not exactly huge and you are going to run out of space fairly soon; there is not sufficient space to store all the Benchmarks at the same time, for example. This organisation does, however, mean that the system can immediately take advantage of extra memory simply by initialising the return stack at the highest available memory.

The version of Forth implemented on the Ace, in summary, is a good version which incorporates all the desirable features of a standard Forth dictionary with additions to make full use of the features of the machines; some useful words which are omitted can easily be added if the need arises.

Documentation

The manual is impressive; written by Steven Vickers, one of the two designers, it sets out to be both a user's manual and a self-instruction course in Forth. It does not quite succeed but it does as good a job as most other manuals for machines in this class. It has 181 pages with illustrative examples of the use of all the words in the dictionary, and reference sections including details of the memory map and locations for all the system variables, so all features of the machine are available to the user. A section of the manual explains how to write code definitions (words defined in machine code for extra speed). The manual is written in a fairly light-hearted manner, so that anyone intelligent enough to want a computer in the first place should be able to make sense of it. An illustration of the style is this quote from the section on loading programs from tape: 'Let us suppose that your tape has an interesting program called DVLC — it runs a game in which you are menaced by hundreds of vehicle licence application forms falling out of the sky, and you have to destroy the enclosed vehicle registration documents.' Clearly the author has had a recent unfortunate experience.

Benchmarks

The Benchmark timings given below were taken using the Benchmark programs discussed elsewhere in this issue. They were taken in SLOW and FAST modes. The word SP! which is an essential element of these benchmarks is not available in Ace Forth, so I have defined it as

: SP! HERE 12 + 15419 ! ;

Where HERE 12 + calculates the bottom of the stack at 12 bytes up from the next dictionary space and 15419 is the address of the system variable SPARE (not available as a Forth word) which holds the next free space on the stack. The timing of 'magnifier' is subtracted from the other figures to compensate for the time taken by SP! which would, of course, have been much quicker if defined as CODE.

Conclusions

The Jupiter Ace is a cheap computer at £89.95, and externally it looks cheap. It does not have colour and with the price of colour machines dropping fast this could turn out to be a big disadvantage. It has as yet no peripherals, though Sinclair ones can be adapted and Jupiter themselves will shortly be bringing out a parallel Centronics interface. There is no software around either as yet but hopefully this will change soon especially if a large number of machines are sold; it could even bring about a boom in Forth software which could be run on a variety of machines. It is a bit difficult to imagine what the market for this machine will be; a lot of people may be put off by the Forth language itself with its use of Reverse Polish notation (calculators which use this system have never been particularly popular except in the scientific community). However, there are real benefits to be had from this machine as opposed to many of its competitors; programs will run appreciably faster than their equivalents on a Basic machine; anyone who is prepared to persevere with Forth will find it a rewarding experience which will lead to a quicker program development time, and more reliable programs as well as a better understanding of the operation of the machine; and simple Basic interpreters written in Forth as well as a lot of other interesting software are available through the Forth Interest Group. The Jupiter Ace is a very interesting machine; I would not like to predict whether or not it will be a sales success but it deserves to be. It uses a very good version of the Forth language and has a reasonably clear and detailed manual.

The Jupiter Ace is available only through mail order at present from Jupiter Cantab Ltd, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP. The price including power supply and leads is £89.95.

Benchmark timings

BM	Name	Time SLOW	Time FAST
1	magnifier	10.6	6.3
2	do-loop	27.8	20.9
3	literal	44.5	28.6
4	variable	42.6	27.4
5	literal-store	77.1	43.6
6	variable-fetch	60.7	36.1
7	constant	43.3	27.4
8	dup	64.7	39.9
9	increment	62.9	38.0
10	test>	3.1	51.5
11	test<	113.9	71.6
12	while-loop	131.3	81.9
13	until-loop	127.9	78.6
14	dict.-search	16.7	12.4
15	arithmetic	98.5	62.6

See also 'Forth Benchmarks' elsewhere in this issue.

Fig 1 Table of Forth words used by the Jupiter Ace

!	★	★/	★/MOD
(	°	°/	°/MOD
+	+LOOP	.	.
-	."	/	/MOD
0<	0=	0>	1+
1-	2+	2-	:
;	<	<£	=
>	>R	?DUP	@
ABORT	ABS	ALLOT	AND
ASCII	AT	BASE	BEEP
BEGIN	BLOAD	BSAVE	BVERIFY
C!	C,	C@	CALL
CLS	COMPILER	CONSTANT	CONTEXT
CONVERT	CR	CREATE	CURRENT
D+	D<	DECIMAL	DEFINER
DEFINITIONS	DNEGATE	DO	DOES>
DROP	DUP	EDIT	ELSE
EMIT	EXECUTE	EXIT	F*
F+	F-	F.	F/
FAST	FIND	FNEGATE	FORGET
FORTH	HERE	HOLD	I
IF	IF	IMMEDIATE	IN
INKEY	INT	INVIS	J
LEAVE	LINE	LIST	LITERAL
LOAD	LOOP	MAX	MIN
MOD	NEGATE	NUMBER	OR
OUT	OVER	PAD	PICK
PLOT	QUERY	QUIT	R>
REDEFINE	REPEAT	RETYPE	ROLL
ROT	RUNS>	SAVE	SIGN
SLOW	SPACE	SPACES	SWAP
THEN	TYPE	U*	U.
U/MOD	U<	UFLOAT	UNTIL
VARIABLE	VERIFY	VIS	VLIST
VOCABULARY	WHILE	WORD	XOR
|	|		

The following 79-Standard words do not appear in Ace Forth: ', +!, -TRAILING, 79-STANDARD, >IN, ?, CMOVE, COMPILE, COUNT, DEPTH, EXPECT, FILL, KEY, MOVE, NOT, STATE, [COMPILE], SP!.

The following words are extra to 79.Standard Forth: ASCII, AT, BEEP, CALL, CLS, FAST, IN, INKEY, INVIS, LINE, OUT, PLOT, RETYPE, SLOW, VIS.

Technical specifications

Processor	Z80 3.25MHz
ROM	8k
RAM	3k
Keyboard	Rubber keys, 40 keys with auto-repeat and caps lock
Mass storage	Domestic cassette recorder, 1500 baud.
Screen	TV (black and white), 32x24 characters, 64x46 dots in graphics
Sound	Internal speaker
Ports	Expansion port contains power rails, address, data and control lines. Accessible through IN and OUT.
Language	Ace Forth



STAND IN LINE, GET YOUR PICTURE TOOK...

Photography. Now, there's a subject to contemplate. Like playing a guitar, it is something that is easy to do in a simple fashion, but it is almost impossible to become a master.

The world and his uncle has spent many joyous hours taking full-colour photographs of Aunt Ethel's knees (neatly exorcising thereby the part of Aunt Ethel that has always affronted a delicate set of ear-drums). Pocket Instamatics can be seen distorting the careful tailoring of every other suit seen walking down Oxford Street. The other every-other-suit is only not being distorted because the Instamatic is in someone's hand, taking a glorious, full colour shot of the top half of the right-hand corner of Selfridges.

Yet, if it is done properly, photography can capture a mood or emotion — a nuance of the pain or happiness felt by a subject, an insight into the horror of war and the joy of laughter. A master with a camera can see and capture what most of us miss until the photograph gave us the time and space to observe.

So many things can be photographed it is hard to know where to start sometimes. Should the camera be pointed at people — old people that smile, young ladies that work the Page 3 circuit — or should it be pointed at the inanimate things of our world: cars, mountains, computers, telephones, data, plates of chips or. . ?

Data?

Yes, indeed, why not photograph data? In fact it is becoming eminently sensible to photograph data instead of carrying out all this silly nonsense about encoding it in magnetic flux.

In a few years time, and almost certainly before the end of this decade, it is reckoned that the majority of data storage in small systems will be photographic rather than magnetic. Who says so? Well, actually it's a Mr Bill Martin, who works for Control Data, planning that company's product and marketing strategy in storage peripherals. As an important sideline, of course, this means observing what IBM gets up to.

He has to watch this particular company because of its pre-eminent position in the computer business. Where IBM leads the others have to follow, and be damned quick about it. In fact they usually try to out-guess the Blue Giant, at least in terms of the general outline or configuration of an up-coming product.

This means that Bill Martin is well aware of not only the IBM marketplace, but also the technologies involved in all aspects of data storage. He is a wizz at magnetic storage techniques such as disks and tapes, and fully understands their advantages and disadvantages. He is also a reasonable wizz at photography and its implications.

To be fair, the photography in question is not the same as yer actual David Bailey (or Editor Rodwell, for that matter). No, what this particular photography refers to is the optical disc.

This has enormous potential in the small computer systems market because of its truly staggering storage potential. Its use will require a rethink on how users store their data, and on the economics of storage, vis-a-vis existing techniques. It will also bring about an important development for the large numbers of first time users that will continue to make up the majority of the personal computer market for years to come. The development is that, for the first time, they will not be able to lose their data. . . ever.

First, however, some facts. Bill Martin is predicting that by the mid to late 'eighties, there will be optical disc storage systems available for small computers. He sees this marketplace being developed, quite possibly by IBM, before the mainframe market, if only because with applications like word processing and small business accounting the market itself is well defined.

The storage system will not be cheap to start with, probably around $10,000. It will

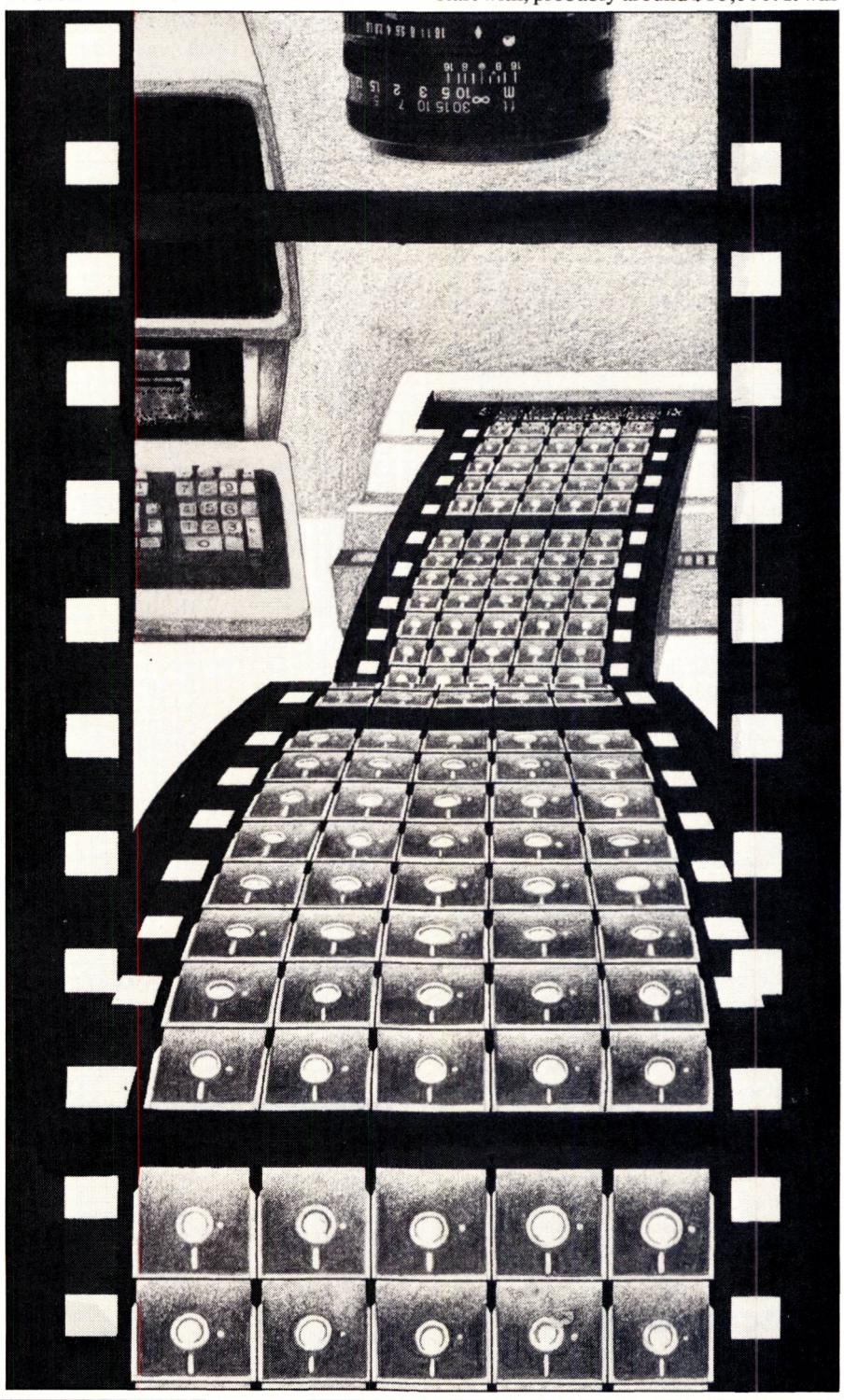


Illustration by Martin Ingley

appear firstly therefore on the bigger 'professional' systems. It would use a standard optical disc that is written to and read from by laser. Each of these would cost around $10.

This is where the fun starts. The capacity of each disc will be around 2,000 megabytes per side. Sounds a lot, doesn't it? Sit and think about it for a while. Modern minifloppies pack around a megabyte per disc. A mini-winnie crams maybe 50 megabytes. Each side of an optical disc will be the equivalent of a string of 80 mini-winnies. But the disc can be turned over and the other side can be used. This means that for around $10,010, 4,000 megabytes of storage will be available.

That starts to make nonsense of current data storage economics. For example, a mini-floppy storing 1 megabyte, and costing some $500, provide 2,500 bytes of on-line store for each dollar spent. The optical disc, though more expensive, will provide a staggering 20,000 bytes of on-line storage per dollar spent.

The change in the economics of data storage will bring with it changes in the way that storage is used. The relative cost, and more importantly the inconvenience, of magnetic disk storage means that it is against the user's interests to be profligate with storage resources. Floppy disks are inconvenient at times, hard disks need backing up and, because of its very nature, magnetic media can easily lose data.

Well, that's not entirely fair. It is not normally, the magnetic media itself that loses the data, it is usually the electronic systems and software that drives them that actually perpetrates the loss. And it is the inherent complexity of these elements — either externally so that the poor user barely understands how to operate them, or internally so that he can get at least some idea — that creates the well known situation of the user who pressed the *wrong* button and sent all his files to the great data-dump in the sky.

With optical disc this need not, indeed will not, happen. I will now expound on the reason why.

Like many people, the first time I considered the subject of optical discs as a storage medium I fell into a classic trap. 'Ah,' said I, 'they'll be okay for archival use — excellent in fact — but as there is no erase or over-writing function, they won't get used for on line storage.'

Wrong.

They will, and the reason is quite straightforward — brute capacity. At 2,000 megabytes per side a user can be as profligate with storage as it's possible to be. Should a disc ever become full (and that would take some doing) then all the user has to do is turn it over and start again. Should that side become full, well then, just spend $10 on another one.

If you let this attitude to data storage sink in, its implications become clearer. Optical disc systems no longer are seen as being just for archival use. It matters not that you can't erase data. In fact you shouldn't want to (in most cases anyway). Even in really profligate applications like word processing, which uses up storage like it's going out of fashion, there is really no need to erase or over-write files. It is an advantage not to have to.

As Bill Martin points out, the optical disc automatically produces father/son file structures, and gives an automatic 'audit trail' of those files. Because a file cannot be erased it can never be lost or erased accidentally. Any amendment or addition to a file will just produce another, latest, version of it. The original will still exist.

This has important implications for a variety of applications, of both textual and numeric types. The daily grind of backing up files will no longer always be necessary for the back-ups will already exist. The inherent father/son structure for creating files would seem to match the requirements of the accounting/data processing areas to a tee. It would also fit many of the requirements of the word or text processing environment.

Unfortunately, the one drawback of the early use of optical discs is going to be the cost. The hardware will cost considerably more than a domestic disc player because it will have to incorporate a 'write' as well as 'read' capability. In time, of course, the price will drop, and so will the price of the discs. Then the systems could prove to be unbeatable in terms of price and performance, instead of performance alone. At that time, maybe the magnetic era could come to a close.

And remember, all this refers to using optical discs in a predominantly conventional data processing manner, storing data as '1's and '0's. Even here it would seem to stand up well against magnetic media in all but initial purchase price. But this does not include the many other tricks that optical discs are capable of — the interleaving of data and audio/visual material, for example. There just have to be thousands of applications for that trick that no one has yet thought about. Try thinking — that's what Clive Sinclair did.

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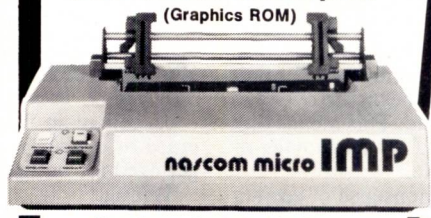

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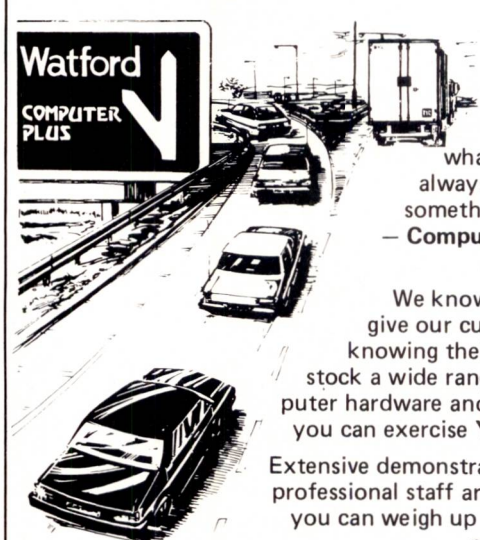

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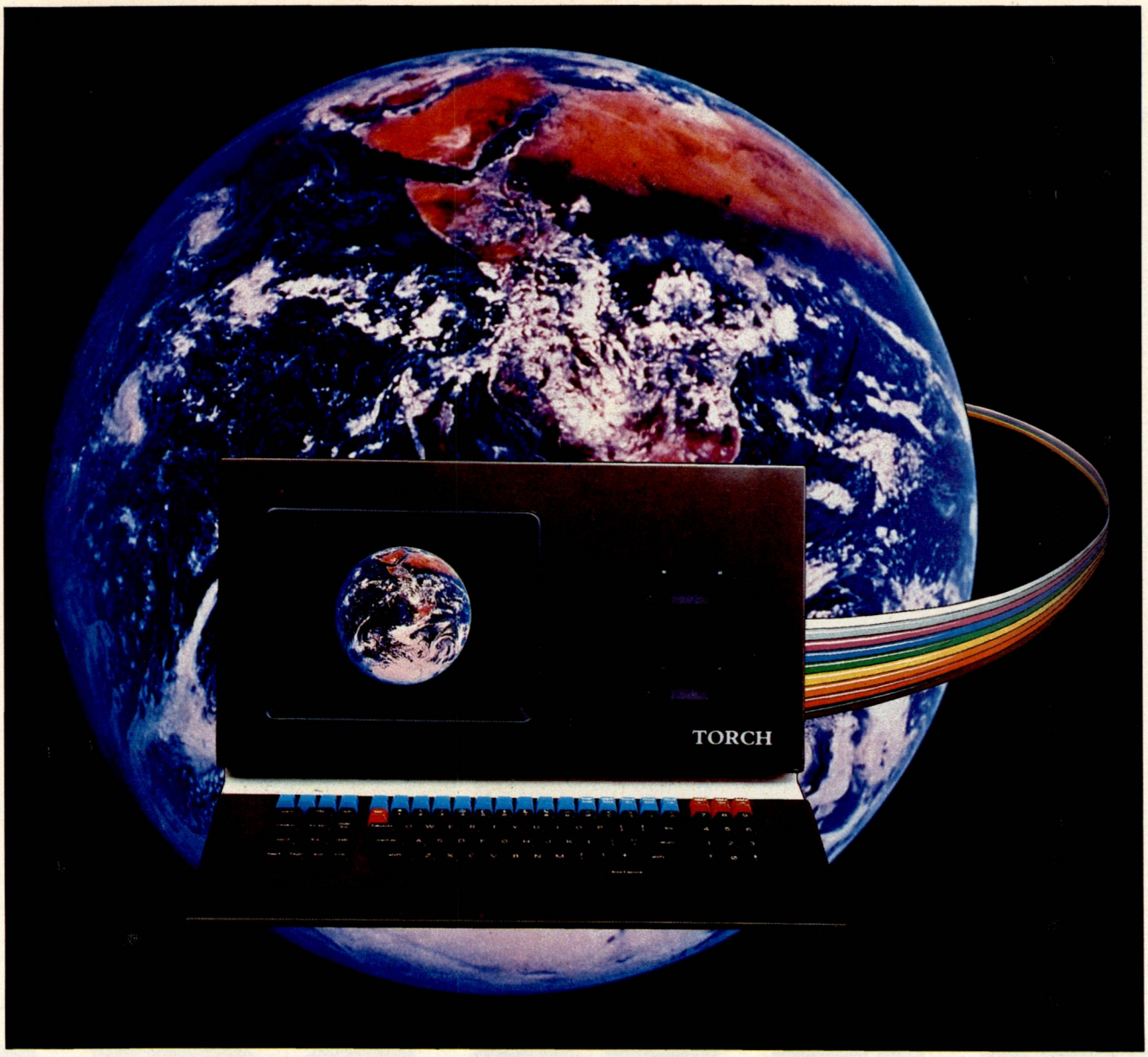

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BENCHTEST

THE TORCH

David Tebbutt investigates an interesting and very versatile British micro with built-in comms and colour.

Cambridge-based Torch Computers has produced a very interesting machine which combines the ability to run standard software products with high resolution colour graphics and in-built communications capabilities. My first impression was one of surprise, since I hadn't really expected to evaluate a machine with such features for some little time yet.

Owned by the Climar Group, Torch is a young and very aggressive company, determined to secure a niche for itself in the world markets. With American and Canadian offices and exhibits at the NCC in Houston and Comdex in Amsterdam, Torch evidently means business — and I wish it every success.

At the time of this review, Torch had got most of the hardware sorted out but there were still some serious gaps in the promised software offerings. Fortunately, its operating system (CPN) is compatible with CP/M and, providing that you can get it on Torch format disks, a wealth of software is available.

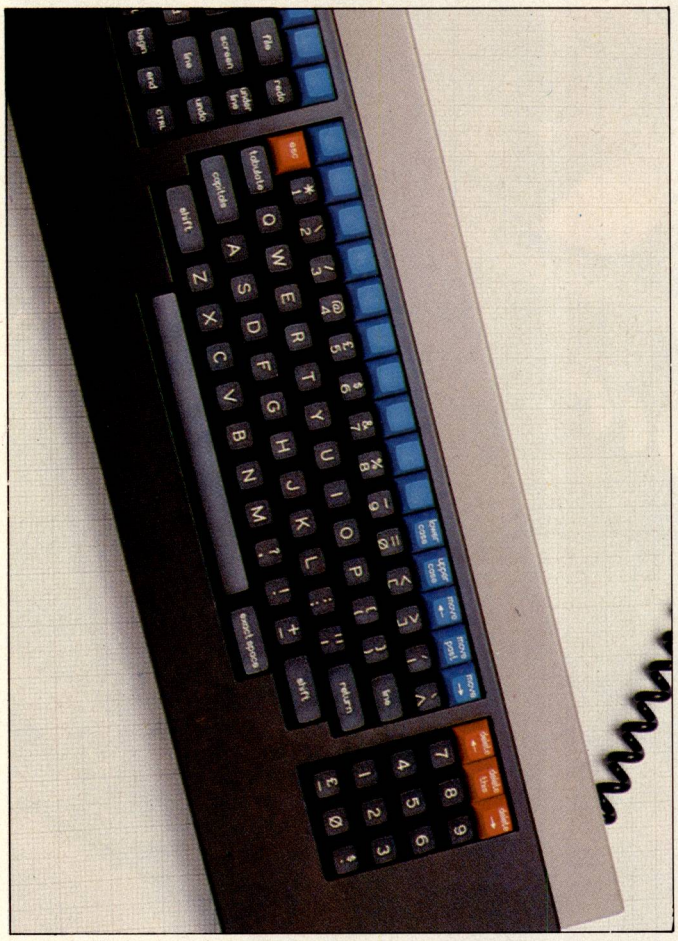
Hardware

My first impression of the machine was that it was very plain, if not downright ugly. The welded sheet metal construction has led to a very rectangular design which makes the machine appear a lot larger than it really is. In fact, it is just about the same size as a Superbrain but without the curves. I understand from Torch that an injection moulded casing is being designed which should make it look a lot better as well as reducing the weight somewhat. On my bathroom scales, the Torch came near to 14 kilos!

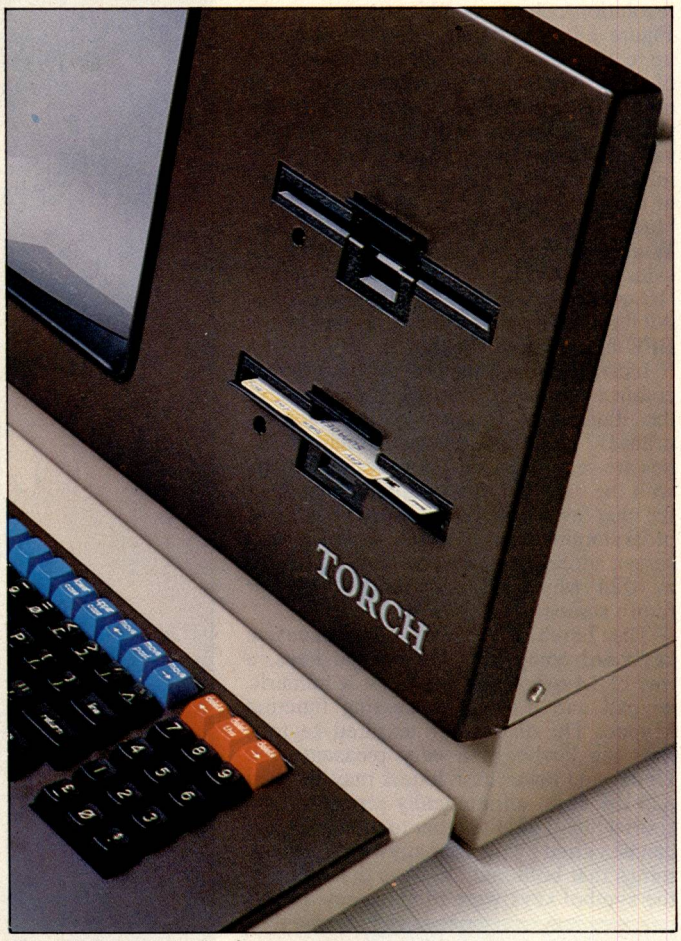
The main unit comprises the screen, disk drives and processors while the keyboard is separate and attached to the main unit by a coiled black lead. The screen is a good quality monitor made by NEC and the disk drives vary. The first review machine had Tandon drives, one of which gave me trouble. The second machine had Mitsubishi drives which behaved perfectly. The review machine contained a 6502 processor and a Z80 processor. Future 'super-Torches' will run a Motorola 68000 processor *as well* as the two current processors. The 6502 processor board is, in fact, the one which drives the BBC machine.

The screen is a high resolution. colour monitor which can handle eight different

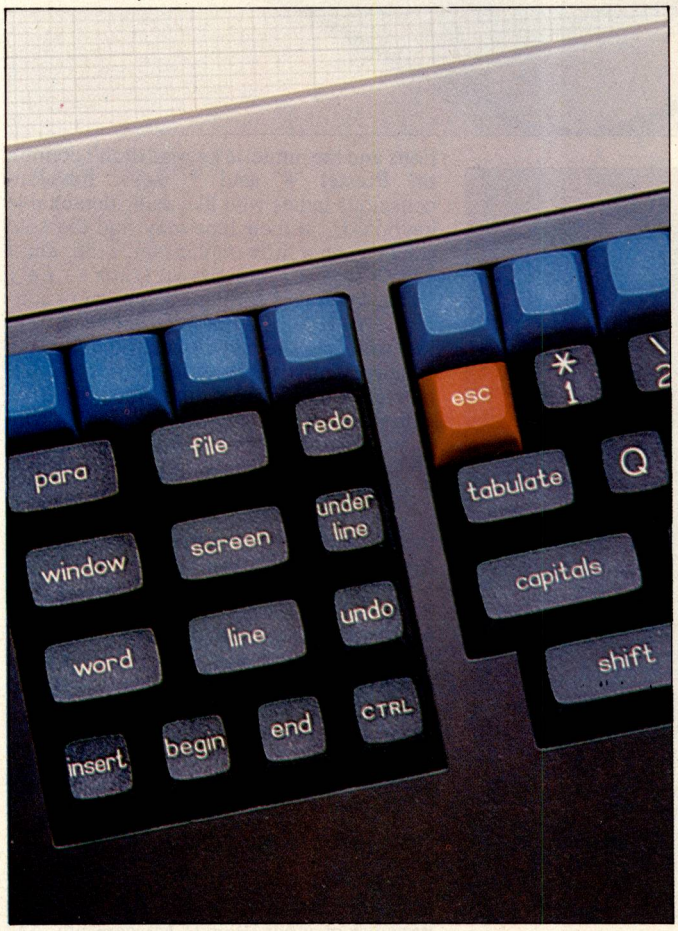
Photography by Ian Debbie



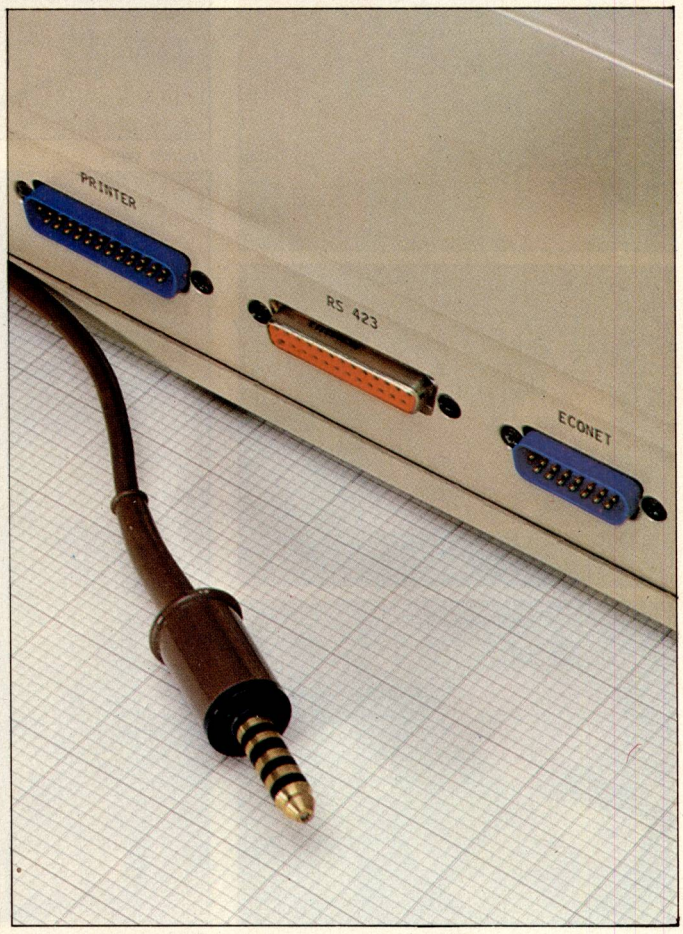
Detachable keyboard.



Twin disks are standard



Built-in editing pad.

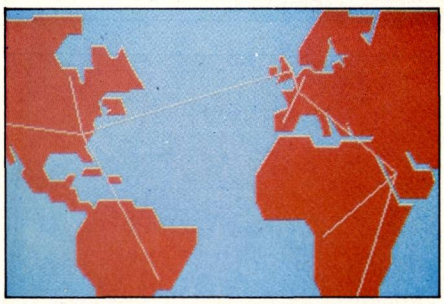


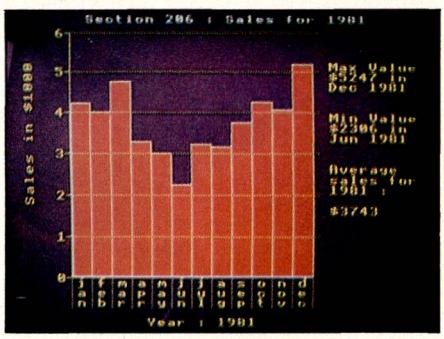
I/O includes direct-connect modem.

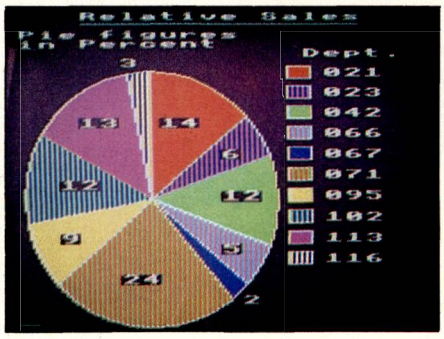
resolution/colour combinations — see Figure 1 for the details. You'll notice that up to 16 colour modes are available. Eight of these relate to plain colours, while the others refer to flashing colours. Although yellow/blue flashing would appear to be the same as blue/yellow flashing, the separate modes are useful since if each is being used at the same time one would be displaying blue while the other displays yellow. Whichever way you look at it, I think the sales literature is naughty when it refers to '16 colours'. See Figure 2 for the details. All this activity is handled at present by the BBC board inside the Torch.

Individual pixels may be given a different colour to their adjacent neighbours to give the illusion of further colours such as orange. I think that the screen characteristics are very good. They will certainly cope with the vast majority of applications over the next few years. I did notice, when I was programming, that it would accept logical screen addresses up to a resolution of 1280 x 1024 which probably bodes well for future screen developments.

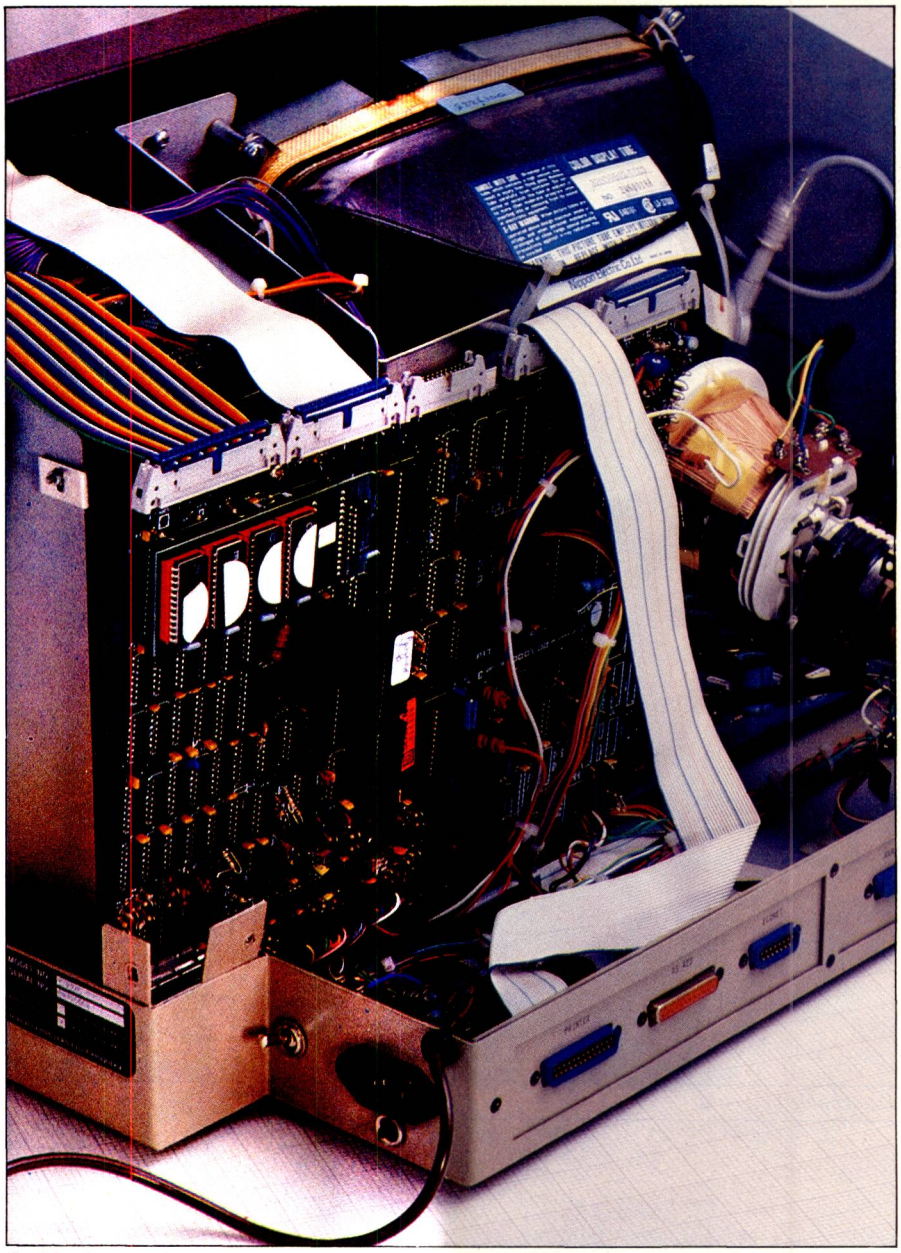
The Torch has a very comprehensive keyboard comprising the normal keys, a row of 14 user-definable keys, a numeric keypad and a word processing function keypad. The dished and textured keytops give the keyboard a very pleasant feel. Upper and lower case letters may be used and the keys automatically repeat after a short while. I didn't bother to time it since it can be varied by the user anyway. The only things that bothered me were that some of the symbol keys were in unexpected positions and the numeric keypad didn't contain the Prestel '#' and '*' keys. Fashion-conscious ladies who like using detachable keyboards on their laps may find the cold steel casing a little unpleasant. I did, and I wasn't wearing a miniskirt! (*Liar — Ed.*)



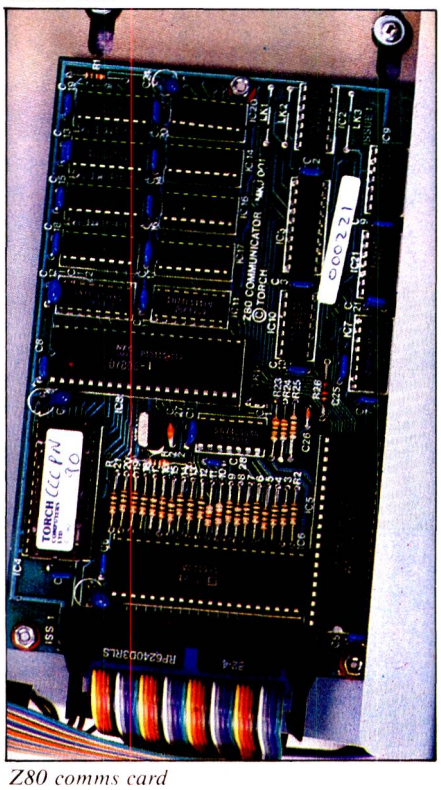




Impressive colour graphics



Inside view.



Z80 comms card

The keyboard contains a number of editing keys — one set operates on the current line while another set allows you to move a 'shadow' cursor to a different line so that relevant parts of the other line could be embodied in the current line. Does that make sense? It overcomes CP/M's inability to allow cursor movement to previous screen lines. I found it very useful anyway, and a pleasant change from having to retype CP/M commands whenever I made a trivial mistake.

Setting up the user-definable keys is a doddle. You simply type the word KEY followed by its number and contents. <cr> can be included using the stretched-out colon (¦) followed by M. Use <cr> to finish the entry and the new function is attached to the key. I found this particularly useful when initialising and copying disks since it is so easy to mess up these commands. This is the sort of command I encoded:

FORMAT B: M:COPY A: TO B:

Each Torch is supplied with two 400k disk drives or a single 400k drive coupled with a hard disk of either 10 or 21 Mb capacity. As I

Photography by Kokon Chung. Graphics by Andy Martin

Mode	Colour Modes Available	Text	Resolution
0	2	80x32	640x256
1	4	40x32	320x256
2	16	20x32	160x256
3	2	80x25	
4	2	40x32	320x256
5	4	20x32	160x256
6	2	40x25	
7	Teletext	40x25	

Fig 1 Screen modes

	2 Colour	4 Colour	16 Colour
0	Black	Black	Black
1	White	Red	Red
2		Yellow	Green
3		White	Yellow
4			Blue
5			Magenta
6			Cyan
7			White
8			Black/White
9			Red/Cyan
10			Green/Magenta (ugh!)
11			Yellow/Blue
12			Blue/Yellow
13			Magenta/Green
14			Cyan/Red
15			White/Black

Fig 2 Colour modes

B, BACKGROUND	Colour
BASIC	BBC Basic
C, COMMAND	Submit a file
COPY	File
DEL, DELETE	File
DIR, DIRECTORY	List of files
DUP, DUPLICATE	A disk
H, HELP	List these options
INPUT	Type into a file
KEY	Define a key function
MODE	Screen attributes
PRINT	A file to the printer
REN, RENAME	A file
TYPE	A file to the screen
USER	User number (0-31)
VDU	Screen control codes
VIEW	A graphics file on the screen

Fig 3 Resident commands

said earlier, one of the Tandon drives gave me trouble whereas the Mitsubishi drives were fine. Whether this is a reflection on the drives or not, I have no idea. I understand that Tandon drives are used in plenty of other microcomputers so perhaps something came loose in transit. If you're not familiar with disk drive capacities then you should know that 400k is quite respectable. It is roughly equivalent to 100 A4 typewritten pages. The disks are double sided single density with 80 tracks per side.

A number of connections to the outside world are provided at the back of the Torch. A DIN socket is used for plugging in a cassette player. Incidentally, this is the only way of saving programs written in the built-in BBC Basic. It gave completely trouble-free operation when I used it with a Sanyo Slim 3G recorder. An RS432 port allowed me to connect up to another computer (a Superbrain) and, by connecting the 'Ready to Send' and the 'Clear to Send' pins to each other, I was able to fool the Torch into exchanging files with the Superbrain. In fact I took a CP/M program (Cardbox) and its associated data files from the Superbrain and got it running successfully on the Torch. I'm sure that I could have attached my printer too, but I couldn't fathom out the appropriate connections. A Centronics interface is provided for those who need parallel connections.

An external UHF monitor socket allows you to connect a display screen which echoes the information on the computer screen. This would be useful for exhibitions and talks, for example. I tried it on a portable black and white TV and the picture disappeared off the edge of the screen but I presume this sort of thing can be adjusted. An RGB output socket is also provided but it wasn't connected to anything inside the review machine.

An Econet connector suffered the same fate. It disappeared into the bowels of the Torch where it wasn't connected to anything either. More usefully, a flying lead attached to an internal modem allows you to plug into the telephone system and communicate over the line with other computers. I used this to great effect as you will see later in the Benchtest.

An internal analogue to digital converter allows you to accept signals from up to four analogue devices through the connector supplied. Each analogue signal is converted to 12 bits. The only other external sockets and controls are the power socket, the keyboard socket, a contrast control, a reset key and a rather old-fashioned looking on/off switch.

A 3½in, 8 ohm speaker receives signals from the four-channel (three music, one noise) sound synthesiser and, thanks to the ability to vary amplitude and envelope shapes, it is possible to get the machine to make some fairly pleasant sounds. The BBC board contains a speech synthesis unit which one of the demonstration programs used to produce rather slow American speech. Apparently this part of the BBC machine is being improved in revision 4 to give the speech more natural speed but no doubt the American accent will remain.

Overall, the hardware seemed very good quality and it was certainly robust. As we go through this review it will be hard to tell whether we're reviewing the BBC machine or the Torch, so dependent is it on the BBC base board for all its peripheral handling activities. No doubt Torch is planning to replace the board in the long term with one of its own. First, though, we can expect to see the 68000/Z80 board mentioned earlier. People who buy the current model should be able to upgrade to the SuperTorch without any problem.

Firmware

The Torch has two main firmware elements — BBC Basic which is on the BBC board and CPN, the operating system. Try saying CPN over the 'phone to a friend and see if they think you're talking about some other, well-known operating system. It makes me feel uneasy that Torch deliberately chose this selection of three letters when there are over 16,000 other three-letter combinations to choose from. CPN, by the way stands for Control Program Nucleus. Since it is in ROM, it doesn't intrude too much on the memory associated with the Z80. In fact 63k is available for application programs. The screen memory (20k) is on the base board so graphics do not interfere with memory availability either.

As if to confuse the public further, Torch has called the console command processor (CCP in CP/M) CCCP, which stands for *Cambridge* Console Command Processor. I suppose all this is pure accident or it is to stop people like me saying 'Oh no, not another new operating system'? In fact I wouldn't say that Providing people give a perfect emulation of an existing standard operating system then I think the user wins both ways. He can run popular software while taking advantage of the additional facilities offered by the new system. The people who are mad are those who decide that CP/M is rubbish and then introduce their own operating system which bears no resemblance to any other operating system, living or dead. Oddly enough, they are often companies who don't expect to sell more than a few hundred machines a year and therefore end up charging the earth for software which has to be specially commissioned. At least Torch didn't fall into that trap.

What Torch has done is to produce a machine which is very easy to use because so much is sitting there in ROM from the moment you switch on. For example, you can format disks and copy files using programs resident in memory; see Figure 3 for a list of resident commands.

One direct command not on the list is FX which is used to set internal attributes of the Torch — things like printer port details, flashing speed, baud rates and so on. This command actually brought home one of the frustrations of having the Torch for review. Since the base processor board is the BBC board, many of the things I wanted to do were implemented on this. Torch is not allowed to sell the BBC manual so I had great difficulty finding out how to write programs and access the internal workings of the equipment. I could not get a BBC manual for love nor money. In the end I 'phoned one of Acorn's directors early one Saturday for a telephone course in using the BBC machine. It was a bit silly and a bit irritating for both of us that this was even necessary, so I used *PCW*'s BBC articles from earlier this year to do most of the work.

Software

Like so many computer manufacturers, Torch managed to get its hardware act together more quickly than its software. One product, called Executive Aid, is claimed to comprise three elements — a card indexing system, a word processor and a diary system. Only one of these was available at the time of review. A Torchlink program was supplied which allowed me to access and exchange files with other computers. After succeeding only occasionally, I called Torch and mentioned my inconsistent results and they informed me that there was no CRC (a checking system) in the Torchlink program and it was about to be replaced by Torchmail which would be much better. I understand that Torchmail is in the post to me and I am sure that it will be much better because Torchlink came close to being very useful. Torchtel, the program supplied to allow access to Prestel, worked very well indeed and I'm rather dreading my next 'phone bill since I was hooked up to Prestel for several hours.

At first I thought that Prestel was boring and amateurish but once I got away from the 'what's on in Brighton' type of screen, I found plenty to interest me. Mind you, it was all frustratingly slow. For me the most relevant items were the Viewtel microcomputer news pages. Since they invited users to write to them, I even got round to using the mailbox facilities. I know my letters were sent; I wonder whether they arrived — there's no way of telling. Electronic Insight too had quite a bit of microcomputer information but I think it has to take second place to Viewtel at the moment. I must confess that, although I found Prestel interesting, I would be hard pushed to justify using it myself. It ties up the telephone and costs a fair bit of money purely in connect time, never mind the other charges associated with it. I can see the day not very far off though when instant access to relevant information will become even more important than it is now and that, coupled with things like telesoftware and access to interesting private databases, will increase Prestel's popularity providing the Source, or something like it, doesn't get in first.

THE TORCH

I couldn't use the Telex or Datel facilities which are offered by Torch so I can't pass comment on them. I asked Torch whether UHF broadcasts could be received so that Ceefax and Oracle facilities could be used. The answer is that, since the BBC board is in there, all you have to do is add the Acorn Teletext board and you could do this. Other communications programs which I didn't get to see were Torchtalk for communicating with other micros, Torchterm to allow the Torch to act as a terminal to IBM computers and Torchnet for local networking. I read in one of the manuals that the Torch could handle communications in 'background' mode while the user got on with some other job. This is apparently an intention rather than an actuality at the moment.

I was sent some interesting stuff on a music package but, since the package wasn't supplied, I can't comment. It's a shame, since that was one area I'd have enjoyed playing with. In fact, I'm beginning to wish I'd bought myself a BBC machine. All I managed with music was some envelope shaping and simple tunes through the BBC Basic thanks to an article in good old *PCW*. At least it worked and it showed great promise. I even programmed some of the user-definable keys to play set tunes! Hardly the thing to do on a business machine, perhaps.

Wordstar, Mailmerge and Supercalc were supplied and they all worked just fine. A financial accounting package came with the machine but I didn't try it out. I read the documentation and it looked OK. You really need to spend several days at least to get a true feeling for such a package. Cardbox worked just fine on the machine so I don't think anyone will have much trouble implementing CP/M programs on the Torch providing they can configure the screen controls and get the appropriate format disks. MBasic was supplied too and that worked well, both interpreted and compiled. Compiled, of course, was faster than interpreted and, on the whole, Microsoft's Basic ran faster than the BBC version. You will notice that I only checked a couple of the compiled Basic figures simply to give a comparison; see the Benchmarks timings table.

Other languages which are said to be available are Fortran, Pascal, Cobol, BCPL, Algol 80, C, Lisp and Forth.

Documentation

Two manuals were supplied with the machine — a user guide and a programmer's reference manual. The user guide is a delight. It is well written and entirely appropriate to get you over those first few hours while you explore your new machine and its capabilities. The programmer's manual was very good in its way, very well written and comprehensive but, I found, nigh on impossible to use because there was no bridging documentation to put everything into context. I see from the various documents supplied that there is another manual called a systems manual. Perhaps that's the missing link. If I had been prepared to write a few programs in assembler, I think the programmer's guide would have served me very well. It is really written for people programming at that level, or people who have learnt from elsewhere exactly what bits are relevant to a programmer in a high-level language. All round I had a pretty frustrating time, eventually finding things out by trial and error.

For example, I learnt most of the high resolution graphics commands by writing a simple Basic program which sent various combinations of control codes to the screen until I hit on those which had some effect. Later, Maggie Burton extracted me from the mire by digging the codes out of a BBC book. I'm back to that silly business of Torch not being able to supply BBC manuals. Such a manual at the right time would have shortened this Benchtest by about 10 hours.

My conclusions on documentation are that Torch is doing a conscientious job on its manuals. The lack of a BBC manual or equivalent is likely to prove very frustrating for programmers working in high-level languages. Looking at the outline contents of the Systems Guide I'm not at all confident that it will be the answer.

Potential

There's no doubt about it: this is a business machine which can handle most, if not all, current CP/M applications. It goes beyond that, though. The high resolution colour graphics give a potential for presenting statistical information in a far more easily digested way than the common rows of figures. It also allows users to store and view graphic information as well as text and numbers. All that's needed is for the software industry to catch up with this type of machine. I'm certain that they will be very common in a year or two, but right now it poses a headache for people looking for packaged solutions for their graphic software problems.

The communications facilities are very good and, once again, provided the software is made available this probably gives the Torch its greatest advantage over its competitors at the moment. Torch has seen this and its main emphasis on software has rightly been on the communication package mentioned earlier.

So, if you need a machine which can run a wide range of proven software, which has communication facilities and which offers high resolution colour graphics then you should take Torch very seriously indeed.

It's not a pretty machine but functionally it's very good.

Expansion

A 68000 based machine is on its way. It will keep the Z80 processor too, so no systems investment will be lost. The new machine will run 'DAVROS, an all British operating system developed by Torch'. I found that statement pretty depressing until I went on to read that it will support Unix programs. Once again Torch has recognised what's happening and taken steps to improve things but without putting itself out on a limb. There's talk of Torch taking on APL and the UCSD p-System too. Reading between the lines, Torch seems to believe that the 8086/8088 based systems are a temporary phenomenon devised to take advantage of existing software availability. All I can say about that is that they're not alone. I do believe that Apple has bought quite a large number of 68000 chips too. We shall see.

Prices

At first glance the price of the Torch looks high. I think it's important to bear in mind that it has an in-built modem which would cost in the region of £300 if it was bought separately. It has high resolution colour graphics and reasonably high capacity disk drives. Against this, it is currently a 6502/Z80 based machine and prices of these are dropping like stones. You must decide for yourself what you consider is important to you. If you'd never use graphics or communications in a month of Sundays then perhaps this isn't really your machine.

Hardware

Basic Torch	£2795
with 10Mb plus 1 floppy	£4995
with 21Mb plus 1 floppy	£5495
Light pen	£ 60
Dot matrix printer	£ 650
Daisywheel printer	£1350

Software

Basic 80 interpreter	£215
Basic compiler	£237
Torchlink/Torchtel	£400
Wordstar	£275
Mailmerge	£ 90
Calcstar	£175
Financial accounts	£600
MCS fully int accounts	£1250

Maintenance contract 14 percent of purchase price pa.

A basic Torch includes colour, high resolution graphics, inbuilt modem and twin 400k floppy disks. (Incidentally, Torch also supplies a Z80 processor board and twin disk drive for the BBC machine at £780).

Conclusions

For anyopne who needs a high resolution colour graphics, communications oriented, CP/M compatible machine, the Torch should be considered among their options. I get the feeling of 'almost ready' on the software and documentation front which is a pity — it spoils an otherwise fairly professional approach. The machine is heavy and not very good looking but it offers an impressive range of capabilities. END

Benchmark timings

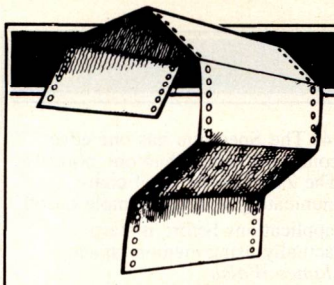
Benchmark	BBC Basic	Interpreted MBasic	Compiled MBasic
1	1.4	1.5	
2	5.4	4.2	
3	14.4	10.6	
4	15.3	10.4	
5	16.1	11.6	
6	24.9	21.1	
7	38.4	33.0	9.2
8	8.9	5.5	4.9

For a full explanation of Benchmark timings, see PCW, Nov 82.

Technical specifications

Processors:	Z80A (6 MHz), 6502 (2 MHz)
RAM:	Main system: 64k; peripheral processor: 32k
ROM:	4k bootstraps for main system; 32k inc Basic, operating system and comms software for peripheral processor.
Display:	12in colour monitor (optional monochrome); 8 text modes, 3 graphics modes, up to 16 colours.
Keyboard	Expanded qwerty with cursor control, editing & numeric pads, 16 user-definable keys.
Disk drives:	Twin double-density, double sided 5¼in, 400k each.
Interfaces:	Centronics parallel, RS232 serial, 4 12-bit A/D inputs, modem for comms in Prestel.
Systems software:	CPN (CP/M — compatible) operating system.
Languages:	BBC Basic in ROM

COMPUTER ANSWERS



Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.



The long way round

How do I get a Basic program to run on my Osborne? The only way I've found is to create the program using Wordstar using the 'non-document' option; call this program "PROG.BAS" and save it with KX. Now put the disk with the Basic compiler and interpreter and type what is underlined: B>A:MBASIC B:PROG.

This method works but I'm sure there must be a better way, because I'm sure that I've lost the advantages of compilation.
R. Emerson, Eindhoven, The Netherlands.

There certainly *is* a simpler way because you are going all around the houses. A lot of people *do* use Wordstar to edit Basic programs; however there is no need to learn Wordstar just for that purpose. Just type MBASIC and you will enter the Basic interpreter; now you can simply type in your Basic program, line by line. Consult your MBasic manual for instructions on editing. When you have completed it you can test the program with RUN. To save a copy of the program just type SAVE "PROG". A. Once you are totally satisfied that it works correctly then you can use the Basic compiler and compile your program. The speed advantages of a compiler will only be noticeable if you have optimised the writing of the interpreted version; for example, used integer variables wherever possible, avoided unnecessary calculations, etc. In a program that is I/O bound you will not notice much of a speed improvement I'm afraid.
SW

Speeding up

Is it possible to convert a Z80-based microcomputer into a Z80A micro by changing a few components? If so, how?
E. Kwok, Ballards Lane, London N3 2NT.

As the difference between the Zilog Z80 and Z80A processors is essentially one of speed, the components that may need changing are those which are speed-dependent or speed-limiting. The Z80 can be replaced by a Z80A simply by removing the former, and plugging in (if your processor chip is socketed) a Z80A. In a few machines this may be enough, but you will almost certainly have to alter the computer's internal 'clock' to match. This may be a matter of altering some jumper settings, or it may mean changing a quartz crystal for another one. The most expensive area is likely to be memory. RAM chips have maximum operating speeds, and the faster ones are usually appreciably more expensive. Thus it is likely that the RAM used in your micro will be just fast enough to cope with the existing processor. You could make the existing memory compatible by using software 'wait states', but then you've lost the speed you changed the processor for! Disk controllers may also be speed-limiting, but as long as your programs do not make a lot of disk accesses, you could live with 'wait states' as a solution.

So, yes, you can change from a Z80 to a Z80A, but if you already have a lot of RAM it could be expensive.
P L McIlmoyle

Horses for courses

From magazines such as your own, and from books, I have learned a lot about hardware, packaged software, and how a computer operates. However, a gaping hole in my knowledge is languages.

I have used a ZX81, and discovered the extreme disadvantages of Basic. Consequently I would like to upgrade both my language and my hardware.

Which high-level language should I choose from the vast range which includes Pascal, Comal, Forth, Cobol, Logo, Algol, Lisp, Pilot, APL, PL1, Fortran, etc?

Are we working towards a 'universal' language, or a series of languages tailor-made for each application? Will the language we learn tomorrow be out-dated in six months' time?

Your magazine is by far the best of those I see at the newsagents, and I thus look forward to some constructive comments — perhaps to a comparison table of the main microcomputer languages?
A L Taylor, Grimsby.

I fear there would not be room in 'Computer Answers' for the table you envisage, but I will give thought to putting it together, in case the Editor would consider an article on this subject appropriate.

Personally, I do not expect to see a 'universal' high-level computer language adopted, if only because it would have to be very complex and hence cumbersome to use if it could cope well with all applications. Having said this, I must also add that the USA military have been hard at work on just such a language for some years, under the name of Ada.

The nearest to a 'universal' language is Cobol, which is very, very widely used for commercial data-processing applications on mainframes (there are also micro versions).

On microcomputers the closest approach to a 'universal' language is in fact Basic! Despite your comments, and Basic's many detractors, a good implementation of this language copes very well with most programming applications, and is much used by professional programmers. The more generally available versions on microcomputers tend to suffer from poor string and file handling,but this problem is not irretrievably built into the language. The other problem with micro Basics is slow execution, due to the infrequent use of compiled versions. A good implementation of Basic, with matrix operators, long variable names, good string and file handling, and a compiler is an excellent programming tool. Ideally, you should aim for the ability to develop programs using an interpreted version, and then be able to compile the finished, debugged program for fast operation. Basic is one of the few languages in which this can be done.

Pascal (and Comal) are of great interest to the academic world, for their use fosters good programming habits. They are not much used commercially because this very feature makes them inflexible. Pascal does seem to be making some head-way of late as a commercial programming language for microcomputer applications.

Nonetheless, it is very much a question of 'horses for courses'. In the mainframe world Cobol still reigns supreme for commercial applications, and Fortran for technical and scientific applications. For 'real-time' 'interactive' (eg, via VDUs) applications Basic and APL are the leaders, with Ada intended to take over at some time. PL1 was a deliberate hybrid of Cobol and Fortran, which has not found a lot of supporters, while Lisp was specifically developed for 'artificial intelligence' applications, and Forth for the control of equipment. Comal, Logo and Pilot all started out for various teaching applications.

So, how to resolve your dilemma? My recommendation would be to ensure that your new hardware does not have any high-level language 'built-in', but is able to load any you like, either from disk (which gives you an effectively unlimited range) or from ROM cartridges which at the present time will probably limit you to three or four languages on any one machine).

If you are lucky enough not to be too worried over the cost I would go for a disk-based machine using CP/M (such as the Osborne 1). Otherwise choose a machine which offers the possibility of expansion to disks running under CP/M.

Why CP/M? Quite simply because this will give you the widest range of high-level language interpreters and compilers commercially available. Don't be put off by all the sniping at CP/M . . .it's not nearly as bad as it's painted, and is very powerful. Anyway, it is now possible to get a program which will add most of the advantages of Unix to CP/M, without adding Unix's major disadvantages.
P L McIlmoyle

Computergook

With reference to the answer from P L McIlmoyle in the November issue of *PCW* regarding CP/M, I would have thought that the latter was a sufficiently simple concept for it to be explained in one column of your estimable publication, with references to further reading elsewhere, and without the use of the quite unnecessarily artificial computergook, which makes the answer incomprehensible to all but the ardent enthusiast.
J. Carey, Canterbury, Kent

It may surprise you to know that I agree with much of what you say. If only the 'computergook' (it sounds even more appropriate if you don't pronounce the 'k'!) were mine – then it would be easy to ignore or dismiss it. Unfortunately, it comes from the writers of CP/M, and more particularly, from the writers of the CP/M manuals. I fear it is largely the lack of clarity of the latter which has earned CP/M the bad name it has in some quarters. As an operating system, while it certainly has some faults, it is good, and certainly easier to use than others of comparable power. And now quite a few of the better aspects of Unix can be added to CP/M with 'Microshell' (sold in the UK by Asro Information Systems).

In my earlier reply I was attempting to explain to someone familiar with CP/M, but not expert in it, who might not be able easily to get hold of the various books and articles in question, just how to use the SUBMIT facility for program auto-start. Thus it was necessary to go into some depth of technicalities.

However, in an attempt to sum up the whole auto-start discussion, and to show that good, plain English is possible when writing about CP/M, I would comment that:

Programs can be made to run automatically on start-up under CP/M by two main methods. In the first, the CP/M BIOS is altered by inserting the name of the program to be run (eg, BASIC MYPROG) in the appropriate place on the disk. As soon as CP/M is loaded these programs will be run. (See: *The CP/M Handbook by* Rodnay Zaks, pp

203, 2060).

The alternative is to make a special file, (with an extension of .SUB) containing the name(s) of the program(s) to be run, and also, if needed, other commands or data. Typing SUBMIT Filename would then cause these programs to be run. (See Zaks' *CP/M Handbook* pp79,81 and *Osborne CP/M User Guide* by Thom Hogan, p107, 110).
P L McIlmoyle

Memory refreshment

Can you explain how 'bank switching' of memory works? Does the normal Z80 refresh system function over the whole of the bank switched memory?
G V Barbier, Tiverton, Devon

In 'bank switching' the RAM memory of the computer is arranged in blocks (or 'banks') of (typically) 64k, and at any one moment only one bank is connected to the processor's data bus, as 8-bit processors can only address a maximum of 64k at any one time. The other banks are likely to contain data, and if they are dynamic rather than static RAM will need refreshing. This can be done by the main Z80 without difficulty.

Switching from one bank to another is done under software control, and it is essential that the memory cards used are equipped with an appropriate control line for this purpose. Thus, if you have an S100 machine you cannot necessarily just slot in some more memory cards. You must make sure that the cards are equipped with a bank-switching control line, that your S100 bus also supports this, and that your operating system software also does so. The newer S100 systems meeting the IEEE S100 spec do support bank-switching.
P L McIlmoyle

Random tip

For the past two months I have been trying to write a machine code random number generator for the ZX81 but with little success. Please could you give me some ideas?
Andrew Quilley, Gosforth, Newcastle-upon-Tyne.

Try playing around with the machine register R; it does not hold a random number but the computer uses it constantly, hence the value changes continuously.
James Walsh

Spectral quirks

At present I am considering purchasing a ZX Spectrum as I already own a 16k ZX81. However I would like the answers to a few questions before I do:
(1) Is it true that the Spectrum crashes when a certain number of keys are pressed at once?
(2) Are you limited to only two colours within the 8x8 pixel character square?
(3) I wish to learn machine-code; what facilities do the Spectrum and manual have to help? Also, are there any good books on the subject?
(4) Since the Spectrum has only one user port, how can a printer plus joysticks, etc, all be connected at once?
Steven Garrett, Southwick, Sunderland

(1) I have heard of cases where the pressing of two or more keys causes some strange effects, but I am yet to hear of one actually crashing. The Spectrum does have some weird bugs, many of which I am yet to discover. If you do have any good ones I would be very interested to hear from you.
(2) Yes, this is the same as for most of the new, cheap colour computers – it is done to save memory.
(3) The Spectrum has few actual facilities for machine code and the manual is rather sketchy on the subject, though there are various assemblers and disassemblers on the market. One of the best is available from ACS Software. At the time of writing there were no really good machine code books on the market for the Spectrum, though 'Interface' may have one ready for the early part of next year.
(4) The Spectrum has one edge connector rather than one port. The Z80 is capable of communicating with 256 simple on/off applications before it starts actually using memory space.
James Walsh

M/C error

When I was typing in the machine-code program in the October edition to display the number of free bytes on the ZX81, I noticed that there were a number of errors in the listing. For this reason could you please publish a corrected edition?
T J Stanfield, Birmingham

Thank you very much for your letter. I apologise for any inconvenience that these errors may have caused you. So here goes for the corrected version:

```
10 REM 12345678901234
29 FOR X=16514 TO 16527
30 INPUT A
40 POKE X,A
45 PRINT X,PEEK X
50 NEXT X
60 PRINT USER 16514
1000 REM THE CODES ARE:
   33,0,0,57,237,91,28,64,167,
   237,82,68,77,201
```

Lines 25 and 70 in the M/C loader program in the same edition should read:

```
25 LET X=X+1
70 GOTO 25
```

James Walsh

THE WORKING SPECTRUM

A LIBRARY OF PRACTICAL SUBROUTINES AND PROGRAMS

By David Lawrence

The Working Spectrum is based on a collection of solid, sophisticated programs in areas such as data storage, finance, calculation, graphics, household management and education.

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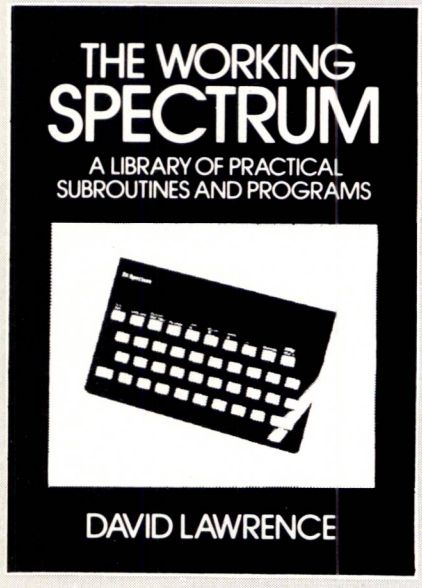

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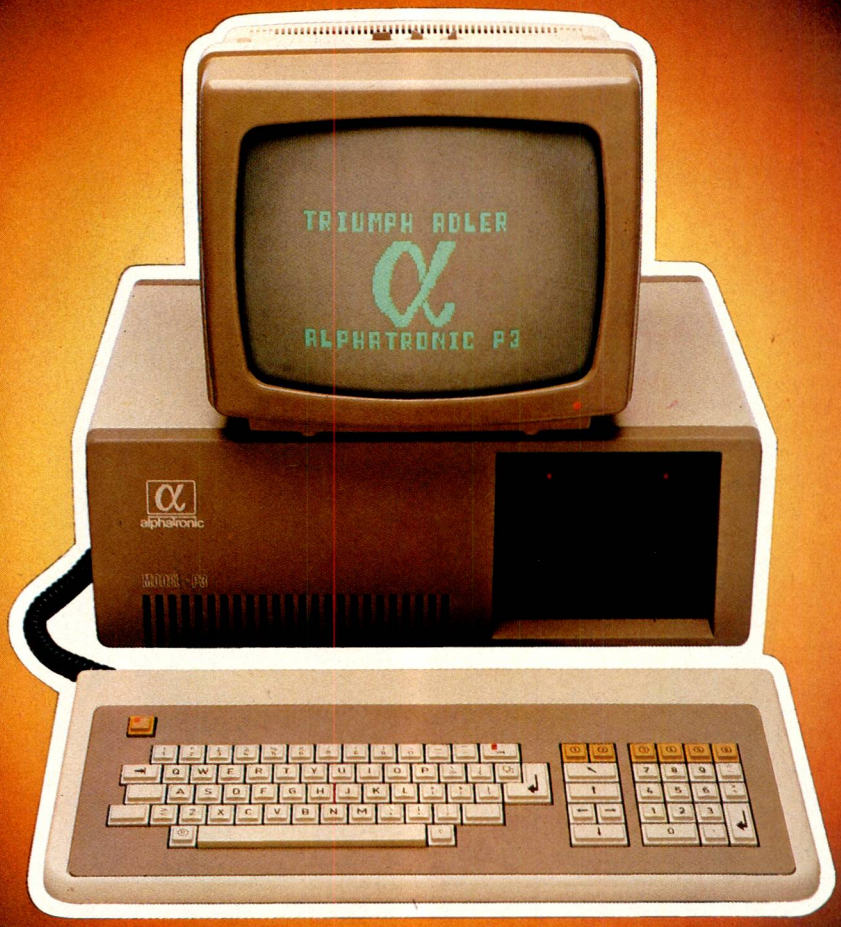

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Computers already play an important role in todays modern offices and industry. It is essential that children being educated today for tomorrow's high technology world, are equipped to learn and understand computer technology if they are to succeed. Many schools and colleges use computers these days, but often do not have sufficient for individual tuition. An ORIC-1 computer in your home will give your children the "hands-on" experience they need, and because ORIC-1 is based on REAL computing systems, it will help all the family understand the heart of this new technology, as well as help with homework, language learning, and give access to a wealth of knowledge that will guide you into the world of Information Technology and Data Processing.

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The ORIC-1 is a high quality, professional MicroComputer with a specification comparable to those costing many times more.

Many software packages are already running on the Basic Language, which include Word Processing, Accounting Packages, Stock-Control Systems, Sales Forecasting, etc.

Using the Oric with its MODEM enables the businessman to send and receive electronic mail via the Prestel Mailbox system, and to access over 200,000 pages of vital information including up to the minute stocks and shares prices, all aspects of travel, with timetables, commodity prices, news media and farming information and a whole wealth more.

THE ORIC-1 SHOULD BE ON THE DESK OF EVERY INFORMED EXECUTIVE.

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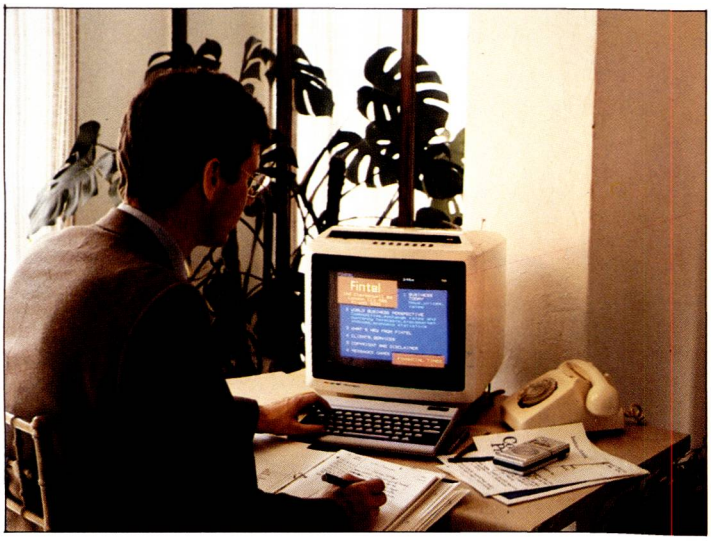
Because the ORIC-1 has graphics that are Prestel/Viewdata compatible, it can be used with the ORIC MODEM to give a host of communications facilities, including **200,000** pages of interactive information covering sport, travel, hotel bookings, games, quizzes, etc., plus **TELESHOPPING**.

TELESOFTWARE enables ORIC users to download (either very cheaply or free of charge) software direct from Prestels'* ALADDIN'S CAVE, via your own telephone.

ELECTRONIC MAIL – the communications system of the future – enables ORIC users, via the Prestel Mailbox system, to send and receive information.

* Prestel – Trademark of British Telecoms Viewdata System.





The ORIC pedigree

The ORIC-1 is superbly designed and engineered. Its futuristic, slim line styling, looks equally good on the executive desk or in the home, and whilst the styling is Scandinavian, the Computer design is all British.

The "electronic heart" is unique to ORIC, and developed by a team of leading U.K. designers. The computing power of this micro is second to none in its class, and offers superb value for money.

ORIC-1 is a major development in MicroComputer design and engineering, with a pedigree that means quality and reliability to its discerning owners, all backed by full after sales service and a 12 month guarantee.

Now there is only one choice ~ ORIC.

CAREFULLY ASSESS THE FOLLOWING MAJOR ORIC FEATURES & TECHNICAL SUPERIORITY

COLOUR – ORIC plugs directly into the aerial socket of your T.V. and has an R.G.B. output if you require colour monitor quality.

The text and graphic displays are ultra bright, giving 40 characters of 28 rows. 8 foreground and 8 background colours can be displayed at any one time.

HIGH RESOLUTION GRAPHICS – A high resolution screen of 240 × 200 pixels (graphics dots) is displayed in full colour. Circles, lines and arcs can be drawn at very high speed for use with animated games, business graphics, or even computer art.

USER DEFINABLE GRAPHICS – with ORIC you have the choice of full Alpha Numeric computer standard character set, OR TELETEXT (CEEFAX/ORACLE) Alpha Mosaic graphics. The ORIC has, of course, Teletext/Viewdata compatible displays, plus the added bonus of being able to create up to 96 characters, of your own choice. Add to these features both Flashing and Double Height characters and you can start to appreciate the full capability of ORIC-1.

SOUND – The ORIC contains a high quality loudspeaker and a dedicated sound synthesiser circuit, producing a full 6 octaves of controllable sound.

Three different tones are available directly from the keyboard to facilitate touch type programming.

For beginners, 4 programmed sound effects – SHOOT – EXPLODE – PING – ZAP – are available for games and simulations etc.

You can even program your own sounds using "SOUND, MUSIC and PLAY" commands, giving the user full control over the dynamics of the sound.

The ergonomic, professional keyboard.



The computer keyboard has been ergonomically designed to enable the user to learn and remember the layout quickly. This driveability, as we call it, is essential for enjoyable speedy programming.

The 57 moving keys have only 2 functions each (not 6 or 7 as some micros) making familiarity with the keyboard a quick and easy process.

The keys have 3 feedback tones for the various functions which can be switched on and off at your convenience.

The keys themselves are well spaced, giving a pleasant tactile feel for ease of touch-typing and programming.

Very important features are the RESET & CURSOR CONTROL keys. The reset key enables the user to re-start a program without having to switch the power off and on. The cursor control keys are useful for ease of program editing and computer games.

The ORIC keyboard is **not** built down to a price, instead it is designed for maximum user 'driveability' and ease of use.

ORIC-1 TECHNICAL SPECIFICATION

CPU/Memory
6502A MicroProcessor with 16K ROM containing BASIC interpreter and operating system. RAM uses state of the art dynamic memories for high board density and low power dissipation. 16K Byte or optionally 48K Byte. 48K model contains 64K of RAM with 16K overlaid by ROM. External control signal allows the use of full 64K RAM or may be used to externally increase ROM.

Keyboard
57 moving keys with tactile feedback. Full upper and lower case with correctly positioned space bar. Full typewriter pitch. Key layout is standard computer type with ESC, CTRL, RETURN and additional cursor control keys. All keys have auto repeat.

Display
Will drive a PAL UHF colour or black and white television receiver. Approximately Channel 36. RGB output also provided on DIN socket with 270° configuration.

Screen – Character Mode (Memory Mapped)
28 lines of 40 characters producing display very similar to teletext. Normally the bottom 3 lines display control and system information. Character set is standard ASCII which is enhanced by the addition of 80 user definable characters. ASCII characters may also be re-defined as these are down loaded into RAM on power-up. Serial attributes are used to control display features, as in teletext, and take up one character position. All remaining characters on that line are affected by the serial attribute until either the line ends or another serial attribute. Display features are:–
a) Select background colour (paper) from one of eight.
b) Select foreground colour (ink) from one of eight.
c) Flash characters on and off approximately twice a second.
d) Produce double height characters (even line top, odd line bottom).
e) Switch over to user definable character set. This feature is used to produce teletext style colour graphics which does not require any additional RAM to operate.

Available colours are Black, Blue, Red, Magenta, Green, Cyan, Yellow and White. Each character position also has a parallel attribute, which may be operated on a character by character basis, to produce video inversion. The display has a fixed black border.

Screen – Graphics Mode (Memory Mapped)
200 pixels vertically by 240 pixels horizontally plus 3 lines of 40 characters (same as character mode) at the bottom of the screen to display system information and to act as a window on the user program while still viewing the graphics display. Can also be used to input direct commands for graphics and see effect instantly without having to switch modes. Graphics display operates with serial attributes in the same way as characters except that the display is now considered as 200 lines by 40 graphics cells. Each graphic cell is therefore 1 pixel by 6 pixels and is the pattern contained in RAM. Graphics display is therefore very flexible by having 8 foreground and 8 background colours and flashing patterns. The video invert parallel attribute is also useable in this mode. ASCII characters may be 'painted over' the graphics area thus enabling the free mixing of graphics and text.

Sound
Uses internal loudspeaker and amplifier and can also be connected to external Hi-Fi system via a DIN connector. A three channel sound synthesizer (The General Instrument 8912) as used in arcade games machines which can produce musical notes from sub-sonic to super-sonic frequencies. Envelope of sound output is programmable and can be used to synthesize various musical instruments. Pseudo Random Noise generator (producing a hissing sound) can be mixed into each channel). Provides interesting sound effects for video games.

Cassette Interface
Connect via DIN socket. Uses Tangerine format which has been field proven over 3 years and thousands of systems. Operates at super reliable 300 baud or reliable super fast 2400 baud. A tone leader allows tape recorders' automatic level control to stabilise before first recording file-name and then dumping program/data with parity lists. At the end of recording several check sums are recorded which will be checked on loading to verify correct operation.
A Schmitt trigger circuit is used on the tape input to remove noise. The Tangerine format is so good it is the one other manufacturers are copying. All types of information may be saved such as programs, data, arrays, blocks of memory, screen displays. After saving correct recording it may be verified before deleting information in memory. Remote motor control of tape recorder is provided; essential for the loading and saving of data files.

Expansion Port
Full data, address and control information for the 6502A MicroProcessor, for connection of Serial Modem and Network interfaces and Disk Pack or Micro Drives. Can also be used for user designed hardware interfaces. Useful control lines allow RAM and ROM to be externally expanded (ideal for adding ROM cartridges). Disk Pack and Micro Drives use these lines to provide 63K internal RAM on the 48K model.

Printer Port
Standard Centronics parallel interface allows connection of a multitude of different types of printer from very cheap thermal types to high speed matrix printers or wordprocessor quality daisy wheel printers. Port can double as 16 general purpose I/O lines.

Reset
Machine resets to character mode on power up and clears program memory. A key on the base of the machine provides a warm start which will return to the command mode (after a program crash or never ending loop) without destroying program or data.

Display Commands
Foreground and background colours are controlled by INK and PAPER commands and double height and flashing characters by DOUBLE AND FLASH.
INVERSE will give inverted colour printing. These commands (except DOUBLE) may also be set globally for all DRAW, CIRCLE AND PLOT commands and may be used in direct mode or within a program.

Sound Commands
Three tones can be produced directly from the keyboard.
a) A high beep when an alphanumeric key is pressed.
b) A low beep when a special key is pressed (e.g. Delete, Carriage Return).
c) A bell tone when the control G key is pressed.
The user can switch these sounds off as desired. There are four pre-programmed sound commands for use within programs. These are:
i) PING, produces a bell-like tone. Is also used as control G tone.
ii) SHOOT, simulates a gunshot.
iii) EXPLODE, creates the sound of an explosion.
iv) ZAP, produces a space-invader 'laser' sound.
To facilitate the creation of other sounds there are three general purpose commands: SOUND, MUSIC and PLAY. SOUND has a range of 15Hz to 62kHz. MUSIC will play notes within a seven octave range. Up to 3 voices can be used at one time.

Mathematical Operations and Functions
The standard +, −, ×, ÷ are available as are the functions: sine, cosine, tangent and their inverses, exponential, log, absolute value, integer value, sign and square root. Full algebraic precedence is used to ensure that calculations are performed in the correct order. There are also functions to display the amount of free memory and the position of the cursor. PEEK and POKE allow direct access into memory. The boolean operators of AND, OR and NOT are available as are relational operators: =, <, >, <> (not equal) <=, >=. Machine code subroutines may be called with the USR command. User defined functions are available using DEF-FN and program data may be manipulated using DATA, READ and RESTORE. ON GOSUB and ON GOTO allow programmed jumps to a choice of locations.
All mathematical functions are accurate to 9 digits with a range of between $2.93874 \times 10\text{-}39$ to $1.70141 * 10^{38}$.
An Immediate mode allows the computer to be used as a calculator.

String Operations and Functions
Strings may be up to 255 characters in length. There are a number of functions to manipulate strings: ASC, CHRS, LEFTS, LEN, MIDS, RIGHTS, TAB, VAL. Strings may be concentrated (joined together) using +. Strings may be compared using =, <, >, =<, =>, <>.

Variables
Variable names may be of any length, although only the first two characters are acted upon. They may consist of combinations of the letters A-Z and numbers Ø-9. The following suffixes may be applied to variable names.

S	Indicates a string variable.
%	Indicates an integer variable (−32768 to +32767).
No Suffix	Indicates a normal floating point variable.

Arrays
Arrays may have up to 255 dimensions any may be integer, string or floating point. Arrays are named as for variables (see above).

Other Functions
A random number function RND is available. TAB, POS and SPC allow control of the cursor during printing on the screen. Eighteen different error messages are produced by the system. A complete memory mapped text editor is included for the editing of BASIC programs.

Dimensions
Height: 52mm Width: 280mm Depth: 175mm Weight: 1.1Kg

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The ORIC challenge

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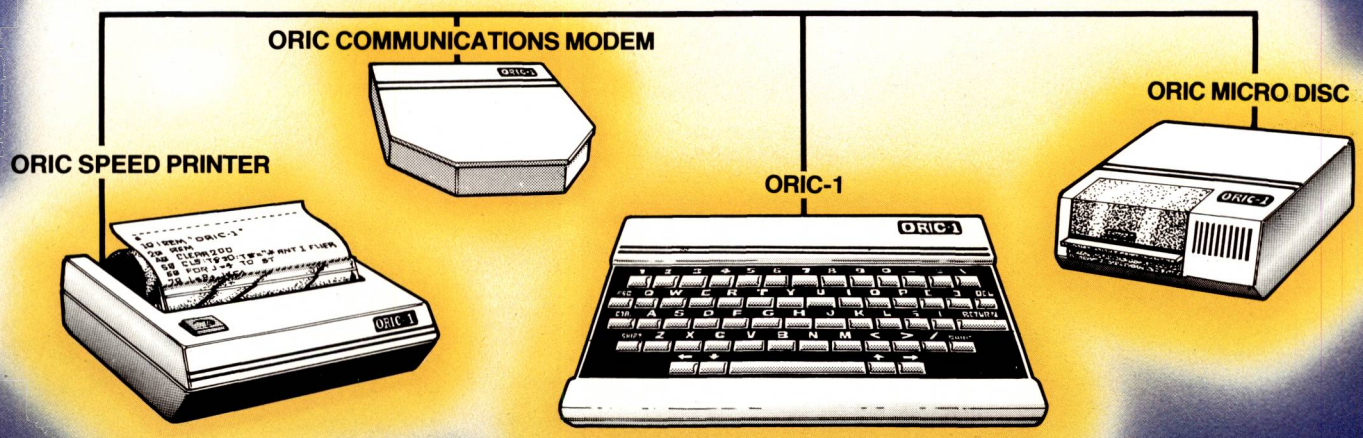


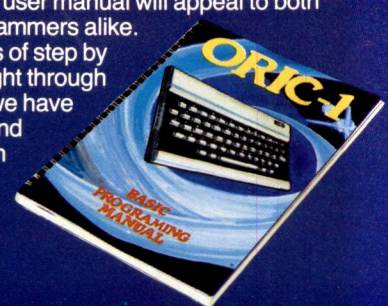
ORIC-1 – As described in this brochure, with choice of 16K or 48K RAM, complete with CENTRONICS PRINTER OUTPUT, CASSETTE PORT, UHF/RGB HI-FI OUTPUTS, POWER SUPPLY CABLE & FULL USER MANUAL.

COMMUNICATIONS MODEM – A must for modern computing. This unit, styled and designed to the ORIC quality standard, is British Telecom approved and enables the ORIC-1 user to receive and send communications via the telephone line.

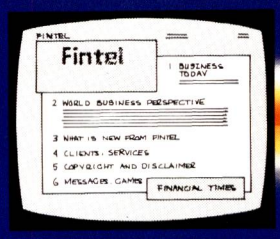
ORIC SPEED PRINTER & MICRO DISC – These units will be available to complete your ORIC system during the first half of 1983. They are designed to ensure maximum value and expandability to your ORIC SYSTEM.

ORIC USER MANUAL – FREE WITH EVERY ORIC-1 PURCHASED. Designed and written by one of the industry's leading professional authors, the ORIC user manual will appeal to both beginners and seasoned programmers alike.

Containing over 200 pages of step by step instructions from basics right through to real computing. We believe we have produced the easiest to read, and most comprehensive instruction manual of its kind.



The real computer system







ORIC
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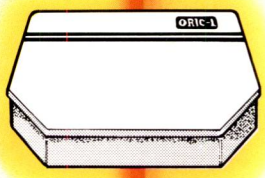
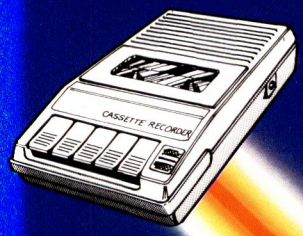
MODEM















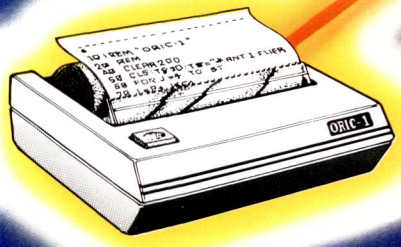
ORIC-1 COMMUNICATIONS NETWORK

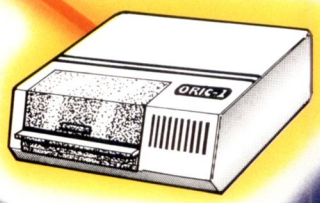




REMOTE
MAINFRAME
COMPUTER

ORIC-1





ORIC SPEED PRINTER

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HOW TO MAKE EPSON, WORDSTAR AND OSBORNE SING AND DANCE

Bob Huckle of Digitus Ltd shows how to get the best from your Osborne/Epson combination.

When I first discovered the Epson MX-80 I believed I had grasped all the reasons for its success. In my view it scored heavily on all fronts — practicality, ease of use, reliability, and cost-effectiveness. On top of all this it batted along bidirectionally and logic-seekingly at 80cps, it looked good, and it was portable (it came in a sturdy box with a handle on it).

One morning I received a telephone call from a distressed customer. In desperation he had taken a stop watch to his MX-80. It was only printing at 50 cps! Oh dear, had those 'awfully nice' Epson people let me down? Further investigation showed that it was also printing with a jolly nice but non-standard typeface (this however was of no interest to my customer).

I took the printer along to the surgery where I received some sound advice from the chief fitter. . . 'When in doubt, read the manual!' It seemed like a good idea and an hour or so later I was almost overcome with the delights displayed before me (I get excited easily) . . . Print options galore, true superscripts and subscripts, the ability to change line heights, a host of international character sets, and full graphics capability! All this for what price?

Being reasonably versed in the art of Wordstar, it was not long before I was experimenting with the different ways of making the MX-80 sing and dance from within a document file. I have also spent some time heavily involved with the Osborne 1 and decided that the combination of these three world leaders required further investigation.

Let's start with the MX-80. Figure 1 shows some of the different print options available. If you find one of the options so pleasing that you would like to use it all the time, the best approach is to modify the printer internally. Refer to the section in your Operation Manual entitled 'Setting the DIP Switches'. Take it slowly and you should find this a simple matter.

It would be nice, however, if you could get the MX-80 to obey your will by selecting the different print options whenever you desire. The way you do this is by sending a sequence of control characters to the printer while it is turned on. The different characters determine the different print options. When you turn the printer off and back on again it resets itself back to normal. You can send these characters directly from the keyboard of your computer (in this case an Osborne). Or you can send them from within a program (in this case Wordstar).

Direct from keyboard

I suggest this method for experimental purposes initially. Load your Wordstar disk and then return immediately to the operating system by typing X. The CP/M prompt A>_ is displayed on the screen. Now type ^P and <CR>. The printer should have jumped into action. From now on, everything you type at the keyboard will be sent to the printer. Let's tell it to print everything in emphasised mode. Type <ESC> E <CR>. Some gibberish will appear on the screen and on the printer — don't worry about this. Now type ^P and <CR> again. This stops your typing being sent to the printer. Return to Wordstar by typing WS <CR> and away you go!

Anything you now print will appear in emphasised mode. Remember, by turning the printer off you set it back to normal. To select other print options, merely enter the correct sequence of characters instead of <ESC> E above. Table 1 gives the correct sequences to be sent for each different option. To choose one print option while using another, you first have to deselect the one in use. The simplest method is to turn the printer off or send <ESC> @ to initialise the printer.

Try experimenting with some combinations. In particular send the combination <ESC> S ^A <ESC> A ^F. This combination is ideal for those terms and conditions you don't want anyone to read!

The table also includes the sequence of characters which turns off the paper end detector. With this off you can feed single sheets through without that blasted buzzer sounding and the printer stopping half way down the page.

Direct from Wordstar

Of course, the ideal solution for a user of Wordstar and the MX80 would be the ability to select the printer's options while creating a document. Hence enlarged titles, emphasised subtitles, condensed tables, etc, could all be chosen at will, to enhance the presentation of the text. We have seen how print options are selected and deselected by sending a unique sequence of characters to the MX-80. These sequences can be sent from within Wordstar and the ^P menu

Print Option	Keyboard Entry Sequence
Condensed	^O
Double Strike	<ESC> G
Emphasised	<ESC> E
Enlarged	<ESC> W ^A
Subscript*	<ESC> S ^A
Underline	<ESC> -
Line Heights	
6 lines per inch (default)	<ESC> 2
8 lines per inch	<ESC> Ø
3 lines per inch (double spaced)	<ESC> 3 H
1.5 lines per inch (triple spaced)	<ESC> A Ø
12 lines per inch	<ESC> A ^F
Other Options	
Initialise Printer	<ESC> @
Turn off paper end detector	<ESC> 8

* Sadly you can't access the Superscript option directly from the keyboard, because you need to send <ESC> S ^@ Does anybody know a way of typing ^@ on the Osborne?

Table 1: Direct keyboard entry sequences from the Osborne 1.

This is the normal default printing mode. Here the MX-80 prints at 80 cps and produces 6 lines per inch. This mode is usually used for fast draft printing.

This is condensed mode which will print up to 132 characters on A4 paper. It's jolly useful for financial reports.

These are double printed characters. They are different to WordStar ^PB characters because the printer offsets slightly on the second pass of the head.

This is emphasised printing. It gives an even stronger impression on the paper. The print speed is reduced to 50 cps.

This¹ line² demonstrates* true superscript printing.

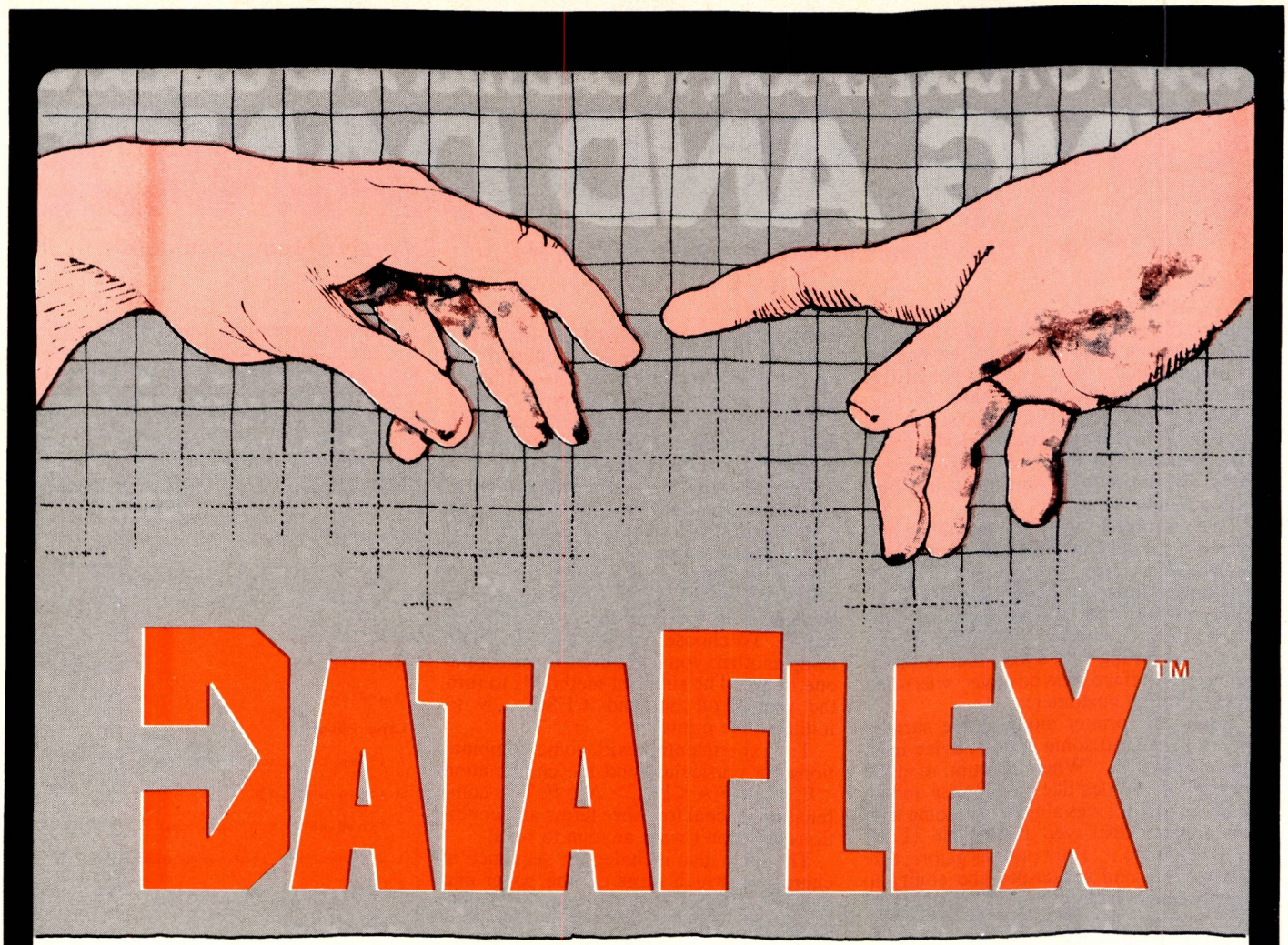
Some enlarged printing

The MX-80 has its own underlining facility. It provides a true underline instead of dashes and you don't have to fill in the spaces manually!

Most combinations are possible. One of the most interesting is Enlarged/Condensed. It produces 66 columns on A4 paper.

This is a combination of Double Printing and Emphasised. Find the dots in this one!

Fig 1 Some examples of MX-80 print options.



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HOW TO MAKE EPSON, WORDSTAR AND OSBORNE

SING AND DANCE

holds the clue. Choosing one of the options from V through to R sends a unique sequence of characters to the printer! At the moment, they're not sending the sequences we want to send, but some of them we can easily change. MicroPro has made it easy for us to change Q, W, E and R. But you can also change V, T (these are not true sub/superscripts at the moment), Y (there is no alternative ribbon colour on the MX-80), A and N (there isn't really an alternative pitch either). I won't go into the reasons why, but the others are best left for the time being.

Ignore for the moment what the above

^P Option	Memory Address	^P Option	Memory Address
Q	06C9	Toggles	
W	06CE	Y (select)	06DD
E	06D3	Y (deselect)	06E2
R	06D8	T (select)	06BF
A	06B5	T (deselect)	06C4
N	06BA		

Table 2: Memory addresses for available ^P options.

Print Options	Select	Deselect
Condensed	0F	12
Double Strike	1B 47	1B 48
Emphasised	1B 45	1B 46
Enlarged	1B 57 01	1B 57 00
Subscript	1B 53 01	1B 54 1B 48
Superscript	1B 53 00	1B 54 1B 48
Underline	1B 2D 01	1B 2D 00
Line Height		
6 line per inch	1B 32	
8 lines per inch	1B 30	
1.5 lines per inch	1B 41 30	
3 lines per inch	1B 41 18	
12 lines per inch	1B 41 06	
Other Options		
Initialise printer	1B 40	
Paper end detector off	1B 38	
Paper end detector on	1B 39	

Table 3: MX-80 print options with the associated select/deselect HEX sequences.

```
0:   ^PX0^PX
1:   <ESC>3H<CR>
2:   <ESC>A0<CR>
3:   <ESC>0<CR>
4:   <ESC>8<CR>
5:   ^PQ^PE
6:   ^PR^PW
7:   ^PT^PA
8:   ^PN^PT
9:   ^OD
```

Table 4: Osborne 1 function key configuration.

options are supposed to do. Just look upon them as sequences of characters being sent to the printer. By changing these sequences, we can decide what the relevant ^P menu options will be. I have decided that the easiest way to do this is by using DDT. For Osborne users, DDT is located on your CP/M utilities diskette. We are about to mess about with the Wordstar program itself. Don't do this on your master diskette. Make a copy.

Before we begin, there are some things we need to be aware of. Wordstar is stored on disk in hex code. One hex character is in fact represented by two normal characters. Hence 1B 00 2D 6C represents four hex characters. Each cell of your 64k memory has a unique address. These addresses are also represented in hex. Typical addresses might be 06DD 0799 and 06CF. DDT gives you the ability to:

1. Load a program into memory, putting each hex character into its own individual cell
2. Locate and change particular hex characters by telling DDT which cells they are stored in (the unique hex address)

and

3. Write the modified program back to disk.

We are now going to change the sequences sent when options Q, W, E, R, A, N, V, T and Y are chosen from the ^P menu. It is important to note that the first six options send only one sequence to the printer whenever they are chosen. Option Y is a toggle. The first time it is used it sends one sequence to select the option. The second time, it sends another sequence which deselects the option. Options V and T are also toggles, but just a trifle more complex. They were originally designed to raise or lower the carriage of the printer half a turn. This gives somewhat compromised superscripts and subscripts. They work in conjunction with each other by sending the same sequences from the same memory addresses — only the opposite way round. V raises the carriage the first time it is chosen, and lowers it the second. Vice versa for T. We now have true superscripts and subscripts on the MX-80. There is no need to merely raise or lower the carriage, and I can't think of any two operations we could usefully combine in this way. We are stuck with only being able to use one of either V or T. The other is redundant.

Table 2 gives the start addresses of the sequences sent by the associated ^P options. Table 3 gives the sequences we need to send to select or deselect the associated MX-80 options. As an example, let's make ^PQ turn on emphasised printing and ^PW turn it off.

Load your CP/M utilities disk (drive A) and your copy of Wordstar in drive B. Type DDT B:WS.COM <CR>. The following message appears on the screen:

DDT VERS 2.2
NEXT PC
3F00 0100

(I don't know what it means either!) Now type S6C9 <CR> (the address is actually 06C9 but leading zeros can be ignored). The screen will now display what currently resides in this memory address. To change the sequence for Q we first enter the number of hex characters in the new sequence

```
^PQ ..... Condensed ON
^PW ..... Condensed OFF
^PE ..... Enlarged ON
^PR ..... Enlarged OFF
^PA ..... Emphasised ON
^PN ..... Emphasised OFF
^PT (select).. Double Strike ON
^PT (deselect) Double strike OFF
^PY (select).. Underline ON
^PY (deselect) Underline OFF
```

Table 5 Allocation of options.

and then the sequence itself. Type 02 <CR> (the number of characters) 1B <CR> 45 <CR> (the sequence). Type X <CR> to finish. The same goes for W. Type S6CE <CR> 02 <CR> 1B <CR> 46 <CR> and X <CR> to finish. ^C brings us back out of DDT to the CP/M prompt. To overwrite the changes on disk type SAVE 62 B:WS.COM. Now load Wordstar in drive A. Prepare and print a document using ^PQ and ^PW somewhere within. Exciting isn't it!

As we've discovered, the MX-80 is extremely versatile. To use all the options in Table 3 we would have to include 22 different sequences within Wordstar. We can include only 10, so some compromise is called for. Combining the information in Tables 2 and 3 with the above procedure will enable you to allocate the available ^P characters to the options of your choice. I found the decision of what to include and what not to include an extremely difficult one to make. I decided to opt for maximum flexibility, which meant choosing lowest common denominators. These basic choices could be combined to provide even further options with a few more key-strokes. I waved goodbye to superscripts and subscripts, as I would use these least of all. True MX-80 underlining was a must — this is so superior to broken dashes. Line heights I chose to control directly from the keyboard and outside Wordstar. Before printing, either single, double or triple-spacing can be selected. The same applies to configuring the printer for single sheets. Table 5 shows my final solution.

Wordstar also enables you to include an end of print sequence. This is located at memory address 06F8 and is normally used to set the printer back to its normal default values. I left this and used the scientific method (when in doubt, turn the printer off and back on again). Most of my work I prepare ragged right. I don't usually include page numbers. I never use hyphens at the end of a line and I find it useful to be able to produce computer zeros (Ø). You may also find it useful to use Wordstar with INSERT off. The following are the memory addresses and patches to produce a Wordstar with the necessary defaults.

Justification off	0386	00
Omit page numbers	03D3	FF
Hyphen-help off	0389	00
Insert off	0362	00
Strike-out character '/'	070B	2F

With reference to the Osborne, there is no need for words to wrap round at column 80. The computer has a unique, scrollable 128-column screen and the Osborne version of Wordstar allows you to edit documents up to 120 columns wide. Editing

GOTO page 208

KEYBOARD ENTRY			WORDSTAR SELECTION				
LINE HEIGHTS			SINGLE SHEET FEED	STYLE 66	STYLE 66	SUPER BOLD	SUPER BOLD	CONTROL DISPLAY	COMPUTER ZERO
DOUBLE SPACED	TRIPLE SPACED	8 LINES PER INCH		-ON-	-OFF-	-ON-	-OFF-	ON - OFF	(Ø)

Fig 2 The Osborne function key template.



FLEXIBLE SUPERFILE

Kathy Lang takes a look at a new CP/M-based data management system.

Superfile is another CP/M based data management system, constructed rather differently from most of those I've reviewed in this series. Instead of a fixed record structure, in which every record must have the same number of items of the same size even if in a particular record there are empty fields, Superfile uses a storage method which allows records to differ widely in structure within the same file. This is achieved by storing item names — called 'tags' in Superfile — with the associated value(s) within records. Such flexibility makes it more likely that you will be able to manage with just one file to hold all your data on one application — though for reasons of efficiency you may need to be more specific than is usual in Superfile about which tags you will most often use to retrieve data.

The adding of data items and tags can be achieved easily with this approach, so there is no need to copy a complete file if you simply want to add a data item. Since the records essentially have no structure, the need for copying files to change their structure does not arise either. The storage of tags within files also permits Superfile to use a compressed storage format, in which items with null values need not be stored, and this may save a lot of space (more than enough to make up for the space the tags take in the records) if you have ill-structured records. However, even if this trade-off does work in your favour, you will still need to consider some side-effects of this method of storage — for instance in the display of information from long items.

Superfile is itself simply a package for storing and retrieving data in a straightforward line-by-line format, with no formatting. It is complemented by Superforms, a form-design package, and Supertab, which allows the generation of formatted printed reports. All three functions are accessed by loading Superfile's overall control program, and then requesting the particular facility you need. Under this control program you can access all the CP/M commands except SAVE, so you can get directories of files, delete files and so on within Superfile. You can also create files of commands (which may be either Superfile or CP/M commands or a mixture of both) to be executed with a single SUBMIT command, just as in CP/M. This is important, as Superfile is a command-driven package and does not use menus, though Superforms and Supertab work partly through menus.

As well as the command-based access to Superfile, interfaces are provided to Microsoft Basic, to Whitesmith's C and to assembler; the supplier, Southdata, which is based in London, will write interfaces to other languages on request, I understand free of charge. However, I think a user would need to be an experienced programmer to understand the interfacing process. You would need a program to read in data from outside Superfile, or to make connections between different Superfile data files.

Data access

All access to data, whether for reading or writing, is achieved either through the LOOK command or through Superforms. The LOOK command simply displays records by listing them on the screen, one item per line; for more sophisticated formatting one uses Superforms. Normally, all tag values are indexed; to index an item, Superfile takes the first word in the item of more than two characters, and reduces it to three characters, consisting of the initial letter and a phonetic representation of the remainder. Thus, in an item consisting of more than one word, you cannot choose to have other words indexed — you must split the item up so that any item to be indexed is the first or only word in an item. If the item contains only words of two or fewer characters, it has an index value of zero.

If you are using a large file of information, it is unlikely that the whole of such an index would fit into a micro's memory, and this would slow access down considerably. The user can increase the size of memory available to the index to the maximum available; if this still won't accommodate the index in memory, access times can be improved by reducing the size of the index so that it will fit. In Superfile this is achieved by the creation of minor indexes, each using only those tags needed for a particular use of the file. If necessary, this minor index file can be given the name of the standard index file, and will thus automatically be used by Superfile when accessing data, without explicit instructions. In this mode, Superfile's method of indexing works very similarly to packages like dBASEII which allows you to have several indexes in use at one time, although the ability to control the size of the memory available for indexing is unusual.

A tag may occur more than once in a record — for instance, if you store personnel records which may include two or three Christian names for each individual, you may use the same tag for each. So a request for people called John would find all those whose name was John whether this was their first, second or third name. This achieves with one request matches which in most packages require the combination of requests with OR (is XNAME1 equal to John or XNAME2 equal to John, or XNAME3 equal to John?) — which is just as well, as Superfile has no method of ORing requests for matching, and can only combine them with AND. All matching is 'case-blind', for instance, a request to match John would also match JOHN.

When data is added to data files, the index is not automatically updated. Updating occurs when the TIDY command is issued; TIDY reorganises the main index and integrates all amended or added information in one operation. This can take some time. If required, TIDY can be used with a minor index instead of or as well as the main index. After information has been added, but before a TIDY is done, Superfile accesses new data by reading the file of new data sequentially.

Constraints

Superfile can handle files up to the CP/M maximum (currently 8 megabytes). The maximum record size is variable within Superfile; initially it is set at 1024 characters, but this can be changed by the user. A record may contain just one field if you wish, or it may contain up to 150 fields in the version of Superfile normally distributed to users; this limit can be changed by Southdata on request. The number of tags in one file is limited to 250, and this limit cannot be changed.

Data may be alphabetic or numeric in form; there is no special data format, so dates must be stored either as three separate items or in year/month/day order if comparisons are to work properly. Numbers are always stored in character format, but may be defined as integers, money numbers or fixed point numbers of a particular precision, and these definitions used to check data when inputting via the forms package.

File creation

The most common way of using Superfile is to have just one file containing all the data, since records do not have to be all of the same format. So, unless this pattern is inappropriate, the user does not need to worry about explicit file creation. To put data in a file, you must first use the LOOK command to set up tags for all those items which you will want to index. You can then simply type in a record using the LOOK command to set up tags for all those items which you will want to index. You can then simply type in a record using the LOOK command, or devise a screen form and fill that in with data. Records may be added, amended or deleted; deleted records may be restored provided you have not yet carried out a TIDY. Since the process, whether using LOOK or a form, is exactly the same for addition and amendment and for simple display, I shall decribe it under 'Display'.

Displaying data

The LOOK command expects each new record to be typed in the form 'tagname=value tagname=value. . .'. Since this involves typing the tag name for each item in each record, you are unlikely to want to use this method for large volumes of data. The alternative is to design a form using the Superforms packge. This involves supplying a caption and a data space for

each item; these can be anywhere on the screen. Then you are asked what tag, if any, to associate with each item in turn.

You can also indicate a wide variety of options, to be used when the form is displayed either to add records or to access them for updating or reading. These include the ability to restrict the value of a particular item to the elements of a list (for instance, to ensure that days of the week are filled in correctly), to validate an item to ensure that it lies within a particular range, and to calculate an item either from constants or from the values of other fields. You can copy from one field to another within a record, and you can specify a 'stay-put' value for a field to be constant across all records.

Items may appear on just one screen line; if an item has more than 80 characters less its caption, then another line can be used for the rest of the item and both lines given the same tag. However, in some circumstances such information may not be retrieved in the order in which it is stored, so you could have line 1 of an item appearing on the form after line 2 when the record is retrieved. This may happen when the user takes the option to store information in the compressed format, which takes advantage of the fact that items with null values do not have to be stored.

You may have as many different forms as you like associated with a single data file. Since a form may display a subset of the items in the records in the file, you can use one form for editing data and another for display. You can also use different forms for particular purposes — for instance using a form without confidential salary information for display to someone who is updating names and addresses.

The forms package is flexible and powerful, and has some very valuable features. However, there are some awkward features, such as the need to go back over each item in the form to specify the tag for each field. A more important limitation is the lack of any facility within Superforms for creating new tags — so you have to know which tags you want to use, and these must be first set up with LOOK before any forms are designed. When setting up my terminal to use Supeforms, I was asked to provide information about the cursor movement keys, yet these were not available to me when setting up the form; I had to use CTRL/L to move the cursor left. CTRL/R for right and so on. In fact I never did find out why the set-up program wanted to know about my cursor keys. . .

Printed reports

Printed reports are set up by using another part of Superfile called Supertab. The report formats are designed on the screen in just the same way as forms are designed for screen display with Superforms, with the addition of a facility for showing how to design reports wider than 80 columns (up to 132) and with enhanced calculation facilities to give totals and sub-totals. The documentation I had on Supertab was a pre-release version, and I couldn't tell whether it is possible to divert a report for the printer onto the screen; without this, one cannot total information across records interactively, as there is no provision for memory variables without writing a program.

Selection

Records can be selected for display either by the LOOK command or by using a predesigned form. Superfile uses indexed searches where you specify an exact match (is Surname equal to Smith?) for items whose tags are in the index, otherwise a sequential search is used. A search with LOOK will, if prefaced by a pound sign, give the number of records matching the selection criteria. You can use wild codes to match partly-known item values; for instance, a request to find John* would match all surnames such as Johns, Johnson, etc (and also JOHNSON, since matching is case-blind).

A single-character wild code can be used where you are uncertain only about one letter; John? would only match Johns (or Johni). If you don't remember how to spell an item, you can use a 'sounds-like' facility, which will, for instance, retrieve Jons as well as Johns if you ask for names which sound like Johns. (Don't expect too much of this, though —three characters-worth is not very much to produce a reliable Soundex-type matching.) For numbers, you may ask for items which are greater than or less than a constant. If you don't remember which tag to use, you can leave the tag name out. But all these inexact searches must, of course, read every record and will therefore be slow for large files.

All selection terms are ANDed together, and only those records which match them all are selected. You cannot use OR or NOT to combine terms in selections.

No sorting facilities were provided in the release of Superfile I tested, although there are plans to include sorting in the Supertab package.

Calculations

Calculations can be performed within records as part of input or look-up, or across records as part of Supertab. You can use brackets to alter the order of evaluation, and the usual arithmetic operators with the standard precedence, although there are no numeric functions such as ABS or square root. If you use Superform's facilities for calculation within records you must be careful about the order in which you display items on a form if you want to use a calculated value for a field which is based on the value of a field which is itself calculated.

Security

Superfile files are 'lightly encrypted' so that you cannot display them with the CP/M TYPE command. Beyond this, there are no true security features, although a five-level password-operated control system is planned for future releases. You can of course provide some security by giving people access through Superforms to forms which display only part of each record — but you can't stop them using LOOK, and it's quite easy to find out how.

Tailoring

There is a setup utility to allow you to tailor Superfile to your terminal which actually uses the novel idea of testing out each terminal feature (clear screen, move cursor left, etc) as the user puts it in — other suppliers please copy! Within the package, you can tailor to some extent by creating files of commands to be executed using SUBMIT; thus allowing inexperienced users to be given exactly those forms or reporting methods desired. For more sophisticated tailoring, Superfile provides a series of procedure calls for use via Microsoft Basic and other languages, although I found the descriptions very difficult to follow without the example program which was advertised in the Table of Contents. . .

Stability and reliability

I did manage to abort once with CTRL/C (though only back to Superfile's control level). I have also talked to a user who had some problems with reliability some months ago but who is now happy with his package. There are, though, some features which should help with data file integrity — for instance the file is automatically closed and re-opened after each write operation.

User image

The user image of the software itself I found reasonably straightforward, though there were some less pleasant features — for instance the use of arbitrary item names within Superforms to compensate for the fact that a tagname may appear more than once within a record. However, this straightforwardness was recognised only after a long and dour struggle with the manual, and with the help of the demonstration program, which as usual tells as much by example in five minutes as most manuals tell you in five hours. The manual is as unstructured as the records in the Superfile data file. Its level of treatment varies from the simplistic to the highly technical even within a single page, it has no index, and the standard of proofreading is appalling.

A particularly unhelpful instance of the last mentioned problem occurs when describing Superforms; this program uses a module called CFORM to create forms and a module called FORMS to display information using forms. The first line of the CFORMS chapter reads 'To load FORMS, enter SUPERFILE [sic] (s1.1) and type "FORMS". . .' Needless to say, it doesn't work like that (perhaps it would be even worse if it did). However, the lack of proofreading also provided a little relief — where else would you find that 'The detail of interfacing Microsoft Basic 80 to Superfile [sic] is handled auto*magic*ally. . .'

Costs

Superfile costs £175 alone, and Superforms and Supertab cost £75 each; these are all single-user versions. A multi-user version is also available for £800. I should have liked the opportunity to try that out, as there are very few true multi-user data management systems around.

Conclusions

At £325 for the total package, Superfile is pretty competitive with those file management systems, such as DMS and dBASEII, which use a more structured approach but have a wider range of facilities; while Cardbox, which also uses an unstructured approach but which can't do calculations, costs only £155. There are a lot of good ideas in Superfile, and if you have data which doesn't have much structure and if you can cope with the limitations I've described (especially the manual), then it would be well worth investigating. I should add that as yet I've only been able to test the demonstration version, with a maximum of 20 records, so potential buyers should, as always, make sure they see the package tested on a sizable file. Finally, the originator and supplier, Southdata, is a London based British company, which *may* make for better support than some.

END

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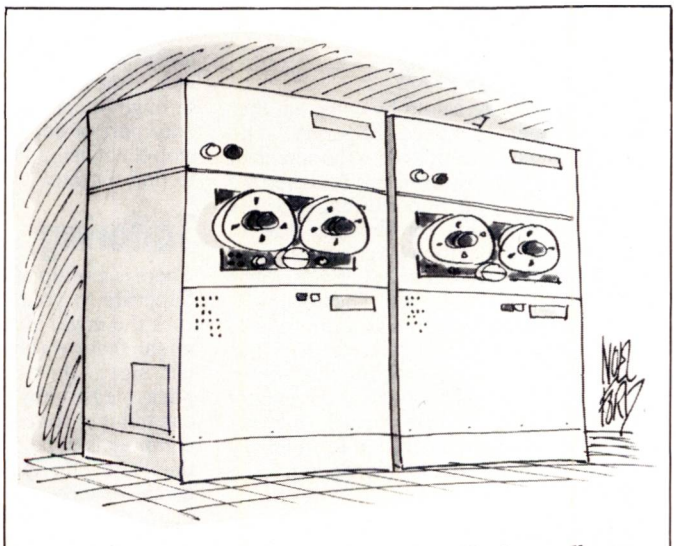

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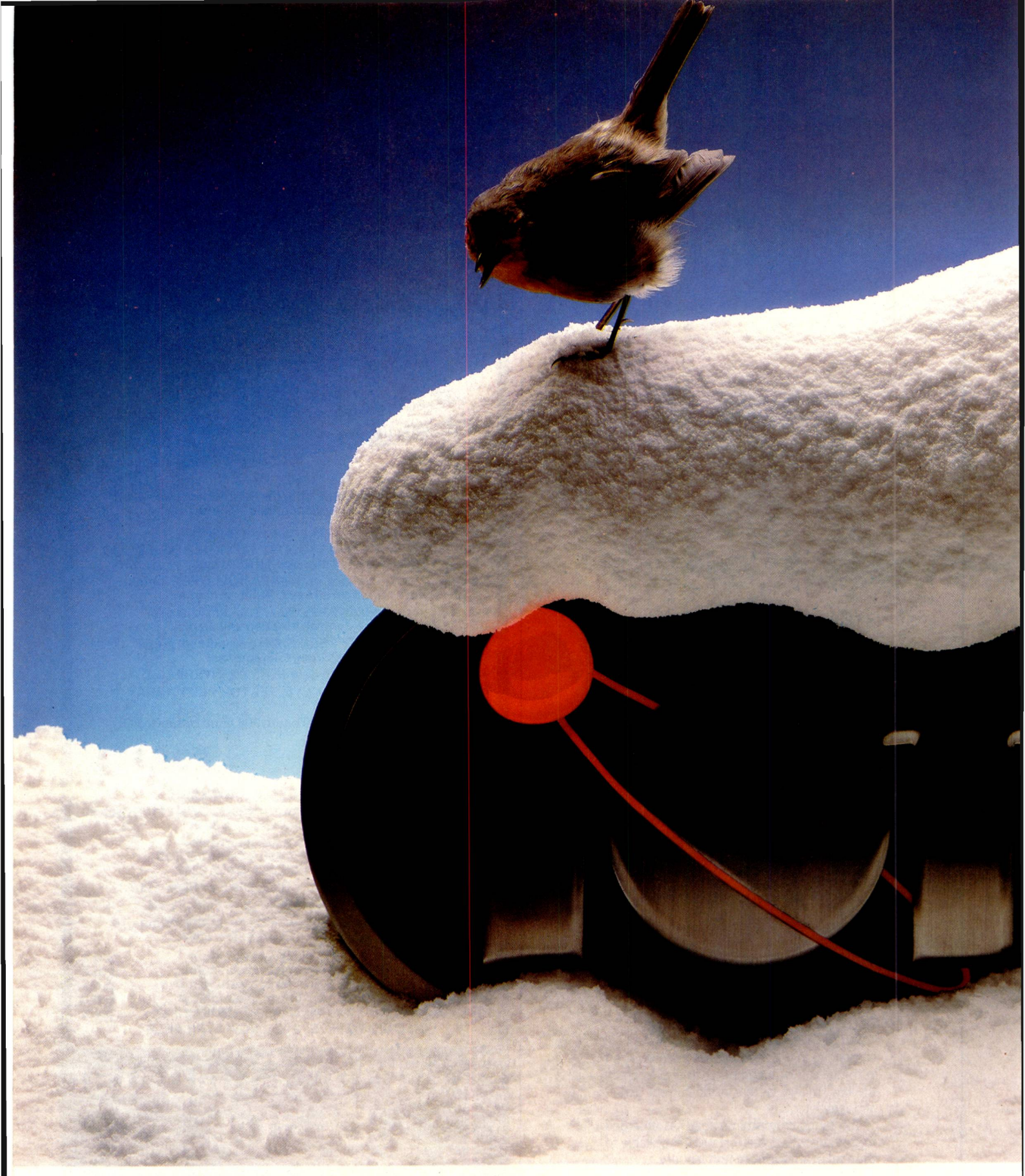

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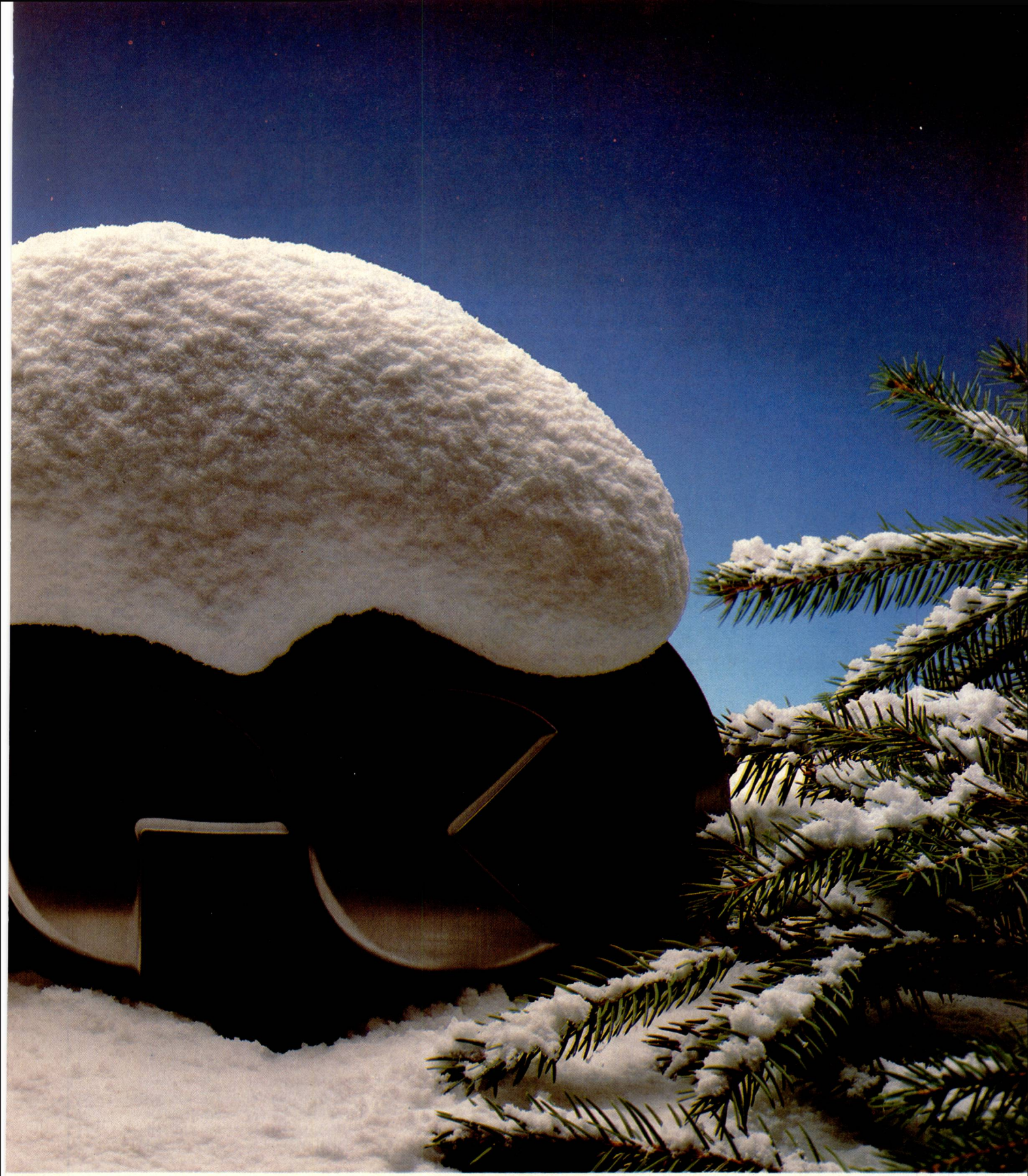

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BBC RESTARTER

Although the BBC micro has no equivalent of the Microsoft command CONT, restarting a program which has been halted (eg, by accidentally hitting the 'escape' key) can be achieved by using GOTO.

I do not know what restrictions apply to this, but certainly if only the variables A% through Z% are used there is no reason why it should not work. Indeed I have experienced no problems in restarting programs using other variables; however I do not know how lucky I have been in this.

Nicholas Phizackerley

ATOM VARIABLE LISTER

This simple program will print out the values of the integer variables A-Z, and will wait for a key to be pressed before returning to the main program.

Before entering it, type ?18=#28, and type this if you press BREAK while entering it. To save it onto tape, use *SAVE "VAR LIST" 2800 28F0. To use the program, *LOAD it from tape, and insert the following into the program you are debugging: ?18=#28:GOS.10, when you want a list of variables.

The program works by placing the four bytes which form each variable in locations 541 to 544, and printing them out as a vector.

Note that extra spaces must not be inserted into the program, as it must stay shorter than 256 bytes to avoid clashing with the normal text area.

Mike Harrison

```
 10?545=@
 20@=12
 40?540=0
 50?540=?540+1
 60?541=(?540)?801
 70?542=(?540)?828
 80?543=(?540)?855
 90?544=(?540)?882
100P.$(64+?540)"="
110P.!541"  "
120IF?540<26G.50
130@=?545
135P.'"   PRESS ANY
   KEY TO RETURN"'
137LINK#FFE3
140?18=#29:R.
```

SPECTRUM LOOK-UP TABLE

The Spectrum Basic includes the READ, DATA and RESTORE verbs. The manual only shows RESTORE followed by a line number — however it will in fact accept an expression. This provides the basis for a fast and economical table look-up technique. The following example illustrates the method.

```
50 REM month table look-up
101 DATA 31, "January"
102 DATA 28, "February"
103 DATA 31, "March"
104 DATA 30, "April"
105 DATA 31, "May"
106 DATA 30, "June"
107 DATA 31, "July"
108 DATA 31, "August"
109 DATA 30, "September"
110 DATA 31, "October"
111 DATA 30, "November"
112 DATA 31, "December"
200 INPUT "Month number?";mm
300 RESTORE mm+100
400 READ dd,a$
500 PRINT "There are "; dd; "days in "; a$
600 GOTO 200
```

The line numbers of the DATA statements are arranged so that a simple expression can relate the required DATA statement to the month number. Statement 300 uses this expression to set the READ pointer so that statement 400 retrieves the corresponding days in the month and month name.

The technique is especially useful with tables containing mixed data types, and variable length strings, as shown. Considerable space and effort are saved over the traditional method of setting up dimensioned arrays.

Mike Kerry

VIC IN HIGH-RES

Here is a tip for anybody with a VIC computer who wishes it had high resolution graphics. The solution to this problem is to redefine the character set to include the patterns required. Normally, the character definition table is held in ROM, and consists of 256 8-byte entries (one for each character), each bit corresponding to one pixel in an 8 by 8 grid. The best way to explain this is by using an example: let's take a Space Invaders character. This fits on to the grid as shown.

Thus the code for this character is: 60,126,219,255,102,60, 66,129

Of course, this wouldn't help much, except that by poking location 36869 (one of the registers in the VIC chip), the computer can be made to expect the character table to be in RAM. The precise details are:

CONTENTS OF LOCATION 36869
252
253
254
255

ADDRESS OF CHARACTER TABLE IN RAM
4096
5120
6144
7168 *special setting*

The address shown is the starting address of the table, which in the first three cases would be 2k long. The value 255 is a special setting which allows the first 128 characters to be defined by the user, but which keeps characters 128 to 255 as the usual first 128 characters (ie character 128 is '@', character 129 is 'A', etc).

So, to set up your own character set, POKE the table into memory at one of the above addresses, then POKE the location 36869 with the correct value, and afterwards the new characters can be printed just as if they were the originals.

This is the trick by which all the fancy VIC games provide such good graphics, and I hope that *PCW* readers will find it just as effective.

Nicolas Weeds

	BIT 7	6	5	4	3	2	1	0	
1			*	*	*	*			00111100 binary = 60 decimal
2		*	*	*	*	*	*		01111110 binary = 126 decimal
3	*	*		*	*		*	*	11011011 binary = 219 decimal
4	*	*	*	*	*	*	*	*	11111111 binary = 255 decimal
5		*	*			*	*		01100110 binary = 102 decimal
6			*	*	*	*			00111100 binary = 60 decimal
7		*					*		01000010 binary = 66 decimal
8	*							*	10000001 binary = 129 decimal

BYTE

ATOM HI-RES POINT TESTER

This short subroutine will test the state of any point on the mode 4 hi-res graphics screen. The variables X and Y are used to pass the co-ordinates of this point to the subroutine, and the variable P is set to 1 if the point was set, and 0 if it was clear (black).

Mike Harrison

```
  1 DIM AA(8):AA(0)=1:FOR W=1 TO 8:AA(W)=AA(W-1)*2:NEXT W
  2
  3 REM MAIN PROGRAM TO BE INSERTED HERE
  4
 98 REM SUBROUTINE STARTS HERE
 99
100 H=((191-Y)*32)+#8000+(X/8)
110 Z=7-(X%8)
120 P=(?H)&(AA(Z))
130 P=(P<>0)
140 RETURN
```

TJ's WORKSHOP

SPECTRUM FLASHY LISTINGS

It is not widely known that ZX Spectrum listings can incorporate colour commands (and indeed OVER and BRIGHT) as well as INVERSE VIDEO. I suspect that this feature is a happy accident of the machine's logical structure for these attributes — but it allows you to produce pretty listings!

The entrance to those effects is to go into extended mode (E) after the line number. You can do this at any stage — on first entering the line, or when using EDIT. We then employ the number keys, shifted or unshifted to get the effects:

These data are set out on Pages 114/5 of the User Guide. The best way to explore them is to set up a little program of a dozen or so REM statements. Once you get the hang of the above, investigate these ideas:

a) Inserting more than one such code after a given line number.

b) Inserting one or more at the end of a line.

c) Adding a REM message in inverse in one line, and using ENTER without returning first to TRUE VIDEO.

d) Inserting these codes within the REM message.

e) Doing the same with a PRINT statement.

f) Seeing the effect of resetting PAPER and INK by direct commands before listing. And even INVERSE 1 and/or FLASH 1.

Try RUN occasionally of course — strange that such flashy listings have little effect on the display when the program is executed!

After a while playing around with these ideas, you should see lots of uses. These include:

a) producing an invisible listing (even when EDIT is attempted);

b) highlighting REM or other statements, perhaps to remind you to check something later;

c) highlighting whole sections of program.

One little note — although (unlike the case of the BBC computer), these control characters do not take up screen space they *do* take up memory. In fact each E-mode numeral code takes two bytes, the same as if got direct from the keyboard.

How to restore normality and what happens if you POKE out a REM, I'll leave to you. But the Spectrum's flashy listings must be unique.

Keith Jammer

Key	Unshifted makes listing	White shift gives
0	black paper	black ink
1	blue paper	blue ink
2	red paper	red ink
3	magenta paper	magenta ink
4	green paper	green ink
5	cyan paper	cyan ink
6	yellow paper	yellow ink
7	white paper	white ink
8	normal brightness	flashing off
9	bright	flashing on

PET DO-UNTIL

Most programmers are concerned about making well-structured programs. In Basic, structuring is very difficult as the language lacks the required control commands. This program for the PET with Basic 3.0 gives a DO/UNTIL structure. It resides in the second cassette buffer and has full error checking. DO/UNTIL may be nested to any degree so long as there is sufficient space on the stack.

To enter the program, type SYS 1024 to get into the monitor, then type, after the full stop prompt, code in Table 1. After the colon there is a double space, but all the other spaces are single.

The code may be saved on tape using a save command in the form S"DO/UNTIL",01, 033A, 03FA. To initialise the routine, type: 0079 4C 3A 03 — not forgetting the double space after the colon. To disable the routine use: 0079 C9 3A B0.

Using the structure is simple. Its basic form is DO: (instructions): UNTIL (number). The instructions are carried out at least once, but are repeated if the number after UNTIL is zero. The number may be a constant, variable, function or condition.

Remember that a condition that is true returns -1, and one that is false returns zero. An example of a condition in a DO/UNTIL loop is DO: GET A$: UNTIL A$="X". The action is obvious from reading the code.

So much for DO/UNTIL — but has anyone got a routine for a propert IF/THEN/ELSE?

J D Slodznik

```
: 033A C9 44 F0 16 C9 55 F0 12
: 0342 C9 3A B0 0A C9 20 F0 4C
: 034A 38 E9 30 38 E9 D0 60 4C
: 0352 70 00 BA BC 01 01 00 F9
: 035A D0 E6 C9 55 F0 2D A0 01
: 0362 B1 77 C9 4F F0 04 A9 44
: 036A D0 D6 A9 03 20 1B C3 68
: 0372 A9 F9 48 A5 79 48 A5 77
: 037A 48 A5 37 48 A5 36 48 A9
: 0382 85 48 20 70 00 20 70 00
: 038A 4C FA C6 BA BD 03 01 C9
: 0392 85 D0 45 A0 04 B1 77 D9
: 039A CA 03 D0 A4 88 D0 F6 A0
: 03A2 05 20 70 00 88 D0 FA 20
: 03AA 9F CC 68 68 68 A5 5E F0
: 03B2 07 68 68 68 68 4C 0E C8
: 03BA 77 68 85 78 4C 53 03 3F
: 03C2 77 68 85 78 4C 54 03 3F
: 03CA 55 4E 54 49 4C 20 57 49
: 03D2 54 48 4F 55 54 20 44 4F
: 03DA 46 0D A5 0E F0 07 20 CC
: 03E2 FF A9 00 85 0E 20 E2 C9
: 03EA A2 00 BD C9 03 20 45 CA
: 03F2 E8 E0 11 D0 F5 45 77 C3
```

SPECTRUM SCREEN$

When writing interactive graphic games for the ZX Spectrum one often has difficulty when using user defined graphics (UDG) because the SCREEN$ function returns the empty string.

I have written a small machine code subroutine which compares a character on screen with the characters stored in ROM (as SCREEN$ does) and RAM (ie, UDG).

To use the subroutine type and RUN the program given (48k Spectrum owners may wish to change lines 1 and 10 to load the sub-routine higher in RAM). The variable P must be declared before any variable or string in the program as the sub-routine assumes it to be there.

To PEEK a given position load the variable P (which must always be a whole number) with the screen position to be tested, then call the sub-routine — ie, LET p=row* 32+column: LET x=USR Peek. The value returned to x is the code of the character at the given position. Character codes 32 to 127 and 144 to 164 are recognised. Sinclair graphics codes 128-143 are not recognised — but if required UDG can be programmed to Sinclair graphics. Any unrecognised character returns a '0'. A '1' is returned if there is an error in p (ie, too large or not a whole number).

Gerard A Allan

```
1311  209113    JSR  1391

1391  AD0302    LDA  1399
1394  F003      BEQ  1399
1396  4CEBFF    JMP  FCEFEB
1399  20EAFC    JSR  FCEA
139C  C91C      CMP  =1C
139E  D013      BNE  1383
13A0  A908      LDA  =08
13A2  20EEFF    JSR  FFEE
13A5  A920      LDA  =20
13A7  20EEFF    JSR  FFEE
13AA  A908      LDA  =08
13AC  20EEFF    JSR  FFEE
13AF  68        PLA
13B0  68        PLA
13B1  A95F      LDA=SF
13B3  60        RTS
```

TJ's WORKSHOP

GENIE LOWER CASE

Users of the Video Genie will know how it signs up with 'READY?' instead of the more usual 'MEMORY SIZE' question. Also the screen scrolls 26 times instead of giving the message 'RADIO SHACK LEVEL II BASIC' which is usual with the TRS-80. A special message or owner's name could replace the second message — possibly for security.

Genie owners will know that even if their machine has the hardware mod for lower case they still have to load a lower case driver, or call the driver in the extra ROM at 3000H. Embedded in the print routines in the Genie ROM there is a test for lower case characters; lower case characters sent to the ROM print routines are automatically converted to upper case before being displayed. If this test could be removed then upper and lower case could both be displayed without another VDU driver.

There is no control key on either the TRS-80 or Genie, however the SHIFT↓ keys may be used as an alternative, but there is a problem. Every time SHIFT↓ is pressed CHR$(26) is generated before the required control code; this is because SHIFT↓ generates control-Z on its own. In the ROM there is a table of ASCII values for the non-alphanumeric keys such as BREAK, CLEAR, ↓ , etc. In the table the value for SHIFT↓ is 1AH or 26 (ie, control-Z) — if this were changed to OOH (ASCII null) then the erronous control-Z would not occur.

All of the above modifications require changes to the first ROM (0000H — 0FFFH); this may be done by replacing it with an appropriately programmed 4k EPROM (eg 2732 or 2532). Some EPROMs are not pin for pin compatible with the ROMs fitted, and in this case one or two address lines may have to be moved.

Below is a table of the locations that require alteration.

M J Tubby

Table of alterations to Video Genie ROM 1

```
                                ;Old location's contents
0059 1A                         ;ASCII value used for SHIFT
                                ;
0105 52                         ;'R'
0106 45                         ;'E'
0107 41                         ;'A'
0108 44                         ;'D'
0109 59                         ;'Y'
010A 00                         ;Null characters
010B 00                         ;
010C 00                         ;
010D 00                         ;
010E 00                         ;
010F 00                         ;
0110 00                         ;Message terminator
0111 0D                         ;Sign up message 26 times carriage return
0112 0D                         ;on Genie, or 'RADIO SHACK LEVEL II BASIC'
 '                              ;on TRS-80
 '
 '
012A 0D                         ;Last of message characters
012B 0D                         ;Carriage return
012C 00                         ;Message terminator
                                ;
0471 FE 40      CP 'A'          ;Test with letter A
0473 38 08      JR C,047DH      ;jump to print if not alphabetic
0475 D6 40      SUB 40H         ;subtract 64, make alpha in range 0-26
0477 FE 20      CP 20H          ;test if lower case
0479 38 02      JR C,047DH      ;jump to print if upper case
047B D6 20      SUB 20H         ;convert lower case to upper case
047D CD 41 05   CALL 0541H      ;print next character on VDU

                                ;New contents
0059 00                         ;ASCII Value for null

0105 - 010F  inclusive          ;message 'Memory size'
0110 00                         ;message terminator
0111 - 012A  inclusive          ;message '    EG3008-II Basic L2
                                ;or any message upto 26 characters long
                                ;e.g.    Name & Telephone no.
012B 0D                         ;Carriage return
012C 00                         ;message terminator
                                ;
0471 00         NOP             ;No operation, i.e. ignore lower case conversion
0472 00         NOP             ;
0473 00         NOP             ;
 '
 '
047C 00         NOP             ;
047D CD 41 05   CALL 0541H      ;print next character on VDU
```

BBC 'BAD PROGRAM' FIX

If you have trouble loading tapes, perhaps because of dropout or some other gremlin, or write programs which go crashing through the Basic buffer and bring up the message 'Bad Program', you are then in a situation where most of the program may be intact but you can not LIST because the Bad Program flag will not go away. If you wish to recover at least something, then try typing the following as a command line — ie, one without a line number. (Any lines starting with a number would be fatal at this stage).

A=&E00: REP.B=A?3: IFA? B=13 A=A=B: U.0 ELSEU. TRUE: A?B=13; A?(B+1)=255<RETURN>

When the prompt returns type: END <RETURN>

You should then be free to LIST the remaining if slightly corrupted, part of the program. If the prompt fails to return after a few seconds, no harm will have been done — do not despair, just press ESCAPE and the dreaded 'Bad Program' will reappear. Now type:

A=?E04:REP.A=A+1.?A=13:P. A-&E00<RETURN>

If, for example, this returns the value 61 then type: !?E00=!6101000D <RETURN> and try the kludge again. All will now be well, but make sure you fix any subtle errors which may have occurred in the listing before RUNning it.

David Julien-Waring

ZX SPECTRUM BUG

I recently had the rather dubious honour of finding what I believe to be the first ZX Spectrum software bug *(you'd be lucky — Ed).* I stumbled across it when writing a short routine for a friend to extract the hundreds, tens and units from a three digit number. The routine was as follows:

```
10 REM X=3 DIGIT NUMBER
20 LET u=x-INT(x/10)*10
30 LET h=x/100
40 LET t=INT((h-INT h)*10)
50 LET h=INT h
60 PRINT "Hundreds=";h; "Tens=";t; "Units=";u.
```

The routine works fine until h−INT h=0.1, eg, when x=410. The Spectrum is therefore evaluating INT(0.1 * 10) as zero instead of one. The way to get round this is to amend line 40 to:

```
40 LET t=INT (.01+(h-INT h)*10)
```

which will ensure that the value is rounded up. Such a 'fudge' is irritating and should have been unnecessary.

Another Spectrum quirk but in this case useful is demonstrated by:

```
PLOT 128,87:DRAW 20,20,780
```

which will 'fill' a circle. Other high values for the third DRAW parameter give equally unusual results. Setting OVER also makes for an interesting effect.

Larry Carasco

SPECTRUM RAM OCCUPATION

I have found a way to find how much memory your program and variables are taking up in RAM. Also I have found a way to create an untouchable line (useful for copyrights). Both these routines are for the ZX Spectrum. To find out the memory used, type in PRINT (PEEK 23641+256*PEEK 23642)−(PEEK 23635+256*PEEK 23636). To get an untouchable line, first type in the line you want at line 1 (like 1 REM (C) M. SANDERSON 1982) then as a direct commend type POKE (PEEK 23635+256*PEEK 23636)+1,0. This will give you a line 0 which can not be taken out or edited in the usual way.

Mark Sanderson

TJ's WORKSHOP

ATOM 'BEEPTAPE'

A considerable frustration for many Atom owners is the lack of a useful 'end of operation' indicator for cassette loading and saving. The only present indication of successful completion is the all-too-silent, and easily overlooked, re-emergence of the screen cursor.

This routine cures the problem by providing an audible 'beep' signal on completion of load and save operations, which repeats until a key is pressed. For good measure, a clearer, visual indication is also provided in the shape of the inverse-video message, 'END OF TAPE TRANSFER'.

To assemble the program, simply type "RUN". I recommend assembling the code starting at #2800, out of the way of normal Basic text space. However, line 90 allows an alternative starting address to be entered, if desired. The program automatically advises you how best to save the machine code (see line 370). Line 380 tells you how to re-initialise the new operating system vectors, which needs to be done should you press BREAK. These vectors are automatically initialised for you if the assembled machine code is loaded using the '*RUN' command.

To appreciate the benefit of this small routine, try it the next time you perform a long LOAD or SAVE. Instead of developing square eyes waiting for the re-emergence of the screen cursor, you can safely get on with something more useful, like writing your next masterpiece!

V. Fojut

```
 10 REM*****************************************
 20 REM "BEEPTAPE"
 30 REM ATOM O.S. PATCH FOR AUDIBLE
 40 REM 'END OF LOAD/SAVE' INDICATION.
 50 REM (C) V.FOJUT, 1982.
 60 REM*****************************************
 70 DIM LL3, L1
 80 FOR N=0 TO 3: LLN=-1: NEXT N
 90 INPUT "ASSEMBLE FROM (HEX)" S
100 INPUT "LIST ASSEMBLY (Y/N)" $L
110 FOR N=1 TO 2
120  IF $L="N" PRINT $21; REM SUPPRESS LISTING
130  P=S; REM SET UP CODE POINTER
140[
150 :LL0 JSR #F96E     \LOAD FILE
160 :LL1 JSR #F7D1     \EXECUTE CONTROL CODES
162];REM               \& PRINT FOLLOWING STRING
164 !P=#D07:P=P+2 :REM CARR.RET. & "BEEP"
166  $P="end of tape transfer"
168  P=P+LEN(P):REM    \REALIGN "PROGRAM COUNTER"
170[     NOP           \END OF STRING MARKER
180      JSR #FE71     \KEY DOWN?
190      BCS LL1       \NO, BEEP AGAIN
195      JSR #FFED     \CR/LF
200      RTS           \YES, EXIT.
210\
220 :LL2 JSR #FAE5     \SAVE FILE
225      CLV           \FORCE FOLLOWING BRANCH
230      BVC LL1       \(=JMP IN RELOCATABLE CODE)
240\
250 :LL3 LDA @LL0%256 \SET
260      STA #20C      \UP
270      LDA @LL0/256 \NEW
280      STA #20D      \ADDRESSES
290      LDA @LL2%256 \IN
300      STA #20E      \VECTOR
310      LDA @LL2/256 \TABLE.
320      STA #20F
330      RTS
340]
350 NEXT N: PRINT $6: REM TURN SCREEN ON
360 @=5
370 PRINT " *SAVE""BEEPTAPE""&S,&P,&LL3'
375 @=4
380 PRINT "TO SET UP VECTORS, LINK #" &LL3'
390 END
```

PET TO REAL-ASCII

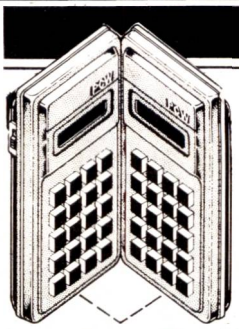
For Old ROM PET 2001, this machine-code converts PET ASCII to real-ASCII if characters have to be sent to a printer (device nr 4).

When printing to the screen nothing is changed. Strings in PET are never changed. The program was developed to be able to print lower case characters on an ASCII printer (Epson MX 80 with a standard IEEE-interface). When loaded any PRINT statement can be replaced by
SYS (826)A$
SYS (826)A$(X,Y)
SYS (826)A
SYS (826)A(X,Y)
SYS (826)any expression.

Robert de Rooij

```
100 REM CONVERTS PET-ASCII TO REAL ASCII
110 REM FOR PET 2001 OLD ROM TO EPSON MX80
120 POKE 59468,14
130 REM AUTHOR R DE ROOIJ
140 REM MELIS STOKESTR 35, 5013 BK TILBURG/HOLLAND
160 REM IDEA DERIVED FROM A PROGRAM
170 REM ON PAGE 143 BEST OF UK COMMODORE PET NEWSLETTER
180 REM IN STEAD OF 'PRINT A$' TYPE 'SYS(826)A$'
190 REM AFTER EACH SYS-COMMAND YOU HAVE TO TYPE :PRINT, AS NO
210 REM CARRIAGE-RETURN IS GENERATED.
220 REM PROGRAM WORKS FOR ALL EXPRESSIONS (NUMEROUS AS WELL
    AS STRINGS).
230 REM IT WORKS FOR SIMPLE VARIABLES AND ARRAYS.
240 REM SET PRINTER ON-LINE WITH OPEN4,4:CMD4
250 REM ALL ASCII-VALUES, HIGHER THEN
260 REM 191 ARE DECREASED BY 96.
270 REM ATTENTION: DEVICENUMBER MUST BE '4'.
280 REM STRINGS IN PET ITSELF ARE NOT BEING CHANGED.
300 REM ON THE SCREEN YOU ALSO CAN PRINT BY TYPING THE COMMAND
310 REM SYS(826)A$ INSTEAD OF PRINT A$.
320 REM WHEN LOADED THIS SMALL MACHINE-CODE IN THE CASS.BUFFER
330 REM YOU CAN, AT ANY TIME, CALL FOR SYS(826)
340 REM DURING PROGR.MODE AS WELL AS IN DIRECT MODE.
350 REM THE CODE IS FULLY RELOCATABLE WITH ONE EXCEPTION.
360 REM YOU MUST CHANGE THE UNCONDITIONAL JUMP IN LINE 858.
380 REM SEE DISSASSEMBLER LISTING.
390 REM THESE ARE THE BYTES 859/860.
450 FORR=826TO875
460 READ A:POKE R,A: NEXT
470 DATA  32,184,204, 36, 94, 48,  6, 32,175,220
480 DATA  32,107,211, 32,126,213,160,  0,170,240
490 DATA  28,177,113, 72,173,100,  2,201,  4,240
500 DATA   4,104, 76,100,  3,104,201,192,144,  2
510 DATA 233, 96, 32,210,255,200,202,208,228, 96
600 STOP
700 REM AN EXAMPLE
710 PRINT"This was printed by the command 'PRINT'"
720 SYS(826)"This was printed by command 'SYS(826)":PRINT:PRINT
725 PRINT"Printed by the command 'PRINT':":
730 PRINT"How much is 144^2*12/6? This is"144^2*12/6:PRINT
740 PRINT"Printed by command: SYS(826):"
750 SYS(826)"How much is 144^2*12/6? This is"
760 SYS(826)144^2*12/6:PRINT
770 Y=826:SYSY"In stead of 826 You may of course use a
    variable":PRINT
 780 SYSY"And now open your ASCII-printer. Type 'RUN 700'"
READY.
```

```
DEC  HEX                          Hex                DEC
826  33A   20 B8 CC   JSR  $CCB8                     52408
829  33D   24 5E      BIT  $5E                       94
831  33F   30 06      BMI  $347                      839
833  341   20 AF DC   JSR  $DCAF                     56495
836  344   20 6B D3   JSR  $D36B                     54123
839  347   20 7E D5   JSR  $D57E                     54654
842  34A   A0 00      LDY  #$00                      0
844  34C   AA         TAX                 0
845  34D   F0 1C      BEQ  $36B                      875
847  34F   B1 71      LDA  ($71),Y                   113
849  351   48         PHA                 0
850  352   AD 64 02   LDA  $0264                     612
853  355   C9 04      CMP  #$04                      4
855  357   F0 04      BEQ  $35D                      861
857  359   68         PLA                 0
858  35A   4C 64 03   JMP  $0364                     868
861  35D   68         PLA                 0
862  35E   C9 C0      CMP  #$C0                      192
864  360   90 02      BCC  $364                      868
866  362   E9 60      SBC  #$60                      96
868  364   20 D2 FF   JSR  $FFD2                     65490
871  367   C8         INY                 0
872  368   CA         DEX                 0
873  369   D0 E4      BNE  $34F                      847
875  36B   60         RTS                 0
```



Time marches on and Calculator Corner must march with it. From now on this column will be called PORTABLE COMPUTER WORLD, so that not only calculators but new machines like the Sharp PC1500 and the HP-75C and Epson HX20 can be covered without hurting anyone's feelings. Just to prove that I don't intend to forget calculators, this months column, by Ed Rosenstiel, is for the TI-59

CONTINUED FRACTIONS

In my time continued fractions were not done at school, so I'll explain briefly this remarkably easy to understand concept which may well have been known in antiquity, and which has ramifications in many branches of higher mathematics.

Any (real) number X has a unique counterpart of the form

$$N_1 + \cfrac{1}{N_2 + \cfrac{1}{N_3 + \cfrac{1}{\text{etc}}}}$$

with integral Ns, either finitely many — when trivially X = N_1 or when X is just a common fraction, ie, rational — or else the 'continued fraction' (technically called 'simple' since all its 'numerators' are 1) goes on for ever, like an infinite series.

Take, for example, X = 2.2857142857142857142

hence $(X - 1)(X + 1) = X$, ie, x^2-x-1=0

Of this equation

$$X = \sqrt{5/2 + 1/2} \simeq 1.62$$

is the relevant root, since X>1. Many will recognise this equation as the one for the famous 'Golden Section', which defines a rectangle with sides 1 and ≃1.62 respectively, and that the so-called 'convergents' of [1;1], ie, 1/1, 2/1, 3/2, 5/3, 8/5, contain the well-known Fibonacci numbers. (This example also shows that there are periodic CFs which are not just the square root of an integer.)

Having loaded the CF-program into the TI-59, any *real* number can also be entered — eg, π^2 (with π ≃3.141592654), which gives the CF of $\sqrt{\pi^2}$ = CF of π = [3;7,15,1,292,1,1,1,2,1,· · ·] accurately to 10 places. Although unending, no periods or regularities have been discovered among the first several thousand partial quotients of this CF, nor in any other irrational reals excepting square roots *and* the Euler number e = INV 1n 1 and some simple arithmetical formulas based on these two exceptions. (Enter e^2 and discover a 'regular' non-periodic infinite CF!)

The CF of another Euler number called γ (gamma) = the limit (as n — ∞) of $(1 + 1/2 + 1/3 + \ldots + 1/n - 1n\ n) \simeq$ 0.577. . . has also been calculated to several thousand digits without finding any regularities. This makes it likely by unproven that this number is not rational, but here is one of the famous unsolved problems of mathematics, namely whether γ (gamma) is the root of some algebraic equation or is transcendental like e and π , or is rational after all.

Now to use the inverse CF-program: Enter in sequence the partial quotients of some CF by pressing after each of the first five the keys E,A',B',A,B, respectively, then follow further entries by alternating between keys A and B. After any entry and appropriate key stroke the corresponding convergent is displayed, first its numerator, then the denominator. After the first two entries (E and A'), whenever zero is entered and followed by the keystroke which was used last, the decimal value of the convergent reached so far is displayed and the program is reset.

Examples

a) $\pi \simeq$ [3;7,. .].
Enter 3,E; display 3.
enter 7,A';display 22(PAU/PRT)7
enter 0,A';display 3.142857143

b) $\pi \simeq$ [3;7,15,1,292,. . .]
Enter 3,E; display 3.
enter 7,A';display 22(PAU/PRT) 7
enter 15,B'; display 333(PAU/PRT)106
enter 1,A; display 355(PAU/PRT)113
enter 0,A; display 3.14159292

It is noteworthy that the approximation $\pi \simeq$355/113, known already in China in antiquity, which is accurate to 2.7×10^{-7} is followed by the unusually large partial quotient 292. Such large PQs in CFs often give a clue to hidden and obscure interrelationships (Churchhouse, 1973).

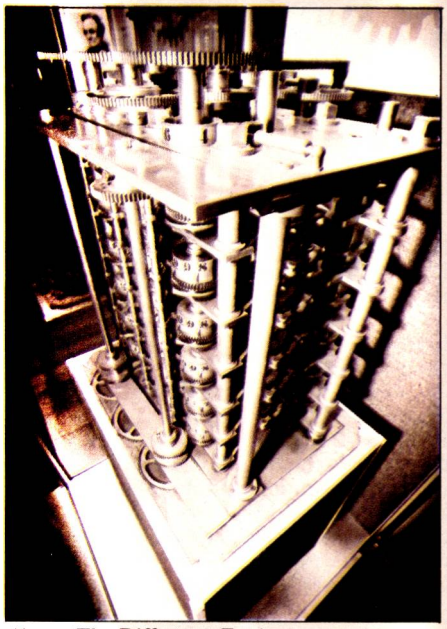
Regarding the (so far unending) CF of γ (gamma) it is — as for the CF of π — not even known whether the partial quotients have an upper bound, but that they are unbounded for e was already known to Euler (1701-1783). Finally, the convergents of $\sqrt{N}$ readily supply integer solutions of the famous PELL equation $X^2 - N.Y^2 = 1$ (Beiler, 1964) — but that is another story.

References

Beiler, A H: *Recreations in the Theory of Numbers* Dover Publications, Inc., New York, 1964.
Churchhouse RF: *JIMA, 1973,9,17*
Patz W *Tafel der regelmassigen Kettenbruche,* Becker & Erler, Leipzig, 1941.

CE WHILST INTOXICATED.

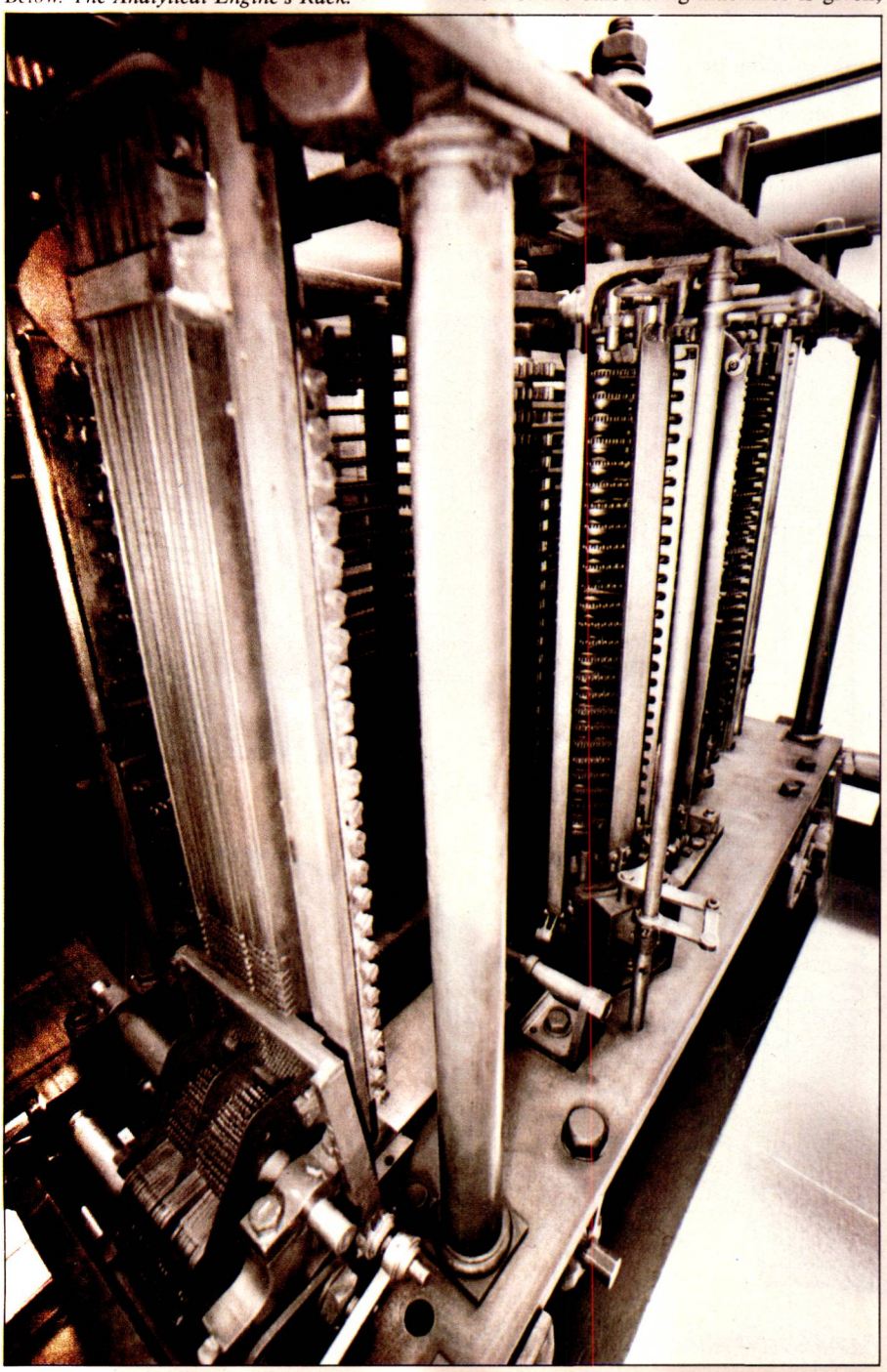
KNOWING NO BETTER THE FOOLISH BEARS ATTEMPT TO REPAIR THE DEV



THE NEARLY MAN

Charles Babbage is remembered as the man who nearly invented the digital computer. Working in a pre-electronic age he nevertheless discovered principles which were not put into practice until Von Neumamin in the 1940's. His mechanical computer was defeated by the lack of precise enough manufacturing techniques. Nigel Holder tells the story.

Above: The Difference Engine.
Below: The Analytical Engine's Rack.



This is an account of the work of the pioneer of automatic calculating machines, Charles Babbage. His Difference Engine and Analytical Engine will be discussed. The emphasis is mainly historical, and as such there will be no detailed descriptions of how the machines work. A general overview of the calculating machines is given, as well as a description of the problems that Babbage faced.

With the advances in technology towards the end of the eighteenth century, mathematical tables assumed an increasing importance as an aid to calculation. These tables were more often than not riddled with errors, introduced either during the original computation or at the typesetting stage.

The Difference Engine

The method used to calculate the tables was the 'method of differences'. This had the advantage of using addition only in calculating the next value of a function, even if the function was very complex. This simplified the task of the computers (the name given at the time to the human evaluators), and reduced the risk of error since addition is easier to perform than multiplication. Another great asset of this method is that each result obtained relies on the previous result. Therefore, if the hundredth result is correct then it is almost certain that all of the previous results are also correct.

The method of differences work as follows (see PCW Dec pg 134):

If a function such as $F(x) = 3x + 7$ is evaluated for successive values of x, the difference between adjacent values of F(x) is found to be constant.

For $F(x) = 3x + 7$

x	*F(x)*	*D^2*
0	7	
1	10	3
2	13	3
3	16	3
4	19	3

For $F(x) = x^2$

x	*F(x)*	*D^2*	*D^2*
0	0		
1	1	1	2
2	4	3	2
3	9	5	2
4	16	7	2
5	25	9	2

D^2, the second difference, is constant in case of $F(x) = x^2$.

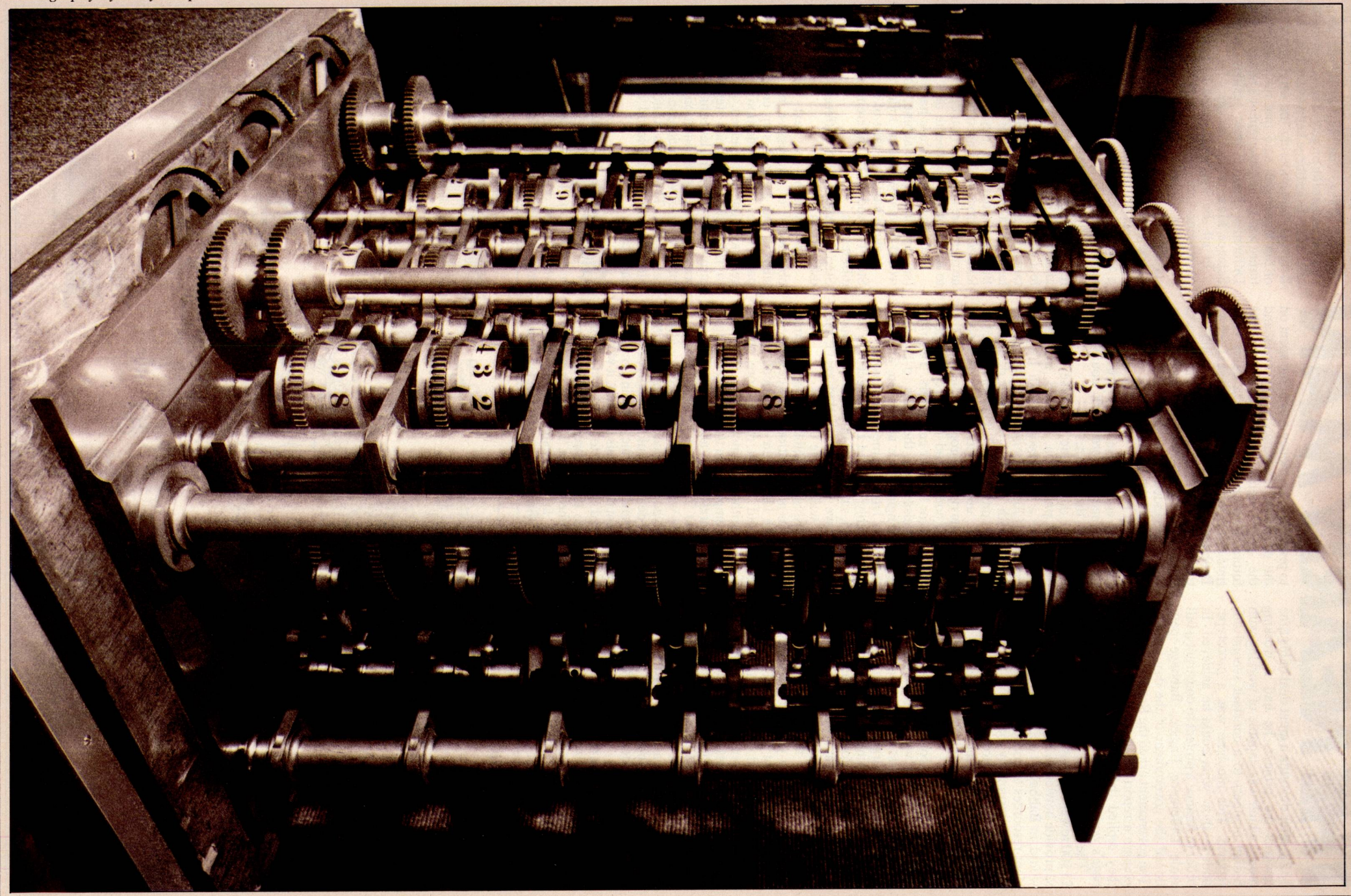
In general, for a polynomial of degree n (x^n), the nth difference will be constant.

Although all polynomials have a constant difference, functions of much greater interest, such as logarithms and trigonometric functions, do not in general have a constant difference.

In order to produce tables for these functions by using the method of differences, it is necessary to divide the function into sections which may be approximated by suitable polynomials.

In 1820 Charles Babbage, aware of the problems inherent in producing tables (he had already produced a few of his own), decided to design and construct a machine which would compute and typeset mathematical tables — a Difference Engine. By

Photography by Tony Sleep



THE NEARLY MAN

1822, after devoting a great deal of his time towards the project, he had a working model which was capable of working with 6-digit numbers to a constant second difference. This machine was a prototype, built to show what could be achieved. In order to finance a project to construct a full scale Difference Engine, Babbage petitioned the government of the day for aid. The government asked the Royal Society to prepare a report on the project's viability; they replied that, in their opinion, Babbage's work should be aided where possible.

The government agreed to advance £1500 towards the project; Babbage agreed to provide between £3000 and £5000. This would, in Babbage's opinion, provide sufficient resources to construct the Difference Engine (presumably based on his experience with the prototype), in two to three years, at which time he hoped that the government would reimburse his financial outlay.

But Babbage discovered that a full scale Difference Engine was a great deal more complicated to construct than a prototype. The machine was larger and more complex, and thus required finer tolerances of components. He also found that the state of engineering at the time was not sufficiently developed to construct his Difference Engine. Babbage therefore decided to devote the first few years of the project to advancing the art of mechanical construction. This involved designing a part and then designing a tool for making the part. During this process, an alternative and often simpler method would sometimes appear — the whole process of design and construction would then be repeated. Although this was a costly and time consuming process, Babbage's work advanced the state of engineering in Britain by many years.

Due to the project taking longer and costing a great deal more than originally anticipated, Babbage frequently found himself asking the government for more money; he had the Royal Society audit his accounts to prove that the money was being spent on the project. Unfortunately, the audit and the government's deliberations on the future of the project meant a delay each time (up to four years in some cases) before Babbage received any money. During this time, work on the project all but stopped; most of the engineers working for Babbage were disbanded (however, this helped to spread Babbage's engineering advances throughout Britain) — each time the money was received Babbage had to hire and train new engineers before work could commence on the project.

It was during one of these enforced breaks in production, in 1833, that Babbage had a disagreement with his chief mechanic (Joseph Clement, who had always stayed with Babbage — even during the breaks in construction). This was never settled and, under British law, mechanics possess the right of property of all tools that they have constructed, even if construction was paid for by their employers. This right was exercised, and the plans to the Difference Engine were also taken, although they were later returned. This would have considerably delayed the project if it had continued, since all of the tools would have had to have been constructed again; this, however, was not the case.

During this time Babbage, while attempting another modification to the design, conceived the idea of the Analytical Engine. This would need a much more sophisticated arithmetic mechanism than that currently employed in the Difference Engine — he therefore set about designing one. After over 20 different designs, he produced one which he considered could not be improved. He decided that this new improved design should be incorporated in his Difference Engine, and informed the government that, in his opinion, it would be quicker and cheaper to incorporate his new design into the Difference Engine than to complete the old one. The government was dismayed at the thought of yet another redesign after nine years of delay (and a change of government) and in 1842 informed Babbage that they would not continue financing the project. The government offered to let Babbage keep everything, but Babbage, remembering the original terms of the agreement, said that the machine's future was in the government's hands — the Difference Engine now resides at the Science Museum in London.

In all, Babbage had spent £17,000 of government money, and it is estimated that he spent a further £20,000 of his own personal fortune. The Difference Engine that Babbage had constructed at the collapse of the project was a working model which had a constant third difference, and handled 6-digit numbers.

Had it been fully completed, the Difference Engine would have been approximately 10 feet high, 10 feet wide and five feet deep. It was to have worked to a constant sixth difference, handling integer numbers to a precision of eighteen digits. Babbage had realised that truncation could lead to errors when accumulating results; he therefore devised a rounding mechanism to round off the eighteenth digit correctly.

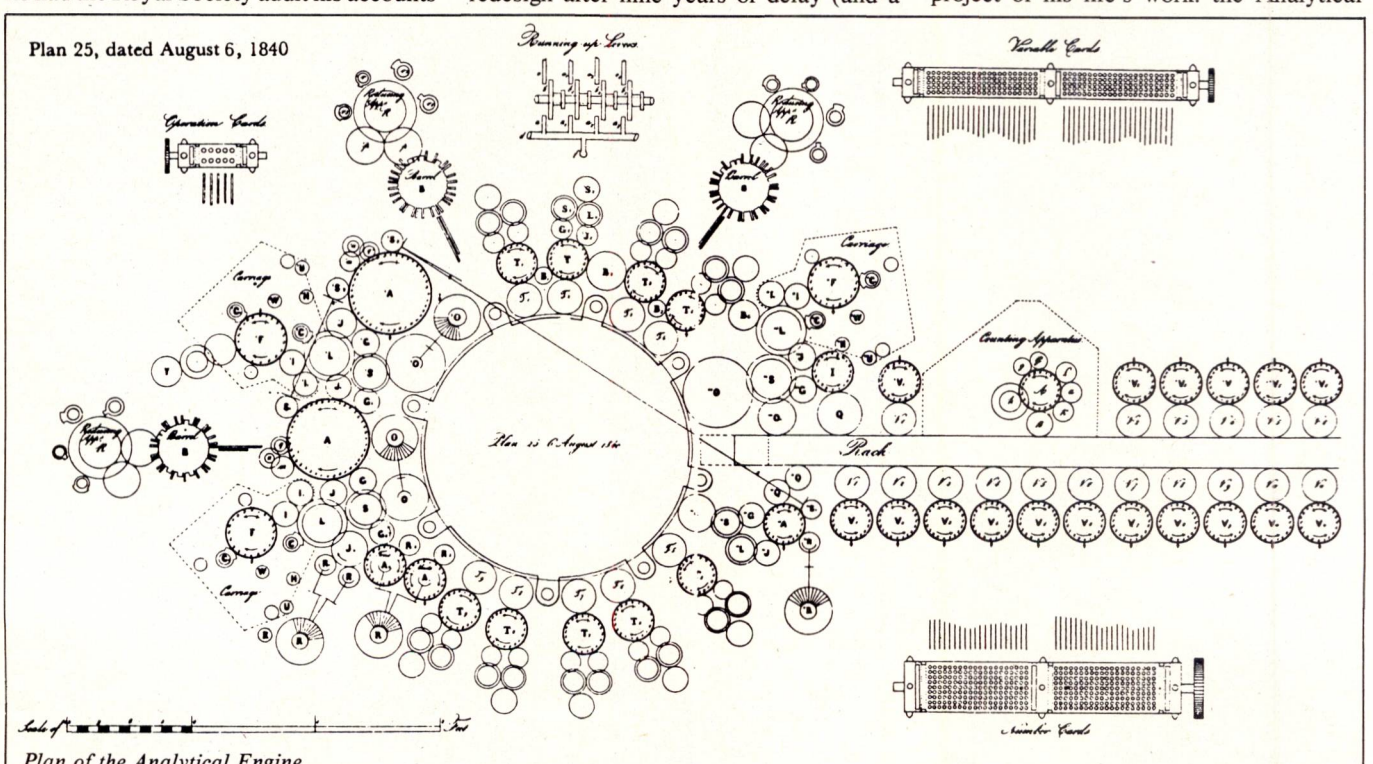
Once the initial values had been loaded (set up) into the machine, the machine would have operated as follows:

A cycle would consist of two steps —
Step 1 : Add ODD differences to EVEN differences
Step 2 : Add EVEN differences to ODD differences

The result of the next value is now obtained. For successive results, repeat steps 1 and 2. Each step consists of two parts since after addition any carries generated had to be added, allowing them to 'ripple through'. Each step consisted of turning the operating lever half a turn backward (producing the addition), followed by half a turn forward (addition of any carries generated). The words 'Calculation Complete' would be displayed at the end of each cycle.

The Analytical Engine

In 1833, Charles Babbage began work on what turned out to be the most ambitious project of his life's work: the Analytical



Plan of the Analytical Engine

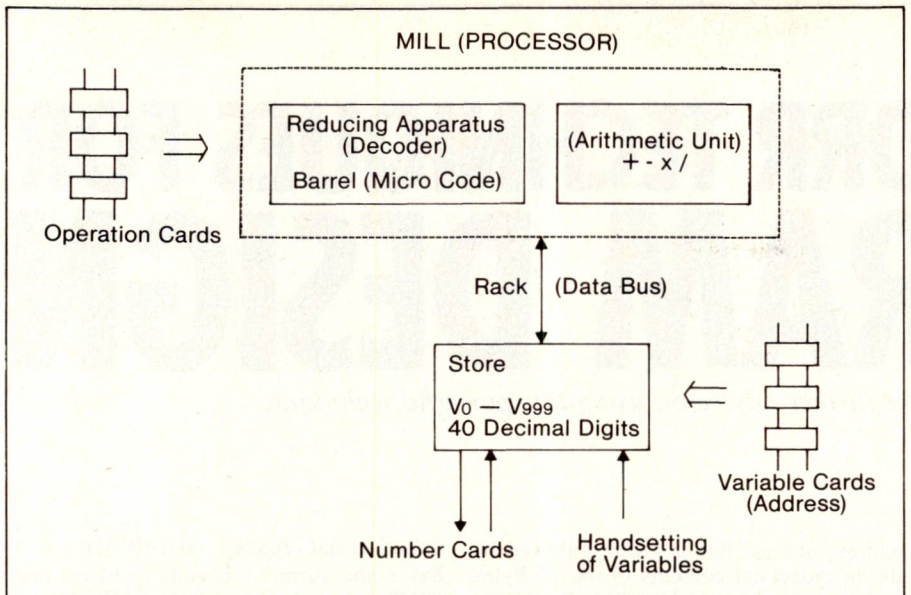
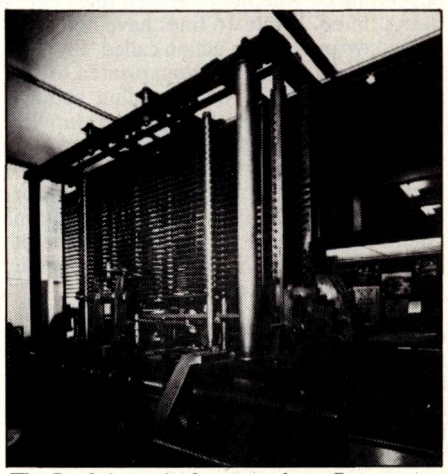


Fig 2 Diagrammatic representation of the Analytical Engine



The Rack is equivalent to a data -Bus

Engine. This machine was strikingly similar in concept to computers of today, although it was never completed. During the many years devoted to the project, many excellent engineering drawings were made of parts of the Analytical Engine; work had in fact started on constructing the machine before Babbage's death in 1871 — at his own expense since there were no means of raising financial aid after the collapse of his Difference Engine project.

The Analytical Engine would have been the first general purpose automatic calculating machine. It was to be capable of doing virtually any mathematical operation. It would follow the instructions programmed into it by its operators, and even go on to make decisions about which instructions to follow next, based on the results of its own computations. Both the instructions and data were to be entered separately on punched cards designed by Babbage. The cards themselves were strung together with narrow ribbons — this enabled the cards to read sequentially in either direction. Following the instructions, a processing unit called the 'mill' by Babbage performed operations on the data and returned the results to the 'store'. The final results were to be printed out or automatically set in type.

The Analytical Engine was conceived to be on a massive scale. It was to be powered by steam and was capable of storing up to a thousand 40-digit numbers; it would have been about the same size and weight as a small railway locomotive. Whenever it required additional values for a calculation it was working on it could signal to its operators that it needed additional values by ringing a bell.

The Analytical Engine was a decimal machine which used sign and magnitude representation for the numbers. A decimal number base was used since, unlike electrical circuits, in a mechanical device it is just as easy to represent ten states as it is two states; the decimal system is man's 'natural' number system. A sign and magnitude representation was chosen since it simplifies input/output and the examination of internal states of the machine. It also simplifies multiplication and division. Throughout the machine numbers are represented by the positions of wheels (each holding a digit), rotating about a vertical axis.

As previously mentioned, the basic theory of design of the Analytical Engine is remarkedly similar to that of modern computers. To show this, Figure 2 shows, in a diagrammatic form, the main architectual features of the Analytical Engine with modern names in brackets. Figure 1 shows Babbage's General Plan 25, which is the general configuration of the Analytical Engine. In contrast to his Difference Engine, Babbage has distinctly separated the Store from the Arithmetic Unit.

The basic four arithmetic operations are provided — addition, subtraction, multiplication and division. Two variations on the above are also provided — multiplication and division with limited precision. These operations are provided for when the full 40 digits of accuracy are not required or when the speed of computation is important. Since the operations are mechanical, a multiplication/division would take about four minutes.

A major innovation was the use of a barrel for control of complex operations such as multiplication and division. The barrel would have studs around the outside, against which levers would rest (with as many as 70 'rings' to a barrel, each ring containing up to 80 studs). As the barrel revolved, whenever a stud touched a lever the lever would move. By use of many levers, the operation would take place synchronously for one revolution of the barrel. Today, exactly the same concept is used in computers, known as micro code (or micro programming). Another great innovation was the advent of a 'look ahead carry' mechanism. Since there were 40 digits to a number, the process of allowing the carry to 'ripple through' would take a great deal longer than the addition itself required. Babbage realised this and developed the technique of 'look ahead carry' (which he called 'anticipatory carry'), allowing an addition to take place in one operation as the carry would be pre-determined. This technique proved the most difficult for Babbage, and he spent a great deal of time perfecting this technique.

Babbage spent most of his time on the project in designing and redesigning parts of the Analytical Engine. He appeared to find great satisfaction with the intellectual stimulus of theoretical design (perhaps it was because he realised that the machine would probably never be built — at least in his lifetime, anyway).

The reading of numbers from the store had a destructive effect in that, once read, the value was no longer held in the store (compare with the destructive read of 'core store' memory on early electronic computers) — if the number was required for further calculation, it had to be written back into the store.

As far as programming the Analytical Engine was concerned, Babbage did not have a very clear idea of how this would be achieved; it was as if this was a secondary consideration — he was concerned mainly with the mechanical working of the machine. The store could be accessed only by specifying the location in the instruction itself; there was no true variable address concept that would allow the store to be accessed as an array or vector. This is not really a criticism of Babbage himself, since the early electronic computers also lacked this ability until John von Neumann proposed it in 1945. The Analytical Engine possessed what is known today as the 'three address system', in which two addresses specify the operands to be used, and the third specifies where the result is to be placed.

It is perhaps a shame that Charles Babbage had so many great ideas, but was never able to realise them fully. If he had successfully completed the Difference Engine, he would have probably been granted financial aid for the Analytical Engine — it is just possible that, given enough time, the engineering technology of the day would have permitted the Analytical Engine to have been constructed. It is ironic that Babbage himself was the prime cause of his failures; he was always updating and modifying his designs — if he had kept to a single design throughout he would have probably completed the Difference Engine. His work was not in vain, though, for it stimulated others into designing and constructing their own Difference Engines, as well as advancing the state of engineering in Britain by many years.

It is not known exactly to what extent Babbage's work affected the design of early electronic computers, although it is thought to be only superficial — in which case it is remarkable that Babbage's concepts are so similar to those of modern computers. It is almost certain that computers would have evolved earlier if the Analytical Engine had been built. It is a shame that Babbage is mostly remembered for his failures; he was a brilliant mathematician and design engineer, years ahead of his time.

For anyone interested in early mechanical and electronic computing, an excellent book to start with is *The Origins of Digital Computers,* edited by Brian Randell and published by Springer-Verlag. The price is £18.45, and the ISBN is 0-387-11319-3. This book contains selected papers, and for the really keen person, the bibliography contains over 850 items. END

WARNIER-ORR TECHNIQUES FOR PROGRAM DESIGN

Paul Overaa gives further advice on using this powerful technique.

Assembly language programming is prone to difficulties that are not generally in higher level languages. One major factor is that assembler programs are notoriously difficult to read, and thus difficult to understand. Such difficulties make progress in writing low level language routines slow compared with equivalent progress in high level languages. As the size of programs increases the difficulties become more apparent, with the result that developing even moderate size assembler programs becomes a major undertaking.

The pioneering work of Professor Warnier in France and the subsequent work of Keneth T Orr in the USA has resulted in an approach to designing and writing programs that is now beginning to be considered as one of the most important advances in program design made to date. The techniques emphasise the role of finding the logical solution to a problem in terms of the program before such considerations as language and coding are dealt with. Because of this the techniques are essentially language independent and are therefore applicable to all types of programming problems.

Resultant programs are logically correct before they are coded and inevitably work 'first time' bar any typing errors from those of us that suffer from keyboard dyslexia. As as example of the technique in use, I have selected a relatively short utility subroutine called DUMP whose purpose is to dump the contents of a selected page of memory in hex form and in printable characters form.

To print the contents of 256 bytes (ie, one page) using 16 lines of 16 bytes, the format to be used is as follows: the starting address of each line is given, followed by the hexadecimal contents of the 16 bytes and secondly by the character representation of those same bytes. Non-printing characters (ie, control characters) must be printed as a period. Figure 1 shows an example of the required format.

Steps in program design

Having described in words what we want our program to do we now attempt to express this in terms of a Warnier-Orr diagram. Figure 2 is such a diagram and contains the bare essentials of our problem. If you are not familiar with the basic concepts then previous articles in *PCW* (October 1981 and April 1982) will be of use. I will restate the essential conventions. The diagrams are sets of hierarchical square brackets that are read downwards within each bracket. The brackets contain statements of what actions are to occur and statements of what decisions are required at certain stages of the program. A statement with a bar written over it signifies the logical opposite — ie, in Figure 2 there is a statement '16 lines printed' which is interpreted as the logical opposite — '16 lines have *not* been printed'. Statements that are mutually exclusive are written with a ⊕ sign separating them. Such statements infer that only one of the actions will be performed. When the word 'SKIP' is written in a bracket it means that no actions are associated with the bracket. If a bracket to the right of a statement does itself contain further statements then these are actions to be performed if the higher level statement has been performed.

Figure 2 tells us that we are dealing with a routine that is called 'DUMP' and that it has some form of beginning block and another as yet unspecified 'END' block. Two mutually exclusive options exist depending on whether or not 16 lines have been printed. While 16 lines have not been printed we perform an action called 'PRINT LINE'. If 16 lines have been printed, then, since there are no corresponding actions within the bracket on the right, we skip the bracket and perform the 'END' block.

Notice that we have not specified how to print a line or how we start or finish our routine. We are only interested initially in attempting to create on paper some form of basic structure consistent with the essential details of our problem.

The next stage in the design process is one of 'iterative refinement' — ie, we look at our problem and attempt to find areas that we can specify in greater detail. In this case our original problem specification indicates that we can add more detail to the 'PRINT LINE' bracket since we have specified that we wish to print the contents of 16 bytes on each line. Figure 3 is the diagram showing this.

Notice that we add to our initial diagram by progressive expansion rather than by altering the basic structure.

Our problem tells us how we are to print each line and we can expand Figure 3 to show that we are to print the contents of each line of 16 bytes in hexadecimal form and then in ASCII character form. Figure 4 reflects this and also introduces statements that indicate we will be using some means of counting how many lines we have printed and how many bytes of current line have been printed.

This process of 'iterative refinement' can

```
AA00H  29 0E 00 00 00 53 C3 41 AA 60 AA F5 BB 43 B9 21   )....S.A.`...C.!
AA10H  1A AA 06 00 09 4E C3 21 B7 00 03 06 09 0C 0F 02   .....N.!........
AA20H  05 08 0B 0E 01 04 07 0A 0D 10 14 1A 06 0C 12 18   ................
AA30H  04 0A 10 16 00 00 00 00 00 00 10 1F 03 07 47 B0   ..............G.
AA40H  04 EB 22 0A AC 21 09 AC 71 21 00 00 39 22 0E AC   ..".."..!..q!..9".."
AA50H  31 40 AC CD D3 B3 2A 0E AC F9 2A 0C AC 7D 44 C9   1@....*...*..}D.
AA60H  21 A4 AA CD 7B AA FE 03 CA 00 00 C9 21 AF AA C3   !...{.......!...
AA70H  75 AA 21 B6 AA CD 7B AA C3 00 00 E5 CD 53 AB 3A   u.!...{.......S.:
AA80H  08 AC C6 41 32 A0 AA 01 94 AA CD 5D AB C1 CD 5D   ...A2......]...]
AA90H  AB C3 BA AA 42 44 4F 53 20 45 52 52 20 4F 4E 20   ....BDOS ERR ON
AAA0H  20 3A 20 24 42 41 44 20 53 45 43 54 4F 52 24 53    : $BAD SECTOR$S
AAB0H  45 4C 45 43 54 24 52 2F 4F 24 21 07 AC 7E 36 00   ELECT$R/O$!...6.
AAC0H  B7 C0 C3 09 B7 CD BA AA CD D3 AA D8 F5 4F CD 3A   .............O.:
AAD0H  AB F1 C9 FE 0D C8 FE 0A C8 FE 09 C8 FE 20 C9 3A   ............. .:
AAE0H  07 AC B7 C2 01 AB CD 06 B7 E6 01 C8 CD 09 B7 FE   ................
AAF0H  13 C2 FE AA CD 09 B7 FE 03 CA 00 00 AF C9 32 07   ..............2.
```

Fig 1

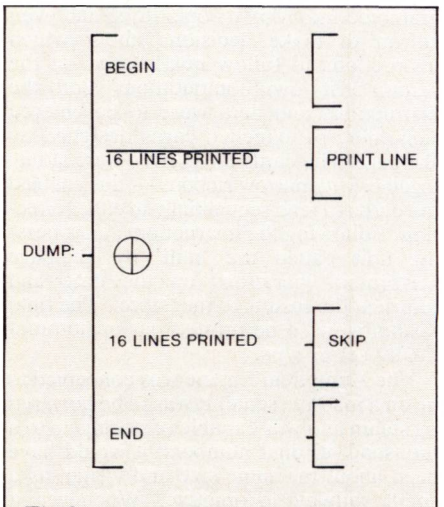


Fig 2

be continued because we also know from our original specification of the problem that having printed the hexadecimal form of our 16 byte line we print the ASCII form of the same bytes. *But*. . . if the character is non-printing then we must print a 'period' instead. These additional restraints are shown in Figure 5 as an expansion of the Figure 4 statement 'PRINT SAME 16 BYTES AS ASCII FORM'.

Notice that as we expand the statement bracket we do not alter any of the other parts of the diagram. The diagram as it 'evolved' is separating the problem into distinct separate logical entities and it is this effect of the design technique that is particularly significant.

At this stage I would mention that these diagrams evolve very quickly once you are used to the technique and as they do they formalise the 'logic' of the problem in a way that is obviously language-independent.

Since the problem we are dealing with is simple it is instructive to combine Figures 4 and 5 to show the complete representation that, as you will see, is the solution in terms of the program design.

Figure 6 is then the combined diagrams of Figures 4 and 5. It represents the logical statement of our problem and it is the logical solution to the associated problem of designing the program. It is possible to continue the process of iterative refinement to any level that is desired, but for the purposes of this example I now wish to consider the transition from our Warnier-Orr diagram to the coding of an 8085 assembly language program. The coding was written for a CP/M environment utility subroutine

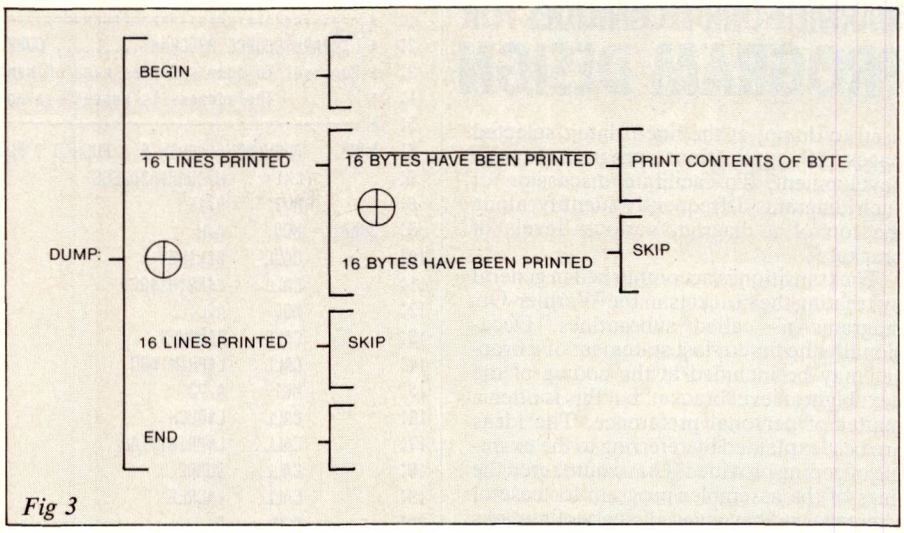


Fig 3

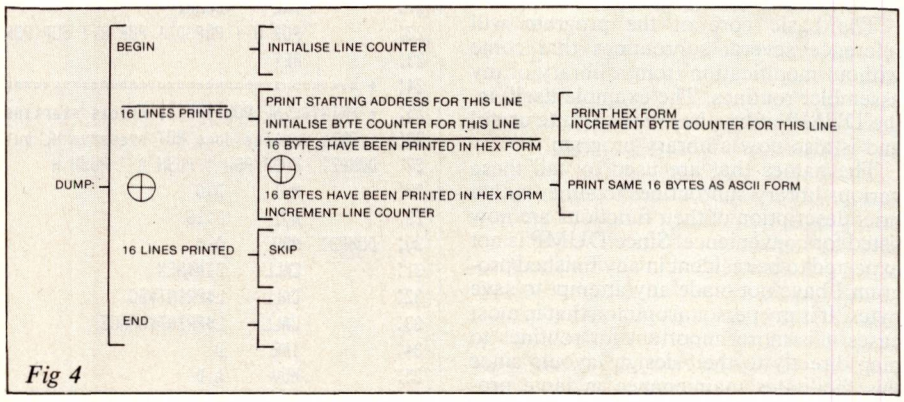


Fig 4

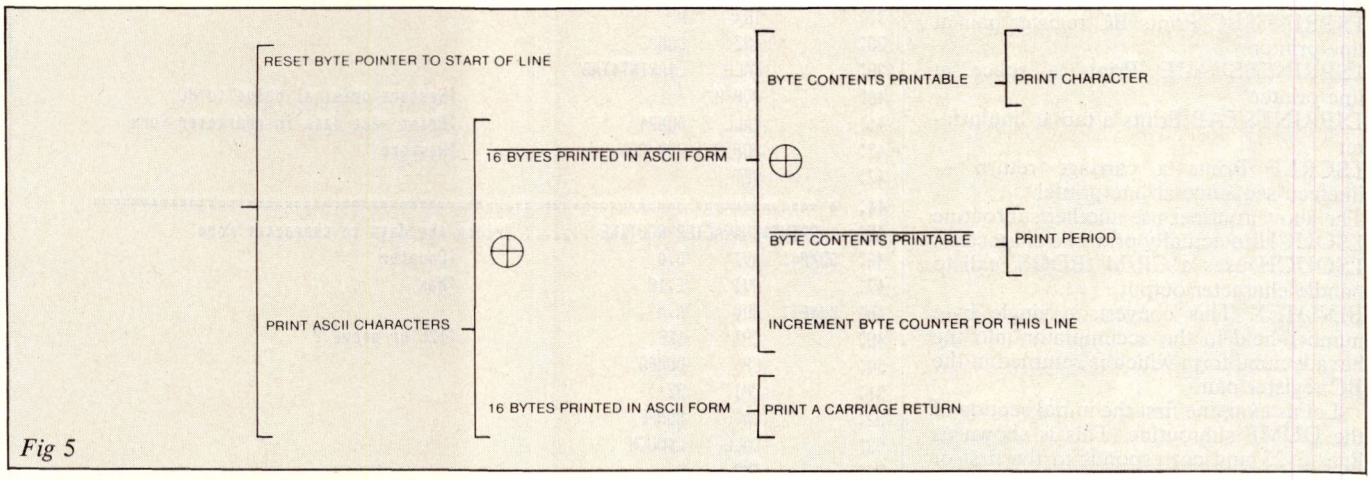


Fig 5

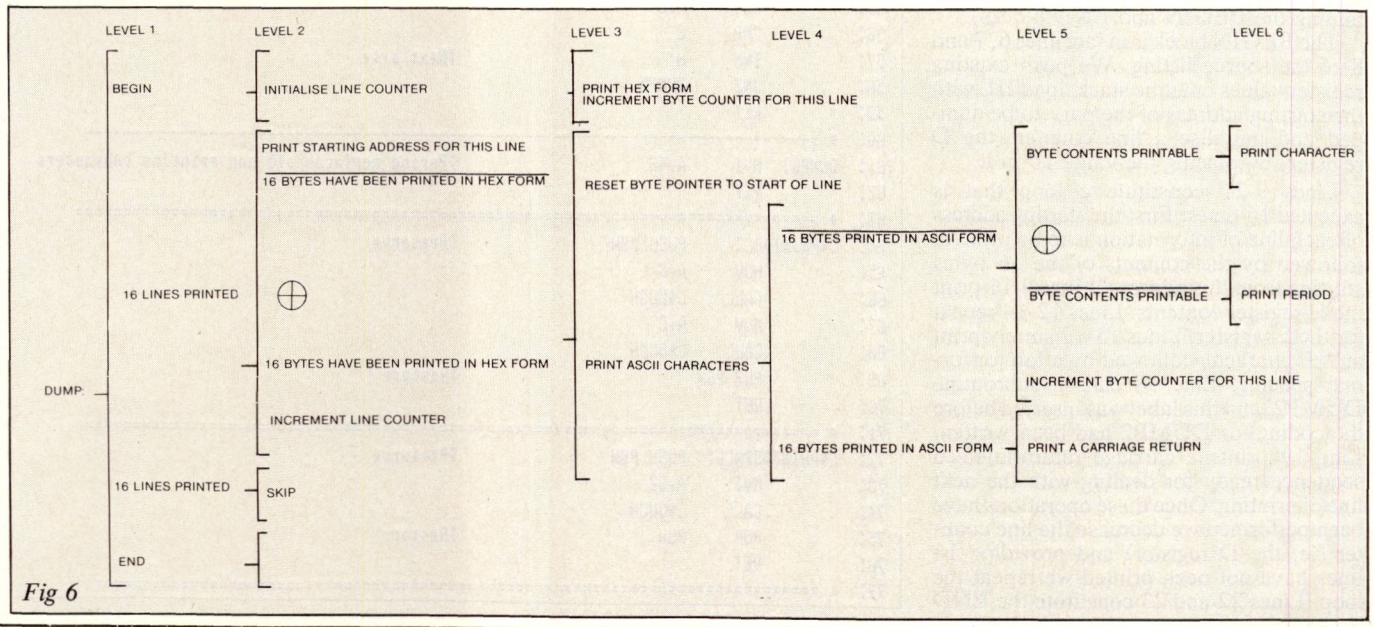


Fig 6

WARNIER-ORR TECHNIQUES FOR PROGRAM DESIGN

used to dump, at the line printer, selected pages of applications programs under development. To facilitate discussion of such diagrams I frequently identify along the top of a diagram various 'levels of brackets'.

The transition is accomplished in general by treating the brackets in the Warnier-Orr diagrams as called subroutines. Occasionally the first or last statement of a bracket may be included in the coding of the next highest level bracket, but this is often a matter of personal preference. The ideas are best explained by referring to the example of coding provided. I have numbered the lines of the assembler program for ease of reference and have placed plenty of remarks within each of the routines.

The basic core of the program will reference several subroutines that come without modification from a library of my assembler routines. The example itself, ie, the DUMP utility, has proved quite useful and is also now a library program.

The names that are used to call these various library subroutines together with a brief description of their functions are now listed for convenience. Since DUMP is not expected to be resident in any finished program I have not made any attempt to save bytes. It is my personal opinion that in most cases it is more important for routines to map directly to their design layouts since this facilitates maintenance in large programs.

L$PRINT$BC Prints BC register pair at line printer

L$PRINT$SPACE Prints a space at line printer

L$PRINT$TAB Prints a tab at line printer

L$CRLF Prints a carriage return — linefeed sequence at line printer

The above routines use another subroutine L$OUCH to actually print the characters. L$OUCH uses a CP/M 'BDOS' call to handle character output.

BIN$HEX This converts a single byte number held in the accumulator into the hexadecimal form which is returned in the BC register pair.

Let us examine first the initial section of the DUMP subroutine. This is shown as lines 6-23 and corresponds to the first or highest level bracket (this is the one containing the BEGIN and END blocks).

The BEGIN block is in fact lines 6, 7 and 8 of the source listing. We push existing register values onto the stack, load HL with the starting address of the page to be dumped and initialise a line counter (the D register) by placing the value 16 in it.

Lines 9-21 constitute a loop that is executed 16 times. First the starting address of each line of information is to be printed, followed by the contents of the 16 bytes starting from this address. Lines 9-11 print the H register contents. Lines 12-14 repeat for the L register. Lines 15-17 simply print an 'H' character followed by a tab for format spacing. Line 18 calls a subroutine DUMP2, and this label was inserted before the coding for DUMP2 had been written. Line 19 prints a carriage return-linefeed sequence ready for dealing with the next line of printing. Once these operations have been performed we decrease the line counter (ie, the D register) and providing 16 lines have not been printed we repeat the loop. Lines 22 and 23 constitute the END

```
1:  * ============================================================================
2:  * LIBRARY SOURCE PROGRAM ..... DUMP.LIB
3:  * Purpose: To dump selected page of memory in hex. and character form at printer
4:  *          The address is passed via an EQU pseudo-op named DUMP$ADDRESS
5:  * ----------------------------------------------------------------------------
6:  DUMP:   PUSH PSW ! PUSH B ! PUSH D ! PUSH H     ;Preserve
7:          LXI     H,DUMP$ADDRESS          ;Address of page to be dumped
8:          MVI     D,16                    ;Counter 16 lines of 16 bytes per line
9:  DUMP1:  MOV     A,H                     ;Print address in hex form
10:         CALL    BIN$HEX                 ;Library routine
11:         CALL    L$PRINT$BC
12:         MOV     A,L
13:         CALL    BIN$HEX
14:         CALL    L$PRINT$BC
15:         MVI     A,72                    ;ASCII "H" character
16:         CALL    L$OUCH
17:         CALL    L$PRINT$TAB             ;TAB on printer
18:         CALL    DUMP2                   ;Prints 16 Hex contents after location
19:         CALL    L$CRLF
20:         DCR     D                       ;Decrement counter
21:         JNZ     DUMP1
22:         POP H ! POP D ! POP B ! POP PSW          ;Restore
23:         RET
24: * ============================================================================
25: * PRINT$LINE ROUTINE... Prints starting location and contents of 16 bytes
26: * This routine does NOT preserve HL but leaves pointing to next location !!!
27: DUMP2:  PUSH PSW ! PUSH D ! PUSH H      ;Preserve
28:         MVI     D,0                     ;Counter
29:         MVI     E,16                    ;Max to exit
30: DUMP3:  MOV     A,M                     ;Contents of memory byte for printing
31:         CALL    BIN$HEX
32:         CALL    L$PRINT$BC
33:         CALL    L$PRINT$SPACE
34:         INR     D                       ;Increment counter
35:         MOV     A,D
36:         CMP     E
37:         INX     H
38:         JNZ     DUMP3
39:         CALL    L$PRINT$TAB
40:         POP H                           ;Restore original value to HL
41:         CALL    DUMP4                   ;Print same data in character form
42:         POP D ! POP PSW                 ;Restore
43:         RET
44: * ============================================================================
45: * PRINT$CHARACTER ROUTINE ..... Prints the data in character form
46: DUMP4:  MVI     D,0                     ;Counter
47:         MVI     E,16                    ;Max
48: DUMP5:  MOV     A,M
49:         CPI     126                     ;126 or above ?
50:         CP      DUMP6
51:         CPI     32
52:         CM      DUMP6
53:         CALL    L$OUCH
54:         INR     D
55:         MOV     A,D
56:         CMP     E
57:         INX     H                       ;Next byte
58:         JNZ     DUMP5
59:         RET
60: * ----------------------------------------------------------------------------
61: DUMP6:  MVI     A,46                    ;Period replaces all non printing characters
62:         RET
63: * ============================================================================
64: L$PRINT$BC:     PUSH PSW                ;Preserve
65:         MOV     A,B
66:         CALL    L$OUCH
67:         MOV     A,C
68:         CALL    L$OUCH
69:         POP PSW                         ;Restore
70:         RET
71: * ============================================================================
72: L$PRINT$SPACE:  PUSH PSW                ;Preserve
73:         MVI     A,32
74:         CALL    L$OUCH
75:         POP     PSW                     ;Restore
76:         RET
77: * ============================================================================
```

```
78:  L$PRINT$TAB:   PUSH    PSW             ;Preserve
79:         MVI     A,9
80:         CALL    L$OUCH
81:         POP     PSW                     ;Restore
82:         RET
83:  * ============================================================================
84:  * ASSEMBLER SOURCE LIBRARY ..... L$OUCH.LIB
85:  * PURPOSE: TO OUTPUT A CHARACTER TO PRINTER VIA BDOS CALL.CHARACTER MUST BE PRESENT
86:  *          IN ACCUMULATOR BEFORE CALLING
87:  * ----------------------------------------------------------------------------
88:  L$OUCH: PUSH PSW ! PUSH B ! PUSH D ! PUSH H     ;SAVE REGISTERS
89:                  MVI     C,5             ;WRITE LINEPRINTER CODE
90:                  MOV     E,A             ;TRANSFER TO BDOS IS VIA E REGISTER
91:                  CALL    BDOS            ;MUST BE PREVIOUSLY DEFINED
92:          POP H ! POP D ! POP B ! POP PSW ;RESTORE REGISTERS
93:                  RET
94:  * ============================================================================
95:  * ASSEMBLER SOURCE LIBRARY ..... L$CRLF.LIB
96:  * PURPOSE: TO OUTPUT TO PRINTER A CARRIAGE RETURN-LINE FEED COMBINATION
97:  *          USING THE ACCUMULATOR.
98:  * ----------------------------------------------------------------------------
99:  L$CRLF:         PUSH PSW                ;SAVE REGISTERS
100:                 MVI     A,CR            ;CR MUST BE DEFINED
101:                 CALL    L$OUCH          ;LIBRARY UTILITY PROGRAM
102:                 MVI     A,LF            ;LF MUST BE DEFINED
103:                 CALL    L$OUCH
104:                 POP PSW                 ;RESTORE REGISTERS
105:                 RET
106: * ============================================================================
107: * ASSEMBLER SOURCE LIBRARY ..... BIN$HEX.LIB
108: * PURPOSE:TO CONVERT A BINARY NUMBER PASSED VIA THE ACCUMULATOR INTO THE HEX
109: *         FORM WHICH IS OUTPUT TO THE PRINTER USING L$OUCH (LIBRARY PROG.)
110: *         THE HEX VALUE AS TWO PRINTABLE CHARACTERS IS RETURNED IN BC PAIR
111: * ----------------------------------------------------------------------------
112: BIN$HEX:        PUSH    PSW                     ;PRESERVE
113:                 MOV     C,A                     ;SAVE VALUE
114:                 ANI     00F0H                   ;MASK OUT LSB'S
115:                 RRC
116:                 RRC
117:                 RRC
118:                 RRC                             ;SHIFT TO LSB'S POSITION
119:                 CALL    BIN$HEX1
120:                 MOV     B,A                     ;READY FOR OUTPUT !!
121:                 MOV     A,C
122:                 ANI     000FH                   ;MASK OUT MSB'S
123:                 CALL    BIN$HEX1
124:                 MOV     C,A                     ;READY FOR OUTPUT !!
125:                 POP     PSW                     ;RESTORE
126:                 RET
127: * ----------------------------------------------------------------------------
128: BIN$HEX1:       ADI     48                      ;THIS ENSURES THAT THE EQUIVALENT
129:                 CPI     58                      ;ASCII NUMBER IS PRINTED IF 0-9
130:                 CP      BIN$HEX2
131:                 RET
132: * ----------------------------------------------------------------------------
133: BIN$HEX2:       ADI     7                       ;ENSURES THAT ASCII LETTER IS
134:                 RET                             ;OBTAINED
135: * ============================================================================
```

block. We simply return the original values to the internal registers and execute a return from the subroutine.

The coding for the initial section was completed first, but as well as referencing some of the library subroutines we placed a reference to CALL DUMP2. This was in effect a 'dummy' label placed into the initial section so we could complete the coding for this section without having to worry about more detailed problems — such as are involved with the printing of each line of information.

The next stage in the development of the coded solution was to write the subroutine corresponding to the label DUMP2 whose purpose is to print the contents of the 16 bytes that constitute a line. The starting address for the line is held in the HL register pair. The following notes apply to lines 27-43 of the source code.

First we save all registers by pushing onto the stack, then as before we set up a loop using a simple counter. This loop will as before be executed 16 times. Using a MOV A,M instruction we place each of the sixteen memory location contents into the accumulator and then print them by using calls to subroutines BINHEX, LPRINT$BC and L$PRINT$SPACE. As we step through the loop we use a INX H instruction to point HL to the next location to be examined.

In this way we are able to deal with printing the hex form of a Line. Our Warnier-Orr diagram tells us that having done this we must print the same bytes in ASCII character form. The solution is simple. . . we reset the HL memory pointer by POP H (which restores the original values) and then we write another subroutine call using a further 'dummy label'.

In this case the dummy label is DUMP4 and it corresponds to the statement in Figure 6 of 'PRINT ASCII CHARACTERS'. Since the diagram indicates that no further actions are required to complete this 'bracket' we simply restore the registers that have still to be returned to their original state and return from the subroutine.

The general pattern for the translation of the Warnier-Orr representation to the final coding should be becoming clear. Once you have a completed diagram to the level of detail required to formalise the logic of the problem you start coding 'level by level'. If you reach a point where some required action involves more coding than can comfortably be written in a few lines than you place a call to another level of subroutines using a 'dummy label'. By doing this you will be able to complete the routine you are currently working on without getting involved with details on a lower level. Having then coded one particular level you can in a similar fashion concentrate your attention on writing the subroutines for the next level down — ie, the ones you used the 'dummy labels' for. This technique is used at all levels until all the 'brackets' in the Warnier-Orr diagram have been translated.

The subroutine DUMP4 — ie, lines 46-59 — uses a simple loop counter as in previous routines to print the contents of the 16 bytes. Since DUMP4 is now dealing with the ASCII forms it is necessary to check that the character is printable, ie, has an ASCII code between 32 and 126. You will see from the coding that cases where this is not true result in a period being printed rather than the character itself.

I have tried to provide sufficient detail of all the stages in the development of the example to enable the technique to be tried on your own programming problems using whatever hardware/software combinations you have.

The essential points to bear in mind are:

1. Express your problem in terms of ordinary language.
2. Draw an elementary Warnier-Orr diagram that is consistent with the most fundamental aspects of the problem as stated.
3. Iteratively refine the diagram by examining areas that you can define more exactly. As the diagram grows it will be formalising the logic of your problem and in fact solving the design problem as well.
4. Choose whatever programming language you feel is appropriate and then code the solution 'level by level' using 'dummy calls' for statements that involve complex brackets — ie, brackets which you feel may involve more than just straightforward coding.
5. Continue level by level until you have completed the lowest levels of subroutines.

To conclude, we can do little better than restate what we have indicated by example to be the main advantages of the technique. We define a problem and by using Warnier-Orr techniques we logically describe the problem and at the same time solve the associated program design problem. We also end up with a logically structured program together with a diagram formally documenting the structure of the problem and the final coding. Because of this, such programs suffer far less from debugging problems and are very easy to maintain since the 'logical independence' of the various sections is accomplished readily with the 'nested subroutine' type of development.

END

HARD WARE

You don't need a Cray 1 to do interesting things with images; even a micro can handle digitised video (although not quite as quickly!). C Grant Dixon explains how.

DIGITAL VIDEO

One of the areas where microcomputers will be making their mark in the future is in the processing of visual images. Of course this is already being undertaken in certain specialist laboratories where the analysis of space photographs and the use of enhancement techniques are the day-to-day workload. Other research workers are looking into the problem of pattern recognition with a view to tying up the computer controlled robots with a television image of the scene where the robot is operating.

Amateur computer enthusiasts have, so far, done very little in this field, but after my article in *PCW* (April 1981) I received a number of requests for information on digitising video signals — so here's some further information on the subject.

The normal 625-line TV picture is generated by interlacing two fields of 312.5 lines each, the field rate being 50 Hz (mains frequency). The aspect ratio of the picture is 4:3 and if we work in round figures this means that we have 400 picture elements (pixels) along a line and 300 pixels in the vertical direction, assuming a sequential scan with no interlacing. Thus in 1/50th sec we have 120,000 pixels, a data transmission rate of 6,000,000 pixels/sec. Can your computer cope with this rate of data flow? Probably not! But there are several ways in which we can reduce this high-speed requirement; first of all we can say that each pixel can be described by a 4-bit word, giving 16 possible grey levels, and packing two such words into one byte. This would give a data transfer rate of 3 Megabytes/sec which is still rather fast.

Secondly, we can slow up the scanning process by converting the fast-scan signal to a slow-scan signal, or even by generating the video signal by a slow scanning process in the first place. We gain by being able to manipulate the video signal at a rate which the computer can handle but we lose the ability to display movement. Slow-scan TV is for still pictures, or, at best, a series of 'snapshots' of a movement. This is no detriment as far as computing is concerned, as the computer will normally be used to store a single image.

When converting from a fast-scan signal to slow-scan it is only necessary to have a temporary buffer store to hold one line of data as the whole picture is being repeated at the fast rate. If, however, the original picture contains movement, it's better to load the whole picture at the fast rate into a temporary picture store using TTL hardware for the purpose. This will give us a kind of 'snapshot' as mentioned above, but it involves a fairly large extra memory which has to be interfaced to the computer — unless, of course, we use the computer memory itself and access it by DMA techniques.

The actual conversion of the analogue signal to a digital one is not possible by the usual A/D techniques which employ counters operating over a given period. The alternative technique, suitable for video frequencies, uses a chain of comparators (Figure 1) which gives an almost instantaneous digital value for the analogue input. Potentiometers W and B are used to set the voltages for white level and black level to match the incoming video signal; the outputs A,B,C,D are then a digital representation of the signal in Gray code. This code has the advantage that only one bit changes at any level transition and it is less liable to cause trouble with 'glitches' on the power

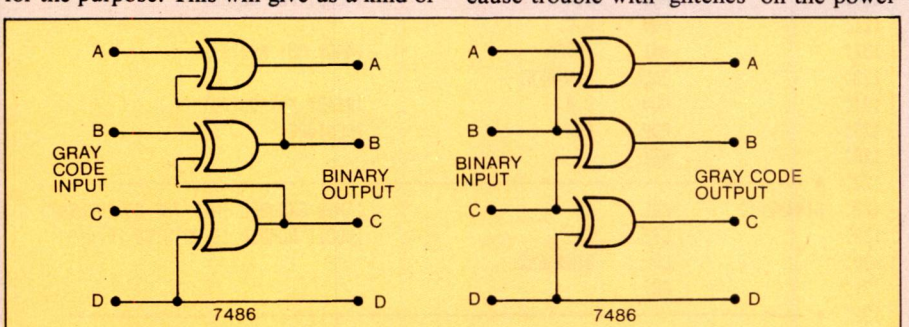


Fig 3 Code conversion using hardware

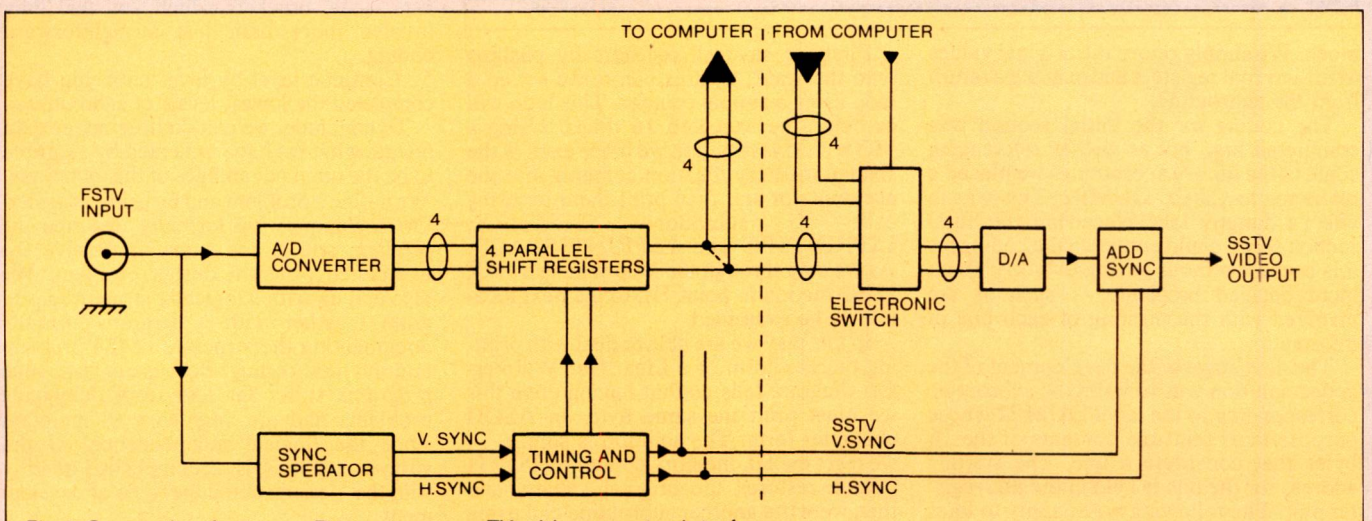


Fig 2 Converting fast-scan TV to slow-scan TV with computer interface

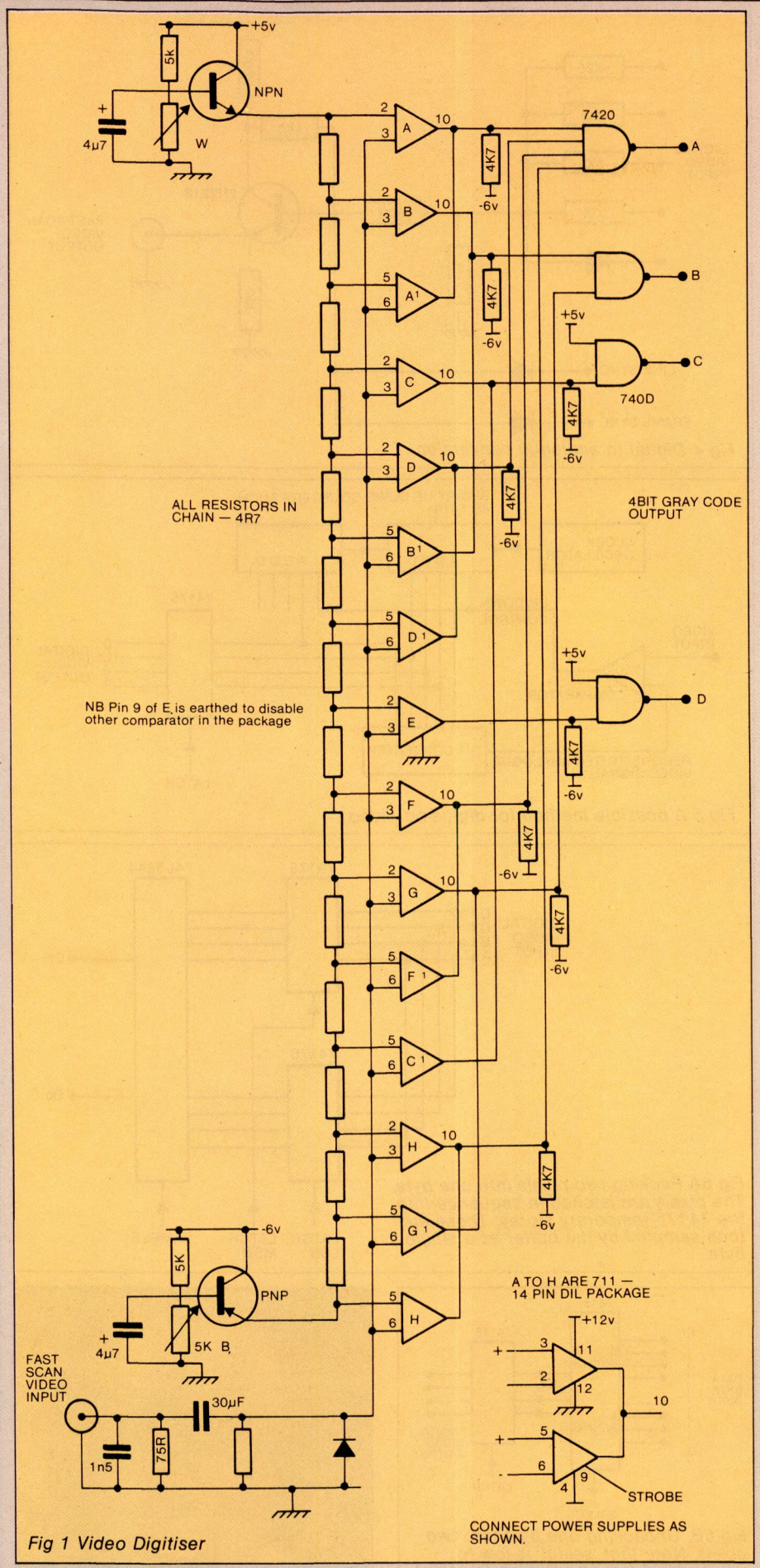


Fig 1 Video Digitiser

HEXA DECIMAL	BINARY	GRAY CODE
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101
A	1010	1111
B	1011	1110
C	1100	1010
D	1101	1011
E	1110	1001
F	1111	1000

Table 1 Comparison of Hex, Binary and Gray codes

lines and elsewhere. Table 1 compares Gray code with hex and binary.

A typical slow-scan converter adapted for linkage to a computer is shown as a block diagram in Figure 2. For those people who are not interested in SSTV as such, and whose only concern is to be able to load video information into a computer, the area to the right of the dotted line can be ignored. In the scan-converter, a 4-bit wide shift register memory is used and a fast clock shifts the video data along the register until one line has been stored. This is then replaced by a slow clock which delivers the data at the output end of the shift register during the next three frames of fast-scan TV. This process is then repeated for a line further down the picture until all lines have been stored. The SSTV used by radio amateurs has a square picture of 128 lines with 128 pixels per line. Thus, every alternate line of the fast-screen picture is sampled and a few lines at the top and the bottom of the picture are ignored. The total storageage area for a picture to these standards is 8 kbytes, with each byte holding two pixels. When SSTV is transmitted each line of 128 pixels is sent in 60 ms ... approx 1 ms per byte or 500 µs per pixel. Now a lot of useful computing can be done in 500 µs and the digital video signal which emerges from the shift register memory can be read at a computer input port and hence stored in computer memory. Special effects, such as contrast enhancement, can be achieved by using a look-up table before storing the pixel.

If the digitised fast-scan signal (Gray code) is converted to binary and then reconstituted by a D/A converter, the signal can be viewed on a TV monitor and it will be found that, despite the A/D and D/A conversion, the picture is still good quality even though we have used only 16 grey levels. Conversion between Gray code and binary can be performed by the circuits of Figure 3; if you prefer doing it by software then refer to *PCW* Sub Set, October 1981. The type of D/A converter usually used for fast-scan video work is a simple weighted resistor network as in Figure 4; the resistors are in the ratio 8:4:2:1 to match the binary digits — the largest resistor gives the smallest current and corresponds to the LSB of the video signal.

Another possible way of digitising a video signal is shown in Figure 5; this is only put in as a suggestion by the author as it has not been tested in practice. We have an 8-bit up-down counter which is continuously driven by a fast clock; the output of the least significant five bits is converted to an analogue signal and compared with the incoming fast-scan signal from the camera. If it is of greater amplitude than the camera signal, then the comparator switches the counter to count down; conversely if it is lower, the comparator switches to count up. The least significant bit is likely to be oscillating rapidly when the video signal is at a steady level so we take the next four bits from the counter as the digitised video signal (binary, not Gray code) and this can be latched when require . For fast-scan TV, a clock frequency of 12 MHz would give 6 Megapixels/sec which is about right.

It is worth noting that an A/D chip has recently appeared on the market as a 'flash digitiser' capable of handling frequencies

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up to 15 MHz; this is the RCA CA3300D. The main snag is the price — in the region of £66 per chip (summer 1982)!

Now we have the picture in the computer's memory we want to display it on the VDU, which is, of course, a fast scan device. Once again we run into problems with speed, and the most promising answer seems to be the elimination of the microprocessor chip and the use of direct memory access (DMA) with some form of hardware interface, possibly using one of the CRT controller chips. Clayton Abrams has successfully used the 6843 CRT controller for displaying stored pictures on a monitor screen (see *Ham Radio,* July 1979). In my equipment, the picture in computer memory is converted to a slow-scan signal which is then sent to a separate slow-to-fast scan-converter with its own 8k memory which can be read out at high speed.

Notice that with access time of 1 50 ns or 200 ns for a modern dynamic RAM chip, the speed of the memory is no longer the problem — it's the speed of the processor and the amount of processing needed which is the limiting factor. Hardware circuits can be used to eliminate the processing needed when, for example, the two 4-bit pixels have to be packed into or unpacked from one byte. Figure 6 shows suitable circuits for doing this. The 74LS 157 is equivalent to a 4-pole 2-way electronic switch and the 74175 is a 4-bit latch used as a temporary store. The switching must take place at a speed which is twice the speed of the memory address clock.

Perusal of *PCW*'s advertising pages, not to mention the helpful equipment reviews, reveals that most computer manufacturers are keen to stress their machines' capability for high-resolution graphics or colour; very few make any mention of any form of grey-scale which is almost essential for picture display, yet the CRT in the VDU is ideally suited for displaying a full greyscale picture. When one comes to the adverts for printers, however, it's a different story. Quite a few manufacturers illustrate their machines with what looks like a photograph emerging from the roller — despite the fact that a printer is essentially a black and white device; even thermal printers are unable to reproduce a satisfactory grey-scale.

The secret is, of course, in the dot-matrix print-heads which are so popular. Examination of some newspaper photographs reveals that they are composed of lots of dots of ink which are closely or sparsely spaced to give the overall impression of the required shade of grey. This is a task for which the dot-matrix printer is ideally suited as long as it is possible to program each individual dot in the print-head. Figure 7 shows the result obtained by Martin Emmerson (G30QD) using a dot-matrix printer to obtain a hard copy of a slow-scan TV picture. In this case the picture resolution was 128x128 pixels and the rather elongated appearance results from the fact that the printer was not geared to produce an equal number of dots/inch in the horizontal and vertical directions.

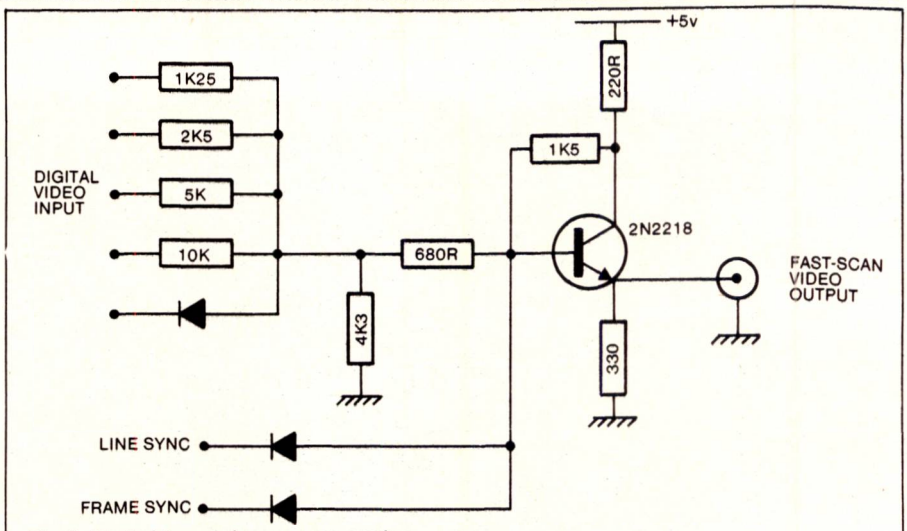


Fig 4 Digital to analogue conversion

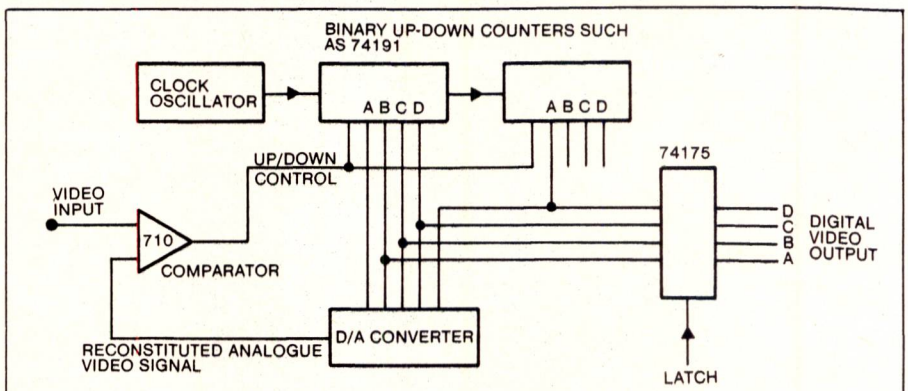


Fig 5 A possible method for digitising video

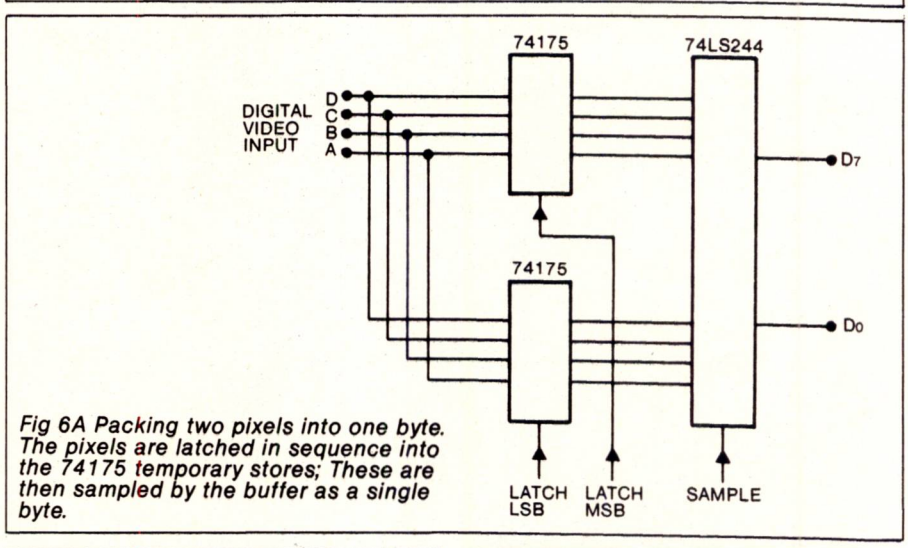


Fig 6A Packing two pixels into one byte. The pixels are latched in sequence into the 74175 temporary stores; These are then sampled by the buffer as a single byte.

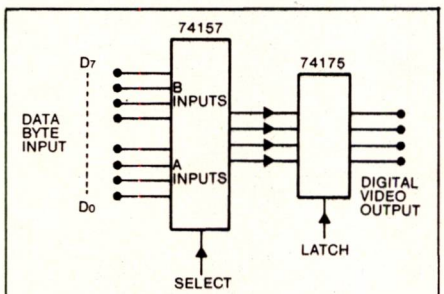


Fig 6B. Unpacking one byte into two pixels. Note that 'select' is low to select the A inputs and high to select the B inputs.

To show how it is done, let us take an example. . . the Thomson 96364 display chip uses a rectangle for each character measuring eight elements wide by twelve elements vertically; within this area is the



Fig 7

usual 5x7 matrix for the character proper, the extra being inter-character and inter-line spacing. If we divide the 8x12 area into blocks of 4x4 elements and let each 4x4 block represent one pixel, then for a 64-character line we have 128 pixels, and for the 16 character lines of the display we have 498 pixels (three blocks per character in the vertical direction). Clearly on this basis the VDU screen will not display a full 128x128 pixels picture but if we have a printer whose print head has similar characteristics it's a simple matter to use a bit of extra paper and print the whole picture.

Each block of dots represents one pixel, and by choosing to print any number of dots from zero to 16 we can, in fact, have 17 levels of grey. Care is needed in choosing which dots to print for a given value of grey as it's possible for the dots in adjacent squares to join up and form an undesirable patterning rather than the overall grey effect which is desired. Figure 8 gives a set of recommended pixels. The resolution of a 128x128 picture is not, of course, anything like as good as a standard TV picture, but does give an adequate picture for radio amateur purposes and possibly for other purposes also. Figure 9 shows a picture which was stored in the memory of my Triton computer, block shifted for tape recording and sent to Alan Striong (G3WXI) of Sheffield. Alan has a Nascom with a different recording format, but a simple program was written to read the Triton tape into the Nascom memory as a hex-dump whence it was fed to a specially built fast-scan display. The original photograph shows clearly how each pixel is represented by two TV lines.

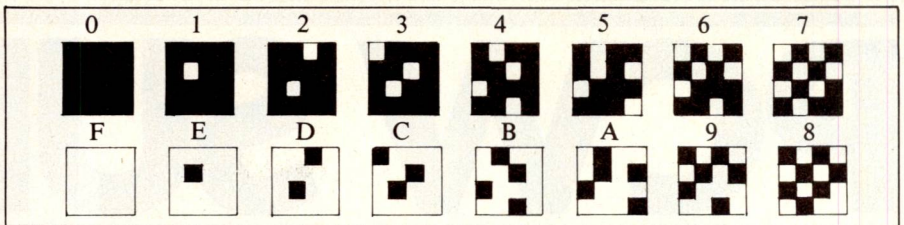


Fig 8

Figure 10 shows a picture printed by the technique outlined above using an Epsom MX100 printer; acknowledgements to Alan Strong whose picture it is. Figures 11 & 12 show two pictures printed from my Triton using an Anadex 9501 printer. This printer uses approximately the same number of dots/inch in both directions and thus gives the correct aspect ratio of 1:1. Not all printers are able to do this, and if this technique of picture printing becomes popular some manufacturers may have to modify their machines to give equal resolution in both directions.

Another point to note is that the printed dots may possibly be larger than the space they are supposed to occupy due to the lateral spreading of the ink in the paper; future experiments will attempt to improve the picture buy using a look-up table to modify the pixels before they are stored in memory.

The field of video computing is rapidly expanding and offers a challenge to computer enthusiasts who are looking for something different on which to exercise their skills. **END**

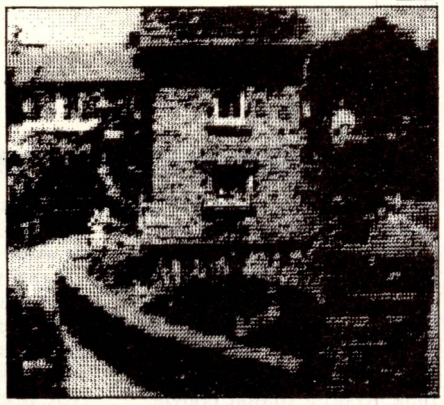


Fig 12


Fig 9


Fig 10

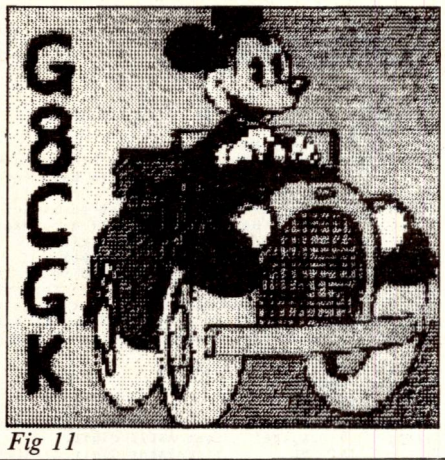
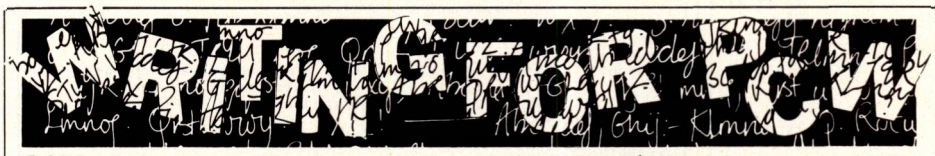


Fig 11



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.

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.

PCW SUBSET

Alan Tootill and David Barrow present more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together this this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET,* PCW, *62 Oxford Street, London W1A 2HG.*

Z80 anybase conversion

Last month we had the 6502 routine, XBIN, to convert an unsigned ASCII encoded number, in any base from 2 to 36, to a 32-bit binary number. This prompted me to fish out a set of routines in Z80 code, which I have had for some time, to do a similar conversion into the 16-bit HL register. These Z80 routines, ANYNO/CTON/DEXBC are from Jim Chance of Birmingham University. In the input string, digits greater than 9 are represented by the characters A to Z. Note the meticulous validation of the ASCII encoded input.

Datasheet

```
;=ANYNO - gets base 2-36 number to HL
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Gets +ve number to binary in HL from digit
;/              strings at (DE) with base (eg, 2 for binary,
;/              16 for hex)in BC.
;/ACTION: Start at left digit, get to binary (F=15, G=16 etc),
;/        add to partial result. If more digits, multiply by
;/        base and loop for more digits.
;/SUBr DEPENDENCE: CTON, DEXBC (local)
;/INTERFACES: A byte in RAM, pointed to by IX, is used to hold
;/             the number of digits in the ASCII string and is
;/             reduced during the routine to zero.
;/INPUT: (IX)=number of digits, BC=number base, (DE)=left digit.
;/OUTPUT:  HL=binary number, NC=o.k. carry=error. (IX) AF,BC,DE
;/         destroyed.
;/REGs USED:  AF,BC,DE,HL,IX
;/STACK USE: 6
;/PROCESSOR: Z80
ANYNO: LD   HL,+0     ;zeroise result register.          21 00 00
AY1:   LD   A,(DE)    ;get ASCII digit.                  1A
       INC  DE        ;increment digit pointer.          13
       CALL CTON      ;convert chr to binary.            CD YY YY
       RET  C         ;return cy set if invalid.         D8
       CP   C         ;compare chr with base             B9
       CCF            ;and return with carry set         3F
       RET  C         ;if not less than base.            D8
       ADD  A,L       ;add                               85
       LD   L,A       ;digit                             6F
       LD   A,H       ;to                                7C
       ADC  A,+0      ;partial                           CE 00
       LD   H,A       ;result.                           67
       DEC  (IX+0)    ;adjust digits left to go.         DD 35 00
       RET  Z         ;return if zero,                   C8
       PUSH DE        ;else save digit pointer           D5
       PUSH BC        ;and base,                         C5
       EX   DE,HL     ;get partial result in DE &        EB
       CALL DEXBC     ;multiply it by base into HL.      CD YY YY
       POP  BC        ;restore base and                  C1
       POP  DE        ;digit pointer.                    D1
       JR   AY1       ;go back for next digit.           18 E3
;CTON character to binary number. Carry=invalid.
CTON:  SUB  30H       ;return with carry set             D6 30
       RET  C         ;if digit less than 0.             D8
       CP   +10       ;return with                       FE 0A
       CCF            ;carry clear if                    3F
       RET  NC        ;digit 0-9.                        D0
       SUB  +7        ;return with carry set             D6 07
       RET  C         ;if digit >9 and <A.               D8
       CP   "Z+1      ;return with carry clear if        FE 5B
       CCF            ;digit A-Z, else                   3F
       RET            ;return with carry set.            C9

;DEXBC 16-bit multiply HL=DE*BC. carry=overflow.
DEXBC: LD   A,+16     ;bit counter.                      3E 10
       LD   HL,+0     ;zero answer.                      21 00 00
HXBL:  SRL  B         ;                                  CB 38
       RR   C         ;gets 1s bit of multiplier.        CB 19
       JR   NC,HXB2   ;                                  30 02
       ADD  HL,DE     ;                                  19
       RET  C         ;overflow return.                  D8
HXB2:  EX   DE,HL     ;get multiplicand to HL.           EB
       ADD  HL,HL     ;double it.                        29
       EX   DE,HL     ;                                  EB
       RET  C         ;overflow return.                  D8
       DEC  A         ;                                  3D
       JR   NZ,HXB1   ;loop for all bits.                20 F1
       RET            ;return.                           C9
```

Z80 square roots

Steven Weller's very fast square roots (August'82) have not gone unchallenged. Both K P Leary of Chislehurst and John Kerr of Glasgow have sent amended versions and pointed out that, in Steven's versions, the correct remainder is not always returned. As KP puts it, since $(n+1)^2 - n^2 = 2n+1$, extracting a square root of k bits can leave a remainder of k+1 bits, since the largest remainder when extracting n is 2n. In other words, a 15 or 16 bit square can have a 9 bit remainder and a 31 or 32 bit square can have a 17 bit remainder.

In the original DSROOT the 17th bit of the remainder is in the carry flag, though this was not stated, but in SROOT the 9th bit of the remainder is actually set to zero.

There is very little to choose between the two corrected versions of the 16 bit routine so, to counter John's move to take over the whole of this issue's SUB SET, we give K P Leary's verion in Datasheet SQR15/16.

Datasheet

```
;=SQR15 - 15 bit square root. SQR16 - 16 bit square root.
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: SQR15 calculates square root of 15 bit 2s
;/              complement positive number.
;/              SQR16 calculates square root of 16 bit unsigned
;/              (assumed positive) number.
;/ACTION:  Shifts pairs of bits in A, L left through A, L, H.
;/         Trial subtraction from 4 times (last remainder in H)
;/         + next pair (in L). Subtrahend is 4 times (last part
;/         root in D) + 1. New part root = twice (old root)
;/         + 1 if subtraction, 0 if not.
;/SUBr DEPENDENCE: None
;/INTERFACE: None
;/INPUT: Number in HL
;/OUTPUT:  SQR15: If number -ve, NZ state, registers unchanged. Else
;/         SQR15 and SQR16: z state, 8 bit positive signed root
;/         in HL, 9 bit positive signed remainder in DE.
;/REGs USED: AF, B, DE, HL
;/STACK USE: Nil
;/LENGTH: 35
;/TIME STATES: 843 max.
;/PROCESSOR: Z80

SQR15:  BIT  7,H      ;test for negative number.         CB 7C
        RET  NZ       ;if so exit with Z flag unset.     C0
SQR16:  LD   DE,40H   ;set subtrahend to zero.           11 40 00
        LD   A,L      ;set up 24 bit accumulator         7D
        LD   L,H      ;in HL, A                          6C
        LD   H,D      ;high bits = 0.                    62
        LD   B,+8     ;set bit count.                    06 08
        OR   A        ;clear carry.                      B7
W:      SBC  HL,DE    ;trial subtraction.                ED 52
        JR   NC,X     ;jump if successful                30 01
        ADD  HL,DE    ;else add back.                    19
X:      CCF           ;switch carry to roll into         3F
        RL   D        ;subtrahend high bits in D.        CB 12
        ADD  A,A      ;shift up next bit pair            87
        ADC  HL,HL    ;in accumulator.                   ED 6A
        ADD  A,A      ;                                  87
        ADC  HL,HL    ;                                  ED 6A
        DJNZ W        ;jump if not done.                 10 F0
        RLA           ;overflow of remainder to A.       17
        LD   L,D      ;root to HL.                       6A
        LD   E,H      ;remainder to E.                   5C
        LD   D,A      ;set remainder high bits.          57
        LD   H,B      ;set root high bits (=0)           60
        XOR  A        ;set Z state.                      AF
        RET           ;return.                           C9
```

KP also sent a corrected version of the 32 bit routine, appreciably faster than the original. But John Kerr's version is faster by just about the same amount again, so here it is in Datasheet DSRTZ. The essence of the improvement

hinges on the fact that the low order subtrahend, previously held in BC, never changes from its initial value of 4000 hexadecimal, so can enter the program as immediate data. This frees register pair BC and saves using the 'stacktop' and all those time consuming EX (SP),HLs.

Datasheet

```
;=DSRTZ - four byte integer square root
;/CLASS: 2 (does not preserve flags)
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates square root of non-negative 32-bit
;             2s complement binary number, giving remainder.
;/ACTION: Terminate if input is negative.
;/        Store input in four low order bytes of working accum.
;/        HL,A,C,IX; clear HL (high order accumulator word)
;/        Clear DE (high order subtrahend; accumulates answer).
;/        Take subtrahend from high order accum. HL,A,C
;/        If carry set (borrow required) add back in
;/        Invert carry status and rotate into DE
;/        Multiply working accumulator HL,A,C,IX by four
;/        Repeat to 16 times. Put remainder MSB into A.
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: BC,DE contains input number (B is MSByte)
;/OUTPUT: Z flag cleared if input was negative; else
;/        BC,DE contains square root; remainder in A,HL
;/REGs USED: AF,BC,DE,HL
;/STACK USE: 2
;/LENGTH: 50
;/TIME STATES: 2792 max
;/PROCESSOR: Z80

DSRTZ:  BIT   7,B       ;find sign of input                 CB 78
        RET   NZ        ;and exit if negative.              C0
        LD    A,B       ;high order input in A,C            78
        PUSH  DE        ;low order in IX; original          D5
        EX    (SP),IX   ;contents of IX saved.              DD E3
        LD    D,+0      ;clear high order                   16 00
        LD    E,D       ;subtrahend                         5A
        LD    H,D       ;and top word of                    62
        LD    L,D       ;working accumulator                6A
        LD    B,+16     ;B is loop counter.                 06 10
DSR10:  SUB   40H       ;take subtrahend from               D6 40
        SBC   HL,DE     ;HL,A,C.                            ED 52
        JR    NC,DSR20  ;if no borrow required jump         30 04
        ADD   A,40H     ;else add back in.                  C6 40
        ADC   HL,DE     ;                                   ED 5A
DSR20:  CCF             ;invert carry status                3F
        RL    E         ;and rotate into answer,            CB 13
        RL    D         ;modifying subtrahend.              CB 12
        ADD   IX,IX     ;shift                              DD 29
        RL    C         ;working                            CB 11
        RLA             ;accumulator                        17
        ADC   HL,HL     ;two                                ED 6A
        ADD   IX,IX     ;bits                               DD 29
        RL    C         ;to                                 CB 11
        RLA             ;the                                17
        ADC   HL,HL     ;left.                              ED 6A
        DJNZ  DSR10     ;do sixteen times.                  10 E1
        RLA             ;remainder MSB into A.              17
        CP    A         ;set Z for valid result.            BF
        POP   IX        ;restore IX                         DD E1
        RET             ;return                             C9
```

Error flags

The error correction routine EFIX8 by John Kerr of Glasgow printed last month was the subject of a late amendment which unfortunately resulted in the documentation giving false information. The original version used the N flag to signal whether a correction had been made but the output state of the N flag is uncertain in the amended version. In all fairness to John, who did alter his documentation accordingly, I take full responsibility for not correcting this part of the Datasheet.

However, I do not feel particularly repentant as the incident does highlight the necessity of careful attention to flag conditions. The point I made last month about using any handy flag result to carry information out of, or indeed into, a routine was that it should be easy to test, perhaps of greater importance is that the exit flag conditions when used to pass information ought to be specifically set, and commented on. Relying on the happy accident that instructions immediately prior to exit produce useful flag results is risky when the slightest change to a routine could destroy the whole set-up.

6502 data protecting

The two Datasheets ECAL6 and EFIX6 are the 6502 versions of ECAL88 and EFIX8 printed last month and also sent by John Kerr.

To recap briefly on the method used by the routines, ECAL produces an error correction byte (ECB) for a data block up to 31 bytes in length. This can be appended to the data before its storage or transmission. On retrieving or receiving the data and ECB, EFIX calls ECAL to get a new ECB for the data block and compares it with the appended ECB. The difference between the two ECBs. gives a correction code which is in effect an index to any single bit which may have suffered inversion during storage or transmission.

In order to calculate the ECB, a parity mask is formed. The highest 5 bits of this mask index the bytes not from the start of the data block but from the end. The lowest three bits index the bits within each byte. Eg, the parity mask for each bit in the byte that is 23rd from the end would be 10111XXX where the Xs would take values 111 down to 000 for bits 7 down to 0 in that byte.

The ECB is initially reset to 00000000 and each bit of the data block is checked in turn. If the bit is reset (0), no action is taken, but if it is set (1) then its unique parity mask is exclusive-ORd with the ECB. This inverts the bits of the ECB which are in the same position as the set bits of the parity mask.

The completed ECB is a collection of eight parity bits such that bit 0 of the ECB shows the parity of alternate data bits, bit 1 shows the parity of alternate pairs of data bits, bit 2 shows the parity of alternate groups of four data bits, and so on in a binary pattern. Any difference found between the stored and new ECB in EFIX will be a binary pattern representing the parity mask of one bit which, because of inversion of that bit, affected one ECB but not the other. As this correction code is exactly the same as the parity mask, EFIX can use the highest five bits to index the byte in which the error has occurred and the lowest three bits to create an inversion mask to re-invert the corrupt bit in that byte.

Datasheet

```
;/=ECAL6 - Calculate error correction byte
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Calculates a one-bit error correction byte (ECB)
;/             to be appended to a data block of 1 to 31 bytes and
;/             subsequently used by EFIX6.
;/ACTION: Abort if no of bytes = 0 or GTHAN 31
;/        Initialise mask to 8 * (no of bytes) +7
;/        Clear ECB
;/        For each byte in data block
;/            For each bit in current byte
;/               If bit is 1 then ECB   ECB   ¥ mask
;/               Decrement mask
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT:  Y = no of bytes      M0,1 points to 1st byte
;/OUTPUT: Cy set:  abort
;/        Cy reset:X=ECB     Y,M0,M1 unchanged
;/REGs USED: X Y P M0 M1
;/STACK USE: 3
;/LENGTH: 60
;/TIME STATES: 63+175 per byte average
;/PROCESSOR: 6502

ECAL6:  CPY   £$20      ;terminate if no of bytes           C0 20
        BCS   EXIT2     ;is greater than 31                 B0 37
        PHA             ;save A and M2                      48
        LDA   M2        ;                                   A5 zz
        PHA             ;                                   48
        TYA             ;move block length to A and         98
        SEC             ;terminate with Cy set if           38
        BEQ   EXIT1     ;no of bytes = 0                    F0 28
        ASL   A         ;move no of bytes                   0A
        ASL   A         ;into highest five bits of A and    0A
        ASL   A         ;set lowest three bits to get       0A
        ORA   £7        ;initial parity mask                09 07
        STA   M2        ;in M2                              85 zz
        LDA   M3        ;save M3                            A5 zz
        PHA             ;                                   48
        LDX   £0        ;clear initial ECB                  A2 00
        LDY   £0        ;and byte pointer index             A0 00
ECLP1   LDA   (M0),Y    ;move byte from data block          B1 zz
        STA   M3        ;into M3                            85 zz
        TXA             ;ECB into A                         8A
        LDX   £8        ;set up bit count                   A2 08
ECLP2:  ASL   M3        ;move bit into Cy and               06 zz
        BCC   SKIP2     ;if it is '1'                       90 02
        EOR   M2        ;then ECB  ECB ¥ mask               45 zz
SKIP2:  DEC   M2        ;next mask                          C6 zz
        DEX             ;decrement bit count and            CA
        BNE   ECLP2     ;repeat for all bits in byte        D0 F5
        INY             ;point to next byte                 C8
        LDX   M2        ;check for end of block when        A6 zz
        CPX   £8        ;parity mask is 7                   E0 08
        TAX             ;ECB into X                         AA
```



'Have you anything just a wee bit fallible?'

PCW SUBSET

```
        BCS   ECLP1    ;repeat for all bytes in block      B0 E6
        PLA            ;restore M3                        68
        STA   M3       ;                                  85 ZZ
EXIT1:  PLA            ;restore M2                        68
        STA   M2       ;                                  85 ZZ
        PLA            ;restore A                         68
EXIT2:  RTS            ;                                  60
```

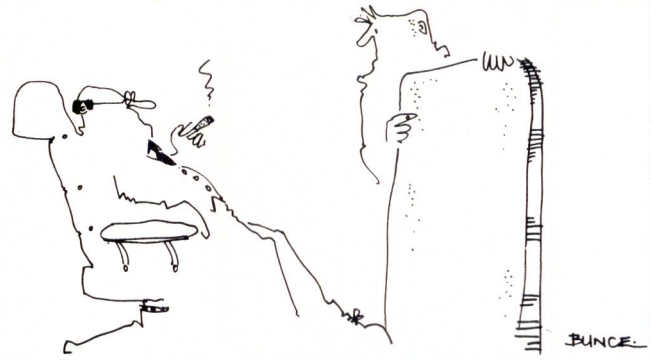
Datasheet

```
;=EFIX6 - Detect and correct a one-bit error in data block
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Examines a 1 to 31 byte data block with appended
;/             ECB and corrects a singler bit error.
;/ACTION: Abort if no of bytes = 0 or GTHAN 31
;/        Calculate ECB of data block
;/        EOR with stored ECB
;/        If no error then terminate
;/            Else use highest 5 bits to point at corrupt byte,
;/             terminating if error in ECB indicates corrupt
;/             byte outside block, lowest 3 bits to produce
;/             a bit inversion mask and invert corrupt bit.
;/SUBr DEPENDENCE: ECAL6 - calculate ECB
;/INTERFACES: None
;/INPUT:  Y = no of bytes excluding appended ECB
;/        M0,1 points to first byte
;/OUTPUT: Cy set:   abort
;/        Cy reset: no error found: Y = no of bytes
;/                  error found: Y = no of corrected byte -1
;/REGs USED: Y P M0 M1
;/STACK USE: 7 (including JSR ECAL6)
;/LENGTH: 53
;/TIME STATES: Average 192 + 175 per byte
;/PROCESSOR: 6502

EFIX6:  PHA            ;save A and X                      48
        TXA            ;                                  8A
        PHA            ;                                  48
        JSR   ECAL6    ;get new ECB of data block         20 XX XX
        BCS   EXIT4    ;terminating if ECAL6 aborted      B0 29
        LDA   M2       ;save M2                           A5 ZZ
        PHA            ;                                  48
        TXA            ;compare new and stored ECB        8A
        EOR   (M0),Y   ;terminating if correction         51 ZZ
        CMP   £8       ;code is too small to indicate     C9 08
        BCC   EXIT3    ;error in data block               90 1C
        TAX            ;save correction code              AA
        LSR   A        ;move highest 5 bits down to       4A
        LSR   A        ;give an index to corrupt byte     4A
        LSR   A        ;and test                          4A
        STA   M2       ;if position is greater than       85 ZZ
        CPY   M2       ;no of bytes in block, terminating C4 ZZ
        BMI   EXIT3    ;with Cy reset if it is            30 12
        TYA            ;subtract index-from-end from      98
        SBC   M2       ;no of bytes to give               E5 ZZ
        TAY            ;index-from-first-byte in Y        A8
        TXA            ;make X a count to corrupt bit     8A
        AND   £7       ;using lowest 3 bits of            29 07
        TAX            ;correction code                   AA
        LDA   £0       ;move a '1' into A                 A9 00
EFLP1:  ROL   A        ;in the same position              2A
        DEX            ;as the                            CA
        BPL   EFLP1    ;inverted bit                      10 FC
        EOR   (M0),Y   ;reinvert it and                   51 ZZ
        STA   (M0),Y   ;restore it to data                91 ZZ
EXIT3:  PLA            ;restore M2                        68
        STA   M2       ;                                  85 ZZ
EXIT4:  PLA            ;restore X and A                   68
        TAX            ;                                  AA
        PLA            ;                                  68
        RTS            ;                                  60
```

Military two-step

I have been advised that perhaps not all of SUB SET readers are aware of the old story about the message, 'Send reinforcements, we are going to advance', being passed by word of mouth along the trenches. Battalion HQ were surprised to receive the request, 'Send three and fourpence, we are going to a dance.' Try decimalising that!



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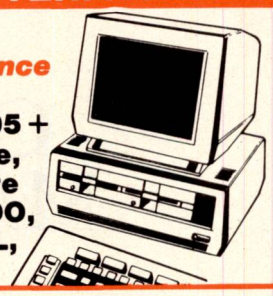

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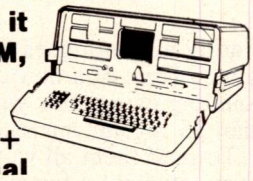

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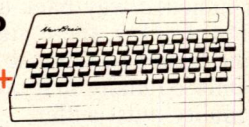

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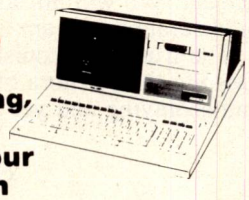

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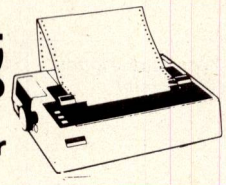

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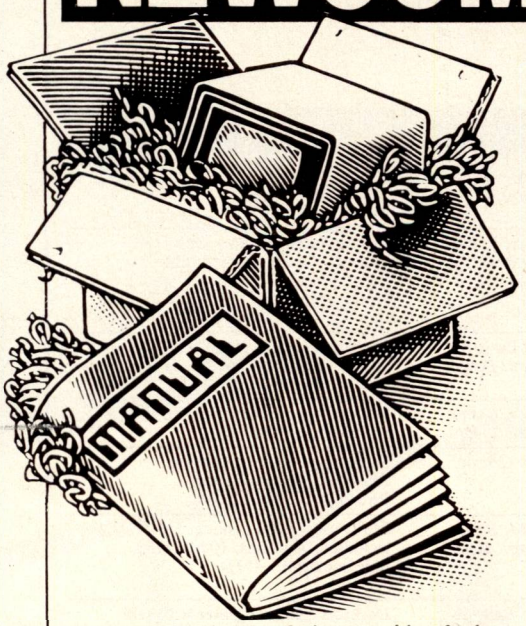


This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex.** The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0 = 0000, 1 = 0001, 2 = 0010, 3 = 0011, 4 = 0100, 5 = 0101 .... E = 1110 and F = 1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

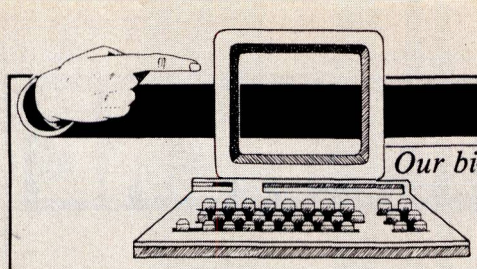
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



IN STORE

Our bi-monthly guide to microcomputing systems. Updates should be sent to: Dick Olney, 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. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12'', 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *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)
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 48151 (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 (£2850)	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:	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.
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

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)
Colour Genie (£200 inc VAT)	Lowe Electronics 0629 4057 (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: 6500: 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 80 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).
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.
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: Aortran: 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
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
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)
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 1 (£1450)	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).
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. Main-frame comm. package. Maintenance contracts. Options: 1.6 Mb F/D. 5-50 Mb H/D. (S&H)
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 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
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.

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.



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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
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)	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: Mailmeeoge: 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 49866 (N/A)	16-56k 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 (£550)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: A: T/E	High res colour graphics. Network station.
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).
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)

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
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)
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 0736 798157 (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)
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 1 (£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
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)

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Calcstar (CP/M) (80 column spread sheet)	59.00	67.85
dBase II (CP/M)	299.00	343.85
Data Star (CP/M) (powerful data entry)	122.00	128.80
D.B. Master (version 3.02)	104.00	119.60
D.B. Master statistics	58.00	66.70
D.B. Master utilities (links with visi's)	58.00	66.70
Desk Top Plan II (while stocks last)	89.00	102.35
Graphmagic (bar graphs, pie charts, etc)	52.00	59.80
Mathemagic	52.00	59.80
Multiplan (microsofts superior spreadsheet)	155.00	178.25
PFS Filing system (new improved)	68.00	78.20
PFS Graph	68.00	78.20
PFS Report	53.00	60.95
Supersort (CP/M)	75.00	86.25
The General Manager	68.00	78.20
Versaform (form generator in Pascal)	199.00	228.85
Visi + (Visicalc Consolidation)	19.45	22.37
Visicalc	105.00	120.75
Visicalc expander (use with 32K/128K cards)	53.00	60.95
Visicalc utilities	34.00	39.10
Visidex	122.00	140.30
Visifile	115.95	133.34
Visiplot	93.00	106.95
Visischedule	144.00	165.60
Visitrend/plot	142.00	163.30
WORD PROCESSING		
Apple Write II	72.00	82.80
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Executive Speller	45.00	51.75
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Pie Writer (40/80 columns)	85.00	97.75
Sensible Speller (new fast proof reader)	69.00	79.35
Screenwriter II (70 col w/out 80 col card)	62.50	71.88
Super Text (40/80 columns)	109.00	125.35
Wordstar 3.01 (CP/M) (enhanced features)	135.00	155.25
Zardax	125.00	143.75
GAMES		
Beer Run (Sirius)	16.95	19.49
Cannonball Blitz (Online Systems)	16.95	19.49
Choplifter (Broderbund)	16.95	19.49
Epoch (Sirius)	16.95	19.49
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Swashbuckler (Datamost)	16.95	19.49
Tawala's Last Redoubt (broderbund)	16.95	19.49
The Prisoner (Edu-Ware)	14.95	17.19
Threshold (Online Systems)	16.95	19.49
Time Zone (Online Systems)	43.75	50.31
Wizardry (Sir Tech Software)	24.95	28.69
Zork II (Infocom)	21.95	25.24
PRINTERS		
Epson MX80T-3 (up to 132 col & hi-res)	299.00	343.85
Epson MX80FT-3 (as above & friction drive)	324.00	372.60
Epson MX82FT (very hi-res graphics)	359.00	412.85
Epson MX100FT-3 (100 cps & wide carriage)	429.00	493.35
Mannesmann Tally MT 120 (160 cps)	365.00	419.75
Nec 8023 (100 cps & prop. spacing)	299.00	343.85
Silentype & interface	159.00	182.85
Smith Corona TP-1 (daisy wheel printer)	449.00	516.35
PRINTER INTERFACE CARDS		
Aristocard Parellel	75.00	86.25
Aristocard Serial	69.00	79.35
CPS Multifunction Card (inc real time clock)	119.00	136.85
Digitek Printmaster (BASIC/CPM/PASCAL)	69.00	79.35
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Digitek Screenmaster 80	185.00	212.75
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Microvitec colour monitor	275.00	316.25
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Sanyo 12" Green Screen	95.00	109.25
Zenith 12" Green Screen (very good value)	89.00	102.35
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Bit Stick	245.00	281.75
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Graforth (fast 3D utility plus music)	43.00	49.45
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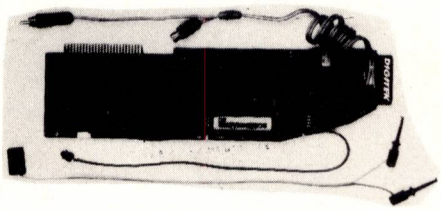

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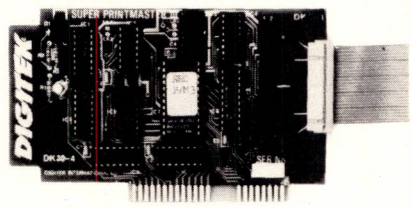

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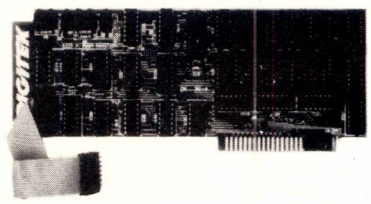

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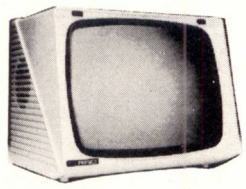

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PCW/13



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B. New! Low Cost Daisywheel Printer. Select 10 or 12 characters per inch or proportional spacing. Features ½ line feed, underline, boldface and programmable backspace. You also get 1/120" space and 1/48" line feed. With Courier 10 print wheel and carbon ribbon. **26-1250**

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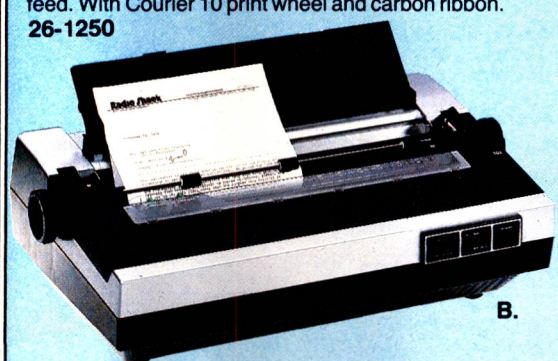

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
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.
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.
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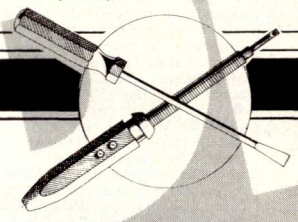
Windrush 6809 (£2418)	Windrush 0692 405189	56k non-volatile CMOS RAM: 6809: 2xRS232 ports: 2xP/P: dual 5¼'' F/D (700k)	OS-9: *Flex: Uniflex Basic: A: PL9: SPLM: Cobol: Fortran: Pascal*	Designed as development system for industrial control/computer station for commercial OEM's. With dual 8'' F/D (2 Mb) £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).



ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

This month is going to be a month of clubs. I have been so keen to waffle about national things in the last few issues that I have neglected mentions for the various clubs around the country. But first, as they say, here is the news. . .

The ACC held its AGM at the tail end of 1982, at the North London Polytechnic. Not many of the members turned up to constitution-monger and raise points of order; I hope that this means that the members are happy with the way the ACC is going. One important decision was made, namely to change the name from ‚Amateur Computer Club' to 'ACC'. This was done in order to emphasise the ACC's national liaison role, while at the same time retaining the initials. Various suggestions such as 'Association of Computer Clubs' had been previously discussed by the committee, but the name ACC was felt to be best, since it can be associated with both the 'club' and 'national body' functions.

Also at the ACC AGM, it was agreed to appoint, informally, a 'Vice Chairman' to be the heir apparent to the job of Chairman. The idea of this is to help provide continuity between the years of the ACC Committee. As the idea is experimental this year, it does not preclude somebody other than the committee nominee standing. The only party state is not with us. . . yet!

Have you seen the ACC area on Prestel? Page 8008 has all the info. . . The ACC is keen to encourage clubs to involve themselves in Prestel, and will be able to make pages available to clubs, via Telemap. There is an ACC National Prestel Committee organising all this, and we would be very keen to talk to anybody interested in putting material up on Prestel. Contact me for more information (address below).

I think it's about time I got the idea of regional groups off the shelf, and waved it around for general discussion. As many of you will know, there is a very successful cooperation of computer clubs in the London area, known as the Association of London Computer Clubs. These clubs benefit each other by being able to share lecturers and to mount exhibitions. They are also able to solve the 'Your club is a little too far away' problem by swapping members. The ACC has been thinking about setting some more of these wonderful groups up in other parts of the country, but so far nothing spectacular has happened as a result of our hints. There seems to be a group starting up in Manchester, and there might soon be one in the Thames Valley area. Anybody interested in regional club groupings, please drop me a line.

Finally on ACC matters, it's about time that I reminded you about the ACC's Club Affiliation Scheme. Many Clubs feel the need for a full newsletter; a substantial proportion of the members attend only a few of the meetings, and it is necessary to give them something if they are going to renew their subscriptions. However, preparing such a newsletter is both expensivse and hard work; a number of clubs are therefore not in a position to do this. Since the ACC prints *ACCumulator* in large numbers, it makes sense for us to make it available to clubs.

The idea of the scheme is therefore that, in return for a capitation fee of £3 per member (with discounts beyond 50 members), the ACC enroll all the members of the club as ACC affiliate members, with full rights, except for the right to be on the committee or vote at the AGM. The ACC then sends *ACCumulator* to the Club, who insert further information, such as a programme or a chairman's letter and then distribute it. Anybody interested in this for their club, please write to me for details.

Uncle Bazyle tells me that there is a Pascal User Group (PUG) lurking in the rain forests of Pinner. They are interested in promoting 'standard' Pascal, rather than having the same proliferation of dialects as Basic has suffered. Quarterly newsletter: enquire Nick Hughes, 01-866 3816, or write PUG, PO Box 52, Pinner, HA5 3FE.

Lonely Mr Sadler, of 18 Wanescot Road, Brentwood, Essex, CM15 9HD is canvassing for support for a computer club in the Brentwood Area. Now, I've had to send them to Ilford or Chelmsford. So here is your answer; Mr Sadler awaits your letter.

Further down my postbag, I find a similar enquiry from Mr D Norden of 138c Church Road, Harrow Wood, Romford, Essex. Perhaps you and Mr Sadler could get in touch. . . (this is beginning to sound rather like Julie Dawn's pen pals spot on Radio 2 in the middle of the night).

The Royal and Ancient Borough of Slough is apparently still devoid of computer clubs; last time I mentioned these worthy people's plight, I received a letter from a Mr P A Seal of 1 Ormonde Flats, Church Road, Iver Heath, Bucks, in which he said that all he knew of was evening courses at Evreham Adult Education Centre (Contact Mr D de Silva). However, he is intending to try to form a club, so why not get in touch?

Back in the teeming Metropolis, I hear tell of '68 Microgroup'. This is half-way between a London based club and a national group with a bi-monthly newsletter. They are interested in micros whose names start 68, which means 6800, 6809, 68000 (ie the Motorola Appreciation Society). The club is described as 'resolutely non profit-making' and the subscription is £5 pa plus £1 per meeting. The Chairman is Jim Anderson, of 41 Pebworth Road, Harrow, Tel: 01-422 4724.

On a rather different note, I have been asked to plug the Central Program Exchange. This is a

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(legal) software swapping organisation. This appeals quite a lot to schools and the like; the emphasis is towards education rather than business. Anyway, contact Central Program Exchange, The Polytechnic, Wulfruna Street, Wolverhampton, WV1 1LY, or telephone Wolverhampton 28521 or 27371.

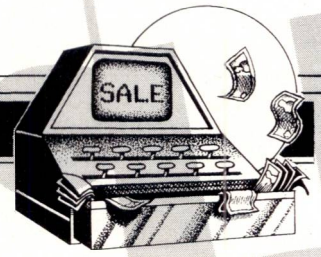
Feeling more rural, we move on to the Chiltern Microcomputer Club. This meets on the first Wednesday of the month at the Garden Centre, School Lane, Chalfont St Giles. They appear to be a general club dealing with many different machines (I wonder if they are interested in a Thames Valley Association of computer clubs). Anyway, contact Mrs W Tibbitts, Ellwood. Dean Way, Chalfont St Giles.

Another club in the London area is the Southgate Technical College Computer Club, which meets fortnightly on Thursdays at 7.30 in Room W102 at the above Tech. Contact the boss, Kevin Pretorius on 01-882 2282 (subscription £5).

At the other end of the A1, we find the Edinburgh ZX Computer Club. This is an extremely active organisation of Scottish Sinclair freaks. Their activities include producing a bi-monthly newsletter containing news, programs and articles and holding fortnightly meetings (2nd and 4th Wednesday) at the Claremont Hotel, Claremont Crescent, Edinburgh (7.30pm). Tutorial groups are held at their meetings, so that beginners can benefit from the more experienced members. Subjects covered include Basic and machine code at both beginners' and advanced levels.

By now they will have organised two ZX computer fairs in Edinburgh, the first (in July) having attracted 1500 people. Their membership rates are £5 pa, or £3 for children, students, pensioners and the unemployed. For more information contact the Secretary, Keith Mitchell, 19 Meadowplace Road, Edinburgh or phone 031-334 8483.

TRANSACTION FILE



Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for cooperating.

● VIC-20 and Datacassette, Joystick, bug byte games, also Spiders of Mars ROM. Machine code book. All boxed as new £225 ono. Tel: Waltham Cross 33895.

● £175 ono Video Genie 32K with editor/assembler and dissassembler tapes plus some books. Contact: Borman "Freebridge", Low Road, Saddlebow, King's Lynn, Norfolk. Tel: St. Germans, 474 after 6 p.m. or anytime weekends.

● Free Hitachi tape deck and extensive software when you buy challenger C1U cased 8K Cegmon 42 x 38 video DAC 300/600 cassette, manuals, leads. Nearly new. £225 ono. Tel: Peterborough 202627 after 18.00.

● Superbrain 64K, RAM, with CP/M 2.2, M Basic, Pascal. All manuals. System hardly used (as new). £1300 ono absolute bargain. Tel: 01-801 1229 evenings and weekends.

● Casio FX702P and FP10 printer and FA2 interface £75; Sharp PC1211 and CE121 interface £70; Realistic minisette £20; New condition. Lea Valley (0992) 768369 evenings.

● TRS-80 16K II. All leads plus full manuals. In original box. Also Microdeal Joystick and over £50 software, including robot attack and scareman. Excellent condition. Only £200. Ring Mr Drubra 01-427 3651.

● 60 MByte ICL/CDC BR2A8 hard disk drive with new disks (IBM 2316) 2.5 Mbaud. 8 Bit bus interface. Complete circuits and manuals. £499. Morling, The Mount, Hatfield Heath, Essex. 0279 730284.

● CBM 4032 Basic IV. 9 months old. Tape recorder, cover, manuals + Raeto West programming manual, tapes. All as new. £525 ono. Meopham (0474) 814592.

● Acorn Atom 12K RAM 12K ROM Programmers, Toolbox, Floating point, Rom Special Recorder, Power supply. Many games, green screen, cost new £340 + games. Excellent condition. Price £225 ono. Tel: 0268 710637.

● Tandy line printer VII – Little used and in excellent condition. With manual and large amount of paper. £150 ono. Telephone Broxburn (STD 0506) 853703 any time (Peter Walker).

● Acorn Atom, 12K RAM, 8K ROM. Hi-res graphics, PSU, leads and all manuals. Also Magic book and lots of software including Invaders and Chess. £160. Tel: Mr B. Grant 01-363 5772 eve.

● ZX81 RAM Sinclair. Built complete with leads and power supply. One games cassette. 12 months old only £60 ono. Manual included. Tel: 01-398 4541 after 5 p.m.

● TRS 80 Model 1 Level 2 16K, manuals, cassette recorder, certain programs, hardly used, worth over £400, £175 ono. Tel: 0242-24184.

● Sharp MZ-80K – 48K RAM, 4MHz CPU, £400+ software including XTAL Basics, Pascal compiler, Forth, Assemblers, utilities, chess, many games, monitor listing, books, news-letters, £380 ono. Tel: Bradford 577424.

● DAI Personal Computer, 48K RAM, 16 colour hires graphics, sound, joysticks, cassette recorder, assembler, tapes, programs. Micro in UK, CPL Boyd 26SU, R.A.F. Gatow, BFPO 45. £595 ovno.

● Genie computer system. Computer, expander, printer, dual disk drives & TV. Will split. Comes with full documentation. Word processing program & application books. For full details and prices please telephone Mike on 01-675 0855.

● Sharp MZ-80K – 48K.4 months old, hardly used. Books, magazines, user newsletters, soft-wares, cassettes, worth £450. Owner leaving UK. Quick sale for £360. 01-837 8888, Room 272, London House, 8-10 pm. Free demonstration.

● NASCOM 2 32K RAM Board equipped 16K, ZEAP 2 in Prom, graphics ROM, PSU. Veroframed, Keyboard cased. NASCOM tested. Perfect condition, little used £275 ono. Tel: Cambridge (0223) 69446 evenings or weekends.

● ZX81 + 16K Sinclair built. Still boxed and complete. As new. Ideal for Christmas – £60. Tel: 01-449 7391 (Barnet).

● Seikosha GP100A – For Sale, as new – only £175. Contact Leigh. Tel: 01-907 8065 after 6 pm.

● BBC Micro Model B. Includes Acorn user magazines and basic programming on the BBC Micro. All leads and manuals included. Emigration forces sale. All for £385. Telephone Cumbernault 33142 Scotland.

● Tangerine equipment; Microtan-65. Fully-Exp £50; Microtanic assembler/Eprom card £30; Motherboard (4-slot) £25; ASCII keyboard £35; MPSI £12; XBUG-V5; 2 £10; 6K RAM (2114) £5; 11, Kilmardinny Drive, Bearsden, Glasgow G61 3PD. Contact Stephen.

● Tandy TRS 80 Microcomputer LII Model 1 VDU cassette manuals, games, reference books, magazines. Expandable numeric keypad. As new. Free delivery 150 miles Cheltenham. Worth £600. £200. Hall Bishops Cleeve 4511.

● Processor Technology Sol for sale. 48K RAM, Dual North Star disks, disk and cassette software. S100 based, and green screen monitor. £2499. Telephone 021-328 2987 evenings only.

● TRS 80 – LII, 16K VDU one year old. Cassette manuals, programs, games, books etc. Any reasonable offer considered. Apply 01-387 7050 x 784 or call 2, East Gardens, London SW17.

● Sharp PC1211 and CE122 printer with boxes, cases, manuals, leads, mains adaptor/charger.Good condition. £115. Also CE121 cassette interface £10. Tel: 031 337 4401.

● CBM – 4016 as good as new. 7 months old. £486. Tel: (01) 998 2724 (Ealing).

● Apple II Europlus 48K manuals and modulator. £425 ono. 16K RAM card £60. Parallel interface card £40; Communication (RS 232) card Half/Full Duplex £40. Phone 01-249 9895 after 7 pm.

● Acorn atom, 12K + 12K, VIA. Switchable 1-2MHz, Large heatsink, PSU, and leads. Books and software tapes. £200. M. Malkin, 19 Rhys Avenue, Kinmel Bay, Rhyl, Clwyd, LL18 5NS.

● TRS-80 Level II 16K,VDU, CTR-80A. All leads and manuals. Tandy computer games book. Over 20 games on cassettes inc. 2 Tandy adventures £310 ono. Tel: B'ham 747-3618 after 6 pm or weekends.

● VIC-20, Datasette Superexpander vic revealed vic men plus other books, programs and magazines. All boxed as new. Perfect condition. Tuition available. Might deliver. Cost £300+ will accept £199. Tel: 021-777-6827.

● Video Genie I, 16K RAM, 13½K ROM, sound, built in cassette player & P/S, TRS-80. Basic, S/W: Assembler, Deassembler, scramble firebird, Maze + personal programs, 5 manuals & cover. £240 ono. Tel: Welwyn Garden City 27887 B/W, R/C T.V. £35.

● ZX-80 Sinclair built. Original packing, with leads. PSU and manual, included excellent condition ideal introduction to microcomputing or computer hobbyist. £45 ono for quick sale. Phone Shoreham 2566. After 6pm.

● ZX-80 — Sinclair built, original packing, with leads, PSU and manual, included. Exc. cond. Ideal introduction to Microcomputing or computer hobbyist. £45 ono for quick sale. Tel: Shoreham 2566 after 6pm.

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● Acorn Atom — 12k RAM 12k ROM £200. Includes Joysticks, ROM, extension board, 2 utility ROMs 6522 via plus £200 of software inc. Forth and Lisp. Fully working. Tel: Manchester 061-881 4473 after 6pm.

● Epsom MX80FT — printer PET Interface £300 PET programs, Papermate word processor PET plan PET aid animator £10 each, Microchess games utilities education music etc. PET books cheap. SAE list. All 50p-£5. Tel: 0926 81 2168.

● Compu/Think — dual disk drive with controller board, cables for PET/CBM 2001. Perf cond, £175 ono. Tel: 0444 455177.

● TRS80 — Pocket Computer and Printer/Cass Interface inc paper, manual and leads, housed in durable locking carry case. Worth £170 selling for £150. Tel: Jonathan 0274 43973 after 6pm. C28 Mannheim Road, Bradford.

● Better ZX81 — 16k plus 4k graphic Rom, pro keyboard with numeric pad, all steel cased and many tapes, books, leads, offers over £100. Tel: Harpenden 827-61564.

● UK101 — 16k cased with buffered motherboard, new Basic Rom, Cegmon, Exmon, Assembler. Also 6821PIA board if required, £130 Tel- 061-437 5621.

● TRS-80 L2/16k — with CTR 41 recorder, new Rom, numeric keypad, leads, manuals, books, approx £80. Software light hobby use only £230 complete, boxed. Tel: Burnley 0282-76237.

● Genie EG3003 — 16k, plus Epsom MX-80 printer, plus printer Interface plus all manuals and cables. Never used, still boxed, worth £800 selling for £490. Tel: 01-435 1300.

● For sale — 1k ZX81 plus ver £30 of boks, 2 M/C plus others. First offer over £60. Upgrading. P Gower, 4 Clyffard Crescent, Newport, Gwent, NPT 4GE.

● Sharp — MZ80k 48k Basic, Sharp Assembler, Machine Language, Hisoft Pascal 3 Compiler, Manuals £365 ono. Tel: Mark 01-578 8719 eve or weekends.

● Video Genie — joysticks, lower case and sound plus £200 extra software including Scripsit, Adventure, Space Games plus books and manuals £270 ono. Tel: Bedford 53322 eve.

● VIC-20 with cassette player. Purchased April '82, manual, leads etc plus over £100 of games and VIC revealed. All £180 ono. Tel: 01-892 6439

● PET 8k — cassette deck, Basic 4, dustcover, manuals, PET revealed and PET graphics, books, games on cassette, boxed, £400. Tel: 01-363 8901 after 6pm ask for Nick.

● TRS-80 — Model 1 L2 16k VDU, cass, unique ROM separate soundbox, PSU, manual, all leads, plenty of software, £500 or offers. Must sell — moving to 16-Bit. Tel: Stubbington Hants 61677.

● Data Dynamics — RO390 printer complete with interface and software driver for Tandy TRS-80 Model I Level II, no need for expansion interface just connect to tape output. Only £99. Tel: Hertford 50243.

● PET 4040 — disk drive plus Basic 4 Roms £475. PET 3016 plus cassette plus toolkit £425. PET 2020 printer £225. All 3 f0r £1050. Offers to Mike. Tel: 021-477 0191.

● MZ-80k — 48k RAM plus manuals, software, Asteroids, Disassembler, extended Basic, etc. 1 year guarantee over 30 programs £320 ono. Tel: 051 342 5789 Wirral. A J Warre, Meadow House, Barnston Road, Heswall, Wirral LIO IUE.

● ZX81 plus 16k — RAM PAC as new Sinclair built, all leads £25, software all worth £110 will accept £90 ono.Tel: 870 2081 (eve). Write: L Baines, 8 Santos Rd, SW18.

● Apple II Europlus — 48k, 16k expansion card, dual drives, B&W Hitachi, Monitor, Paddles, Serial Interface, Visicalc, Visicalc utilities, Supercopy, 50 disks as new. Tel: 01-546 2376.

● Smart 16k — memory expansion with header and 8k installed for UK101 £37 solve The Great Pyramid Puzzle Using your computer £9.95. Speech input with Bigears £19. Tel: 094-68 6627 after 5

● Atari 800 — 16k Ram cassette deck, various software including Star Raiders, many Atari books. Still under warranty by shop. Faultless, original packing £560 for everything. Call Cobham 4569 ask for Ryan.

● Printer SWTPC — type PR-40 line-printer £65 ono. Wanted: GP80 or GP100 suitable for Acorn Atom. Tel: Halesworth 09867 3862 after 5pm, Richard.

● Video Genie — 16k Arrow keys VU Meter and sound unit, fitted manual leads and some software. Good condition, hardly used only £185. Tel: 0382 452614.

● Atari 400 — 16k Basic, Star Raiders plus other games 410 recorder, joysticks, manuals. Exc cond cost price over £450 sell for £320 ono or swap for Commodore 64. Tel: 994 2511.

● Sharp MZ80k 48k boxed machine code and manuals many programs, Invaders, Apollo, Plotter, Cosmaid, lectron waves, Asteroids, Chess, many others, £350 to £375. London area. Tel: 01-554 9488 eve only.

● MK14 RAM — 110 extra RAM revised monitor manual nad specialised book cassette interface PSU special interface board and many extras £40. Tel: 01-422 1990 eve (Hatch End).

● ZX Printer — C/W 1.2 amp PSU, 9 rolls of paper £45 ono. Tel: 01-642 3102.

● Acorn Atom — factory made, 12k ROM 12k RAM, Magic Book, getting acquainted, £50 worth of software, leads, manual, PSU, £180. Tel: Andrew Cardiff 796663.

● MZ80K — 36k toolkit, machine language tapes, reset button, manual, 20 months old, details to connect to Creed 7E Printer, £345 ono. Manchester 061-761 5374.

● Centronics printer — 165cps, 132 column parallel interface, auto motor control, tractor feed, lots of free paper, vgc, leads for BBC Micro, fully working, £189 ono. Tel: Uxbridge (0895) 35129.

● Colour Atom, — fully expanded 12k plus 12k with via chip, new typecolour board, 4 amp PSUY. Much software (Invaders, Asteroids, Star Trek, soft VDU etc). books, newsletter, £235, deliver south. Tel: 0705 321743.

● ZX81 — fitted inside professional keybioard plus 16k RAM plus several 16k programs plus printer, complete with books, leads power supply etc. Bob Hammond. Tel: Maidenhead 28411 ext 282 daytime — price £200.

● Sharp PC-1500 — CE150 printer 4k mem. exp mini cassette, value %£60, 20 rolls paper, spare pens, leads, manuals, software £275 ono. Tel: Worksop4763906.

● HP41C — Scientific calculator with card reader, printer, Wand users, manuals as new, worth £480, will accept £250. Tel: Reigate 40520 (Surrey).

● Apple — Serial Interface by Aristocard, many features, Dot Matrix printer up to 132 columns, tractopr feed, serial, upper and lower case, working well £70 buyer collects. Tel: 0203 72438

● Atari — software on cassette: Temple of Apshai (32k) £17.50 Scott Adams Adventures 7, 10, 11 (24k) £7.50 each. PAC Man ROM cartridge £20. Tel: 01-642 6553.

● QS — character generator and Motherboard. Design your own alphabets and Invaders etc. Boxed as new. exc. cond only £30. Tel: 0634 41159 eve only. Ask for Ian Poynter.

● Atari 800 — (48k) plus Disk plus Recorder plus Star Raiders plus Mission CXommand plus Space Invaders plus many programs on disk and cassette including Microsoft Basic p/exch ZX81 £800 ono, Bill Tel: 01-572 2917 (might split).

● Acorn Atom — 12k plus 17k via printer I/O plus Atom Bus extension ports, Invaders, Snapper, Asteroids, Breakout, Dogfight, 747, Hwrite, manual plus leads. Worth £350 plus, will accept £120 ono. Tel: 01-993 2572.

● Epson MX80FT3 — printer latest Epson model with graphics features, friction and tractor feed: less than 2 months old £310 inc. Tel: Dorothy North, Watford (0923) 31289 after 4pm.

● PET 4000 — Series computer upgraded professional to 32k complete with toolkit, cassette recorder and some software. Commodore 4022 Matrix Printer with paper. All in immaculate cond. £795. Tel: 0792 781370.

● Sharp MZ80k — 48k RAM with extended Basic, books, listings, notes and games inc Missile Command, Invaders, Defender, Adventure £350. Local delivery. Tel: Farnborough (Kent) 0689 52191.

● Tandy TRS-80 — 16k MIL2,1 boxed exc cond,, leads, green screen, monitor, manuals , games, Star Trek, Pyramid, Chess etc £350 ono London. Tel: 01-379 3581 day 01-690 4019 eve. Paul Colbert.

● TRS80 — 16k LII with PSU, cassette, manuals and games. Used very little and want quickl sale so only £230 01-902 4627.

● North Star Horizon — OS/OD drives 56k RAM, DOS Basic, CP/M £1425, ovno. Micro diversions 40x86 video board (S100) plus software £100, 16k RAM boards £82 each. Phone Paul Crawley 515201.

● Wanted: Apple II — Europlus 48k with disk drive. Tel: Stephen Whale. Tel: Romford 614966 after 6pm.

● ZX81 — 16k RAM plus printer. Complete with leads, manuals plus PSU, £85. Tel: 01-504 3149 after 7pm.

● PET — 8k integral cassette immaculate. External Honeywell large keyboard on extension cable, users manual. PETS "Revealed" "Graphics" and "Subroutines". Games tapes £290. Nascom I uncased working £49. Tel: 0633 895451 anytime.

● Sharp MZ-80k — 48k. As new, complete with cover, manual, Basics and other programmes (worth over £100 in themselves) including Space Invaders, Asteroids etc £350 ono. Tel: Kenilworth 0926 56737.

● RML-380Z — 48k RAM Hi-res, colour Graphics, 6-channel sound synthesiser, RS232 interface, several Basics to powerful 16K-5.1D version. Assembler and Forth. Various games and utility programs, £900 ono. Tel: Brentwood 225613.

● ZX81 — plus 16k RAM plus portable black and white Television plus over 75 programs on cassette and one games cassette all for just £120. Tel: Temple Cloud 52576 for further details.

● Tangerine Micron — 24k, system Rack, Motherboard, Bulldog sound board, Hi-res Graphics, Eprom storage board, Eprom programmer, toolkit, keyboard, keypad. Plenty of interesting software. Will demonstrate £200 ono. Tel: Ken 01-801 7894 eve.

● PCW — vols 1-4 in binders £25 ono the lot or will split. HP19C printing calc all standard accessories GQC £160 ono. Steve Yewen 6 Pilham Court, Gainsborough, Lincolns ON21 IPD.

● Centronics Microprinter — P1 good cond 2 rolls paper, manual etc £80 or will swop for 12in green screen monitor. Tel: Lincoln 0522 40621.

● Apple II Europlus — twin disks, 64k memory, 12in green monitor Basic and Pascal languages. As new, guaranteed until August 1983, £1,500 ono. Tel: Chester 0244 41961 (job now involves computers).

● Osborne I — portable computer only 3 months old, complete with Supercalc Wordstar, CPM CBasic and MBasic software new cost £1437, accept £950 ono. Tel: 01-228 8860.

● Acorn Atom — 5k plus 12k colour new style keyboard 1.8A PSU plus books and Acorn software, unwanted gift £100. Tel: Julien Limpsfield Chart 2143.

● Hazeltine 2000 — Data Terminal, acoustic coupler, speed from 300-9600 Baud, detachable keyboard, green screen, great for networks and linking to mainframes vgc, £160 ono. Tel: Darren 01-445 4429 after 6pm.

● Exchange Fairline — 2 plus 2 Berth fibreglass cruiser, toilet, cooker, 60 gallon water tank, 20HP Johnson outboard, moored at Stourport, West Midlands for 4032 PET twin discs, Printer or similar. Tel: 021 358 1872.

● Nascom-2 — fully cased with 32k RAM NAY-SYS 3, Zeap, NAS-DIS, NAS-DEBUG, NAS-PEN, graphics, 8k Basic with toolkit, also extended 12k Basic. Complete documentation £485 ono. Tel: Terry 0494 37566 weekdays or 0793 42305 eve and weekends.

● Superboard — 50HZ 8k RAM 'Cegmon' correct case built in power and TV MOD witrh leads manuals demo tape £70 plus postage. Tel: Maidstone, Kent 6787782 eve.

● PET Model 4 — 32k, pristine cond with green screen, large keyboard, cassette deck, manuals (inc PET Revealed, IEEE-bus interfacing etc.) Program tapes, Chess, Spaceace, Micromon, RTTY etc £520. Tel: St Albans 51037.

● Acorn Atom — 12k RAM, 20k ROM (FP Willowsoft and Program Power ROMs), homemade PSU, leads, software, Astrobirds, Astderoids, Invaders etc, books and extras, £165. Robert Heards, Flat 69, Lower Court, Beeston, Notts.

● Atari VCS — with 20 cartridges inc 3 Activision cartridges and keyboard will accept £200 ono. Tel: 01-552 9403.

● Video Genie — 487k Sound, manuals, books, 42 programs inc Assembler, Dissembler, ZChess, Startrek, original packing £225. Tel: Rotherham 79647 eve.

● TRS-80 Level 2 — 16k new ROM with numeric keypad, new style VDU, manuals, cassette and £50 plus of software. Exc cond £250 or highest offer. Tel: Amersham 6527 (Bucks).

● Sharp MX80k — 48k 8 months old, original boxes, green screenm, dustcover, 25 software games inc Startrek, Adventure, The Valley £325 ono. Tel: Bridlington 601615 anytime. Mr IS McKie.

● PET — 32k New ROM cassette player, toolkit, chip, software includes games ASSEMBLER PET Graphics Routines, Book perf cond £475 ono. Tel: James Tagg 01-979 1648.

● ZX81 — Sinclair built, 16k. Printer 5 cassettes, learning lab £100. Tel: 01-381 28457 eves.

● Commodore PET — 3032 upgraded to 4032, diskdrive printer Visicalc Wordpro and many other programs. Contact Tom Chambers, 12 Saygsbury Road, Sawbridgeworth, Herts or tel after 9pm on 0279 723231.

● VIC-20 — CZN cassette unit, joystick, programmer's aid, super expander C3k, Hi-res and Invaders cartridges, VIC revealed book, magazines and software, complete with manuals £250. Tel: 01-449 9424 after 6pm.

● TRS-80 — 16k L2 boxed complete with numeric keypad, recorder, amplifier, leads, manuals, books and over £200 of software inc Microchess, Invasion Force, Pinball, Editor/Assembler, £320 ono. Tel: Leeds 643116.

● Bargain! — ZX81 plus 16k Sinclair built, complete plus 3 prog, books, all £70 only! Tel: 01-995 0936 after 6.30pm. Quick sale needed, hurry!

● HP41C — with Quadram, card reader, printer, plus access £450 ono. Like new. I'm selling to move up to new HP-75. Tel: 01-351 4746 eves or write Cox, 9 Cheyne Row, Flat 4, Lonmdon SW3.

● Hobbit — cassette system plus 7 tapes for Nascom £100, Teletype £45, Nascom I board with graphics and Cottis/B £45, buffer board, 32k RAMA, keyboard, software, games all cheap. Tel: 01-303 7852 Sidcup, Kent.

● PET 2001 — 8k, new ROMS fitted with reset switch, with manuals, 'PET Revealed', games cassettes. Buyer pleasse collect! Only £250, David Booth 11 Greenfield Street, Dunkirk, Nottingham NG7 2JN.

● OHIO Challenger — 1P 8k RAM and RS232 Interface, Pre-Cegmon operating syste,m (upgraded) Basic in ROM. Several; utility and games cassettes £150 ono. Tel: Chris Armstrong 0970-3181 office hours only.

● S100 IMS Godbout — 8k RAM boards £38. Cromemco 16k (2708) Eprom board £233, Tandon TM100 96TPI 800k 5¼" drive £220, Morrows disc 8in Controller CP/M £95. Tel: 0293 515201.

● BBC Computer — Model B, cassette recorder, Acorn Defender, 5 issues Beebug £375 or will swap for Atari 800 045-36 6143,

● Atari — software Asteroids ROM, Temple of Apshai Star Warrior, £17 each, Hazard Run, Draw Pk, Crypts of Terror £14 each, Adventures One and Eight Galactic Empire £9 each, tel: 045-36 6143.

● ZX81 — 16k RAM Deans keyboard and case with auto-repeat. All leads and maniual, ASASTD Software, £110 ono. All exc cond. Tel: 01-727 6956.

UK101 — with UK02 monitor and 8k RAM. Hardly used only £100 ono. Tel: Malcolm 01-997 9002, 24 Mount Park Road, Ealing, London W5 ZRT.

● Sharp PC1211 — good cond with printer/cassette interface. Good value at £100. Tel: 050 634 3278.

● UK101cased with Cegmon 10k Basic. New Basics 3,4,5 300/600 Baud, 1-2 MHz games inc Invaders with Ikegami 9" B/W monitor only £250. May separate. Tel: Mark on Erith 33906.

● PET — 32k 3032 plus 3040 dual drive, floppy disk unit plus cassette drive plus manuals, exc cond, £875, buyer collects. Tel: Jackie Flynn, Brighton 812270.

● Superbrain — 64k twin disks SSDD (320k) in immac cond with CP/M 2.2, Microsoft Basic interpreter and compiler, £1450; also MICROLINE M80 Printer, RS232 interface, little used, £220. Tel: Dunfermline (0383) 28075.

● Two DRE 7200 — DS/DD cased 8in disk drives new but untesyted, £200 each ono Also two Kode Power supplies for above £30 each ono plus 1 Model B BBCC Machine £380. Tel: 435 3959.

● TRS-80 — 16k Level 2, monitor, cassette recorder, 32k expansion interface, cables and manuals, over £140 worth of software, Editor Assembler, many games, £800 ono. Will separate. Tel: 051 339 7427 after 6pm.

● PET — 32k 4016 professionally uprated with cassette and many tapes. As new with green screen and dust cover, £550. TX80 IEEE printer card £10. Tel: Hemel Hempstead (0442) 41826 after 6.30pm.

● Atom 10k ROM choice 29 or 29k RAM HO-P/S 5V12A plus 12VV cassettes plus recorder, software games, books, newsletters, fitted I/O chips. All leads plus experimentors pack £180 or £220. Tel: Southend (0702) 65063.

● PET 2001 — new ROM 8k upgraded to 32k, large keyboard, separate cassette, sound box, anti glare screen, PET revealed, Vigil, over 50 games, books, first class cond, £500 ono. Tel: Crawley (0293) 83351.

● Sharp 48k — MZ80k with 320 x 200 Hi-res graphics, 2 basics Assembler, Redefinable character set, dust cover, programs, full documentation, books. Any offers over £300? Tel: Marlow (06284) 6136 for details.

● DAI — software, DAI, joysticks, DAI, All kinds of programs including exc games and individual software and joysticks from Germany, each program in English! Free information wanted? Wolf, Oberfeldweg-11,. D-840, Regensburg, Germany.

● TRS-80 — Lev 2 16k and numeric keypad, including manuals, books, magazines, catalogues, up to £350 of software, CTR-80A, recorder £40. All worth up to £750, asking £350 ono. Tel: Wallington 669 3491.

● TRS-80 — pocket computer plus manual and book of fifty programs, games 1 package and cassette interface, £80. Tel: 0243 864021.

● Atari 800 — complete with recorder, joysticks, games and manuals including Dara Atari, £440. Tel: Croydon 01-630 3681 eve, weekends.

● Apple II — integer card, £30. Colour card, slight fault, £30. Tel: Lymington 72518.

● ZX81 — 16k Sinclair made, 6 months old, hardly used in original packing includes 4 cassettes and 15 mags complete only £75 ono. Quick sale. Tel: Northwood 28204 anytime.

● Acorn Atom — 12k plus 12k, exc cond inc PSU, all leads, manuals, Eprom printer, drive, VIA, games packs 1 and 5. 747 flight simulator other information and software details £190 ono. Tel: Mark 051-638 8504.

● Apple II — 48k Europlus single disk drive programs including Database manuals £885. Tel: 263123 weekdays, Stratford-upon-Avon 2928187 weel end. P Howard.

● Video Genie I — 16k, 8 months old exc cond, latest nodel £260. Tel: Crawley 33099 after 5pm.

● TRS-80 — quick Printer II 2½" thermal printer, connects directly to TRS-80 or to Expansion Interface. Hardly used boxed with manual and cable, £85. Tel: 027 564578 (day) 0761 418499 (eve) Bristol.

● Atari 800 — 32k program records, joysticks, Star Raiders, manual plus DE RE Atari, need cash for car so £530. Tel: Farnborough, Hants (0252) 512722 after 5, only 8 months old.

● UK101 — 8K RAM, new monitor, diassembler tape, some home-written progs. manual and cased £220 ono. Tel: Billericay 57592.

● ZX-81 — inc 16K manual, leads etc. ZX-81 pocket Book Games

TRANSACTION FILE

magazines, A Working Knowledge available. All in vg cond. Sinclair built only months old £70 ovno. Tel: Aylesbury (0296) 624661.

● Brand new — Dragon 32 computer 32K, still boxed, manuals etc inc., £160. Tel: Andrew on 01-521 3031. Hurry. Quick sale!

● HP41C — with 2 memory modules, complete with manual and box £80. East Sheen, London SW14. Tel: 01-876 5719.

● Video Genie — 16K complete with manual and leads plus extra cassette recorder. All in exc. cond, £260 ono. Tel- 01-561 4918.

● Video Genie — new June '81, hardly used, books, tapes, £220. Ray Wilkes, Dept of Chem Eng, Bradford University or tel Bradford 594413. Good machine but owner short of cash.

● Adler Alphatronic — P2 48K computer with 12" green display unit, dual 5¼" disc drives and serial interface. New cond. £1145 Tel: 0203 75633

● Commodore 4022 — printer, cables, superb cond, little used £300. Tel: Horndean 597066 (eves), Cosham 321212 ext. 5233 (days).

● Acorn Atom — for sale, colour, 12K RAM, 12K ROM, 4K toolkit ROM 3A PSAU, leads, various games and magic book £200. Tel:R Martin 01-997 9731 after 7pm.

● Sharp MZ-80K — Quantum hires graphics, Knights Commander, Pascal, Fortran, Forth, various games £370 ono. Sharp P3 Printer, expansion box, 6 months old £330 ono all vgc with original packing. Tel: Kendal (0539) 27058.

● Sharp MZ80K — 48K perf cond over year's guarantee left. Games inc Space Invaders plus Adventure Games £300. Tel: (0792) 701186.

● VIC-20 with cassette player. Purchased April '82, manual, leads etc plus over £100 of games and VIC revealed. All £180 ono. Tel: 01-892 6439

● PET 8k — cassette deck, Basic 4, dustcover, manulas, PET revealed and PET graphics, books, games on cassette, boxed, £400. Tel: 01-363 8901 after 6pm ask for Nick.

● TRS-80 — Model 1 L2 16k VDU, cass, unique ROM separate soundbox, PSU, manual, all leads, plenty of software, £500 or offers. Must sell — moving to 16-Bit. Tel: Stubbington Hants 61677.

● Data Dynamics — RO390 printer complete with interface and software driver for Tandy TRS-80 Model I Level II, no need for expansion interface just connect to tape output. Only £99. Tel: Hertford 50243.

● Acorn Atom — 12k RAM 12k ROM £200. Includes Joysticks, ROM, extension board, 2 utility ROMs 6522 via plus £200 of software inc. Forth and Lisp. Fully working. Tel: Manchester 061-881 4473 after 6pm.

● Epsom MX80FT — printer PET Interface £300 PET programs, Papermate word processor PET plan PET aid animator £10 each, Microchess games utilities education music etc. PET books cheap. SAE list. All 50p-£5. Tel: 0926 81 2168.

● Compu/Think — dual disk drive with controller board, cables for PET/CBM 2001. Perf cond, £175 ono. Tel: 0444 455177.

● TRS80 — Pocket Computer and Printer/Casss Interface inc paper, manual and leads, housed in durable locking carry case. Worth £170 selling for £150. Tel: Jonathan 0274 43973 after 6pm. C28 Mannheim Road, Bradford.

● Better ZX81 — 16k plus 4k graphic Rom, pro keyboard with numeric pad, all steel cased and many tapes, books, leads, offers over £100. Tel: Harpenden 827-61564.

● UK101 — 16k cased with buffered motherboard, new Basic Rom, Cegmon, Exmon, Assembler. Also 6821PIA board if required, £130 Tel- 061-437 5621.

● TRS-80 L2/16k — with CTR 41 recorder, new Rom, numeric keypad, leads, manuals, books, approx £80. Software light hobby use only £230 complete, boxed. Tel: Burnley 0282 76237.

● Genie EG3003 — 16k, plus Epsom MX-80 printer, plus printer Interface plus all manuals and cables. Never used, still boxed, worth £800 selling for £490. Tel: 01-435 1300.

● For sale — 1k ZX81 plus ver £30 of boks, 2 M/C plus others. First offer over £60. Upgrading. P Gower, 4 Clyffard Crescent, Newport, Gwent, NPT 4GE.

● Sharp — MZ80k 48k Basic, Sharp Assembler, Machine Language, Hisoft Pascal 3 Compiler, Manuals £365 ono. Tel: Mark 01-578 8719 eve or weekends.

● Video Genie — joysticks, lower case and sound plus £200 extra software including Scripsit, Adventure, Space Games plus books and manuals £270 ono. Tel: Bedford 53322 eve.

● Creed teleprinter with interface for VIDEO GENIE. Good working order; £75. Buyer collects. Tel 0632 745600.

● Acorn ATOM 12k RAM and 8k ROM complete with PSU. All leads. Manuals and some software including Invaders, Fruit Machine. £155. Tel Ringswinford 038 44 4405 West Midlands.

● Why wait 3 months? Brand new 16k SINCLAIR SPECTRUM complete, with 2 games tapes. Cost £130 (including delivery) + long wait. Reasonable offers. Tel Burntwood (05436) 71561, 9am to 9pm.

● Sharp PC1211 pocket computer with cassette interface, printer, manuals etc. £95. Tel Barry 01-434 1365.

● Philips G7000 TV game and computer keyboard. G.cond and in original packaging with 9 cassettes worth £240 will sell for £135. o.n.o. Tel: 01-508 8008 eve. will also sell tapes separately.

● ACORN ATOM — Acorn built. 7k RAM 8k ROM, all leads, software on cassette, £120. Tel (0902) 68302 (West Mids).

● Texas instruments PC100C print cradle for TI58/58C/59 calculator. Boxed, rarely used with spare paper. Tel Iver (Bucks) 655625 (STD 0753). Price £90 ono. Ask for Keith.

● Sharp MZ-80B 64k. CPM dual floppy disks virtually unused complete with original packing £1400 ono. Tel Newbury 35734.

● Spectrum/ZX81 printer + power supply, instructions and original packing. 4 months old. Excellent condition £45 ono. Harpenden 63729.

● Nascom 2 36k RAM professionally built and boxed, Jasys 3, Naspen, Zeap assembler, graphics ROM, revas dissassembler, games software £375. Tel Kidlington 77893 (after 6pm or weekends).

● Xerox 820 system — complete with dual 5¼" disks, CP/M, WordStar, SuperCalc, CBASIC in perfect condition. Unique opportunity saving £1100 on list at only £1199. Tel: Rossendale (0706) 226313 even (Lancs).

● UK101 + premiers, Basic 5, Basic 4, toolkit, 7xJI socket expansion board complete with 2x Eprom boards, assembler dissassembler in Eprom, 32k RAM, uncased, quick sale at £300 ono. Phone 021-360 1718 aft. 6.

● MZ80K 48k, Hi-res graphics including Epsom printer with Direct Interface. Word processor, DataBase, Sharp machine code, Screen dump and many other programs £650 ono. Tel Brentwood (0277) 212114.

● TRS 80 level 2 32k new ROM numeric keypad 16k expansion interface, one disk drive green screen monitor some software books £600 ono. London Surrey area. free delivery. Tel Tadworth 2164.

● TRS 80 pocket computer with printer interface and cassette interface complete (including software). QWuick sales £125. Write: Martin Stubbs, 35, Gagewell Drive, Horbury, Wakefield, W. Yorks or Tel. 0924 277171. After 6.00pm.

● PET 4032, cassette unit, manuals, books, V.G.C. bargain at £425. Tel Kim Swain 01-407 8989 (office) 01-366 8395 (home).

● Sharp MZ.80K 48k VGC still guaranteed with basic forth pascal M/C fortran commander over 100 progs including arcade games manuals still boxed. £420 or nearest offer. Tel. Reading (0734) 64234.

● TI 994/A complete, 3 months old. Inc Invaders + MucAhman, new style joysticks + many listings + cassette recorder + many mags, books, tapes all V.G.C. cost over £350. Quick sale only £250. Tel Rick on 444-9132.

● £1500 Reward for information leading to recovery of stolen North Star Horizon (SS/DD Floppy) No 10-05252; 20MB rodime hard disk no 24000191; diablo 1610 printer no 43977. Usual conditions. 01-370 4907.

● Wanted Sharp MZ-80K. Must be 48k RAM version. Don't want software. Will pay up to £250 if in good nick. 01-578 1413 eves. 01-998 0819 days. Chris Morris.

● VIC 20, cassette recorder, basic course, tapes, books, used twice £185. Video Genie 16k £200. Exchange small PET, Atari 400 or + cash for bigger computer Ipswich (0473) 210028.

● Wanted home computer and accessories for swop with very large 00 gauge model railway — worth £300. Sensible offers tel 01-749 2784 evenings.

● ITT 2020 32k with disk drive and paddles all manuals + Chess Adventure etc. £650. Southend on Sea (0702) 204901.

● Mattel Intellivision VGC still boxed hardly used. Including 6 cartridges — Autoracing Astrosmash Armourbattle Soccer Space Battle and Starstrike worht £290 will sell for £190. Hounslow 572 2308 even only.

● Nascom-1 8k-ROM basic, 48k Gemini G802 RAM, G806 5-slot supermum with 5A-PSU, cottis blandford cassette interface, cased, perfect working order, programs and manuals. £360 ono. Jackson Tel Stevenage (0438) 66355.

● Acorn Atom 12k RAM +4k toolbox ROM & F.P.ROM PSU leads, manuals, 14 taped progs worth over £60 also 2 books. The lot for £170. Tel Glasgow (041) 637 1272.

● Sharp MZ80K games Bomber (Destroy Village) Pow (Zap The Aliens) HMS Torpedo (shoot down fighter planes) Decision maker. Any 2 for £6.00. Langworth 15 Hitchin Road, Stevenage, Herts SG1 3BJ.

● Acorn Atom — 12k + 12k (floating point), Acorn built; power supply, leads, manual + 2 books. Invaders, Asteroids, Astrobirds, etc. (worth £70), also home-made programs £190.

● Tandy TRS-80 MOD1 lev2 — CTR-80 cassette, £20+ books £50+ games progs including Sargon II, Asylum, many adventures + utilities. Perfect for games player or beginner. Only £240! tel 01-942 2385 any time.

● HP41C + memory modules £75 — HPIL module + HP82162A printer £250 — HP digital cassette drive £300 — each with charger. Newcastle Ponteland (0661) 23135 eve.

● Nascom II — Kenilworth case, 64k RAM'B', nassys 3 graphics, toolkit, zeap, nasdis, nas debug, nas pen. £325 ono. Elector VDU + KBD £45 ono. PET computhink disk controller £50 ono BASF 8" double side driver — new £200. Tel Tamworth (0827) 250429

● MZ-80k Crazy Kong £5. great graphics and sound. Also Fruit machine and Bomber £2 each or £7 all 3. Cheque to K. Balfour, 50 Freemans Close, Stoke Poges, Bucks SL2 4ER.

● TRS-80 expansion interface with 16k RAM, single disk drive, 15 diskettes with large amount of software (including newdos), manuals, leads, etc; £350. Tel 01-540 0474 after 5pm.

● ZX-81 Sinclair built +32k RAM power supply, leads, manual 4 cassettes (3D-defender, scramble etc) exc condition + 2 books and magazines. £85.00. Tel 061-428 4398.

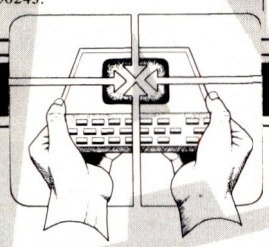
● Microtan 65+ keypad + PSU £60 ASCII keyboard+ case. Incomplete £25. 5V 10A S.M.P.S.U. fully protected + guarantee £40. David Leigh 21 Broadmead Parbold (02576) 3661.

● Apple II Euro plus 16k exc cond includes Eurocolour board, paddles, software, 3 Apple manuals, 2 Appl machine language manuals, carrying case, TV modulator, cassette leads, £575. Tel Southport (0704) 76567.

● Osborne with all software, little used, £1200. DKI microline 83A, unused, £500. Tel Parbold (02576) 2966 evenings.

● TRS 80 L11 16k green screen monitor cassette recorder manuals software including games £275 ono. Tel Winchester 61748.

● Compucorp 625 with VDU twin 5¼ disks 315k/Disck and 40 column printer in one unit. C.Basic, word processor excellent working order + manuals offer?. Ros-on-Wye 62013.



CTUK! CONTACTS

*For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #*

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RG4 0SJ

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

BJ Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
18 Woodmill Lance
Bitterne Park
Southampton SO2 4PY

Christopher Bates
Ashford Main Library
Church Road
Ashford Kent

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Lyn Antill
1 Defoe House
Barbican
London EC2

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Chris Cooper
110 Church Road
Hanwell
London W7

Paul Maddison
Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Chris Woodford
31 Hopley Road
Anslow Burton-On-Trent
Staffordshire

Mike Perry, Steve Collas
or Dave Lee
The Library
Ealing Road
Wembley
Middlesex HA0 4BR

Peter J Kiff
52 Stone Road
Broadstairs
Kent CT10 1DZ

Robin Bradbeer
Polytechnic of North London
Holloway Road
London N7

Derrick Daines
18 Cuttings Avenue
Sutton in Ashfield
Notts

Keith Taylor
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Bradford BD3 8HG

Philip Joy
130 Rush Green Road
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Pete Shaw
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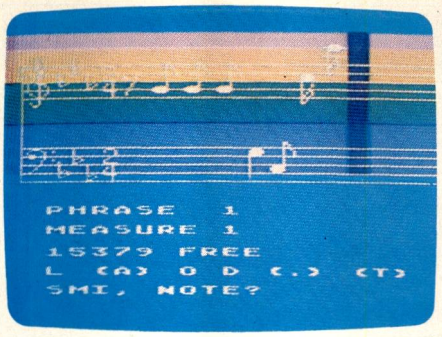
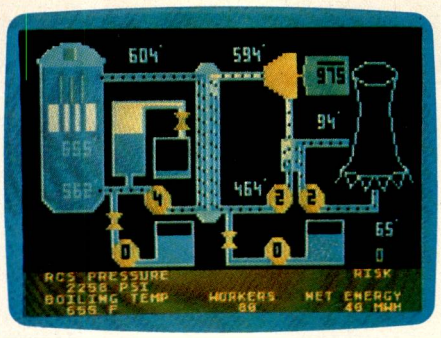
Essex CO15 1NA

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

J M A Kilburn (Headmaster)
Shawfield Norden Community
Middle School
Shawfield Lane
Norden
Rochdale OL12 7QR



Music Composer



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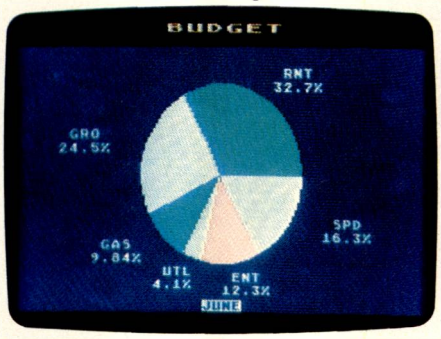
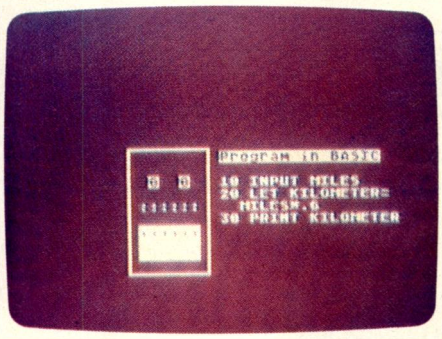
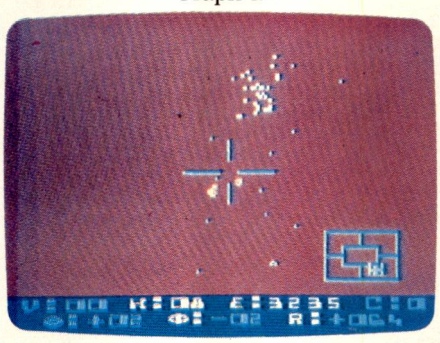


Graph-it



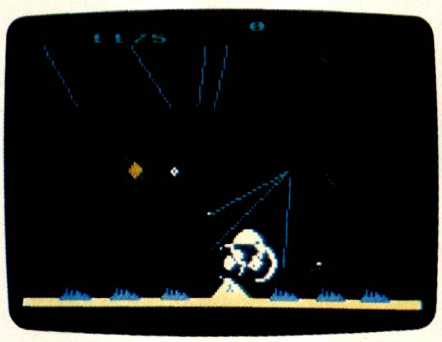
Intro to BASIC 1



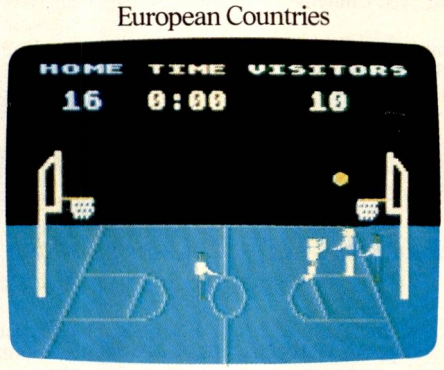
Star Raiders



European Countries



Missile Command



Basketball

3.7 million reasons why the Atari Home Computer is something to see. The display screen used with our computers is composed of 192 horizontal lines, each containing 320 dots. Delivering colour and luminosity instructions to each dot for a second requires 3.7 million cycles...a lot of work for the normal 6502 processor.

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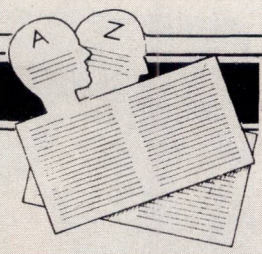
USER GROUP INDEX



These are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition.

National

Forth Interest Group – membership fee £7 pa. Includes Newsletter 'Forthwrite', issued bimonthly. Meetings held in London on first Thursdays monthly at the Polytechnic of the South Bank, Borough Road, London SE1. Contact: Keith Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH.

Proton Acceleration – research and development organisation dealing with 6502-6809 based machines, including BBC, PET, Apple, Microtan. Membership includes 'Accelerator' newsletter, published monthly. OEM and professional bodies welcomed as members. Registered offices: Epworth House, 25/35 City Road, London EC1Y 2DE.

County

South Middlesex Atari Club (SMAC) – meetings fortnightly at Ashford Computer Centre, Clarendon Road, Ashford at 7.30. Membership 50p per meeting.

Harpenden Microcomputer Group hold informal meetings in Harpenden on alternate Monday evenings. Contact: Richard Buchanan, 114 Lancaster Road, St Albans, Herts. Tel: St Albans 61236.

Portsmouth Co-Operative Computer Club – new informal club aiming to give advice on home computers and to see and use different machines. Meetings every Sunday, 5pm at 53a Heidelberg Road, Devonshire Square, Southsea. Contact: Mr A H May, 30 Delamere Road, Southsea (Tel: 0705 830603).

Ribble Valley Microcomputer Club – all sorts of micros welcome. Meetings 7pm 2nd and 4th Mondays monthly. Contact: Ian Thornton-Bryar. Tel: Clitheroe 25933.

SOBAT Computer Club – new address, B25 Berridge House, Hillfield Road, London NW6. Telephone enquiries can no longer be accepted. Anyone interested in

Contact: Brian Milligan, 50 Linkscroft Ave, Ashford, Middlesex.

Towns

BUG – Birmingham User Group for Atari Owners. Meets 2nd and 4th Thursdays monthly at the Matador public house, Bull Ring, Birmingham City Centre. Magazine soon to be launched. Contact Les Ellingham on 0785 41153 or 021 233 1488 if you want to know more.

Caterham Computer Club. Meets every Thursday at 8pm in Caterham Leisure Centre, Godstone Road, Caterham. A BBC micro is available for demonstrations. Contact: Mr M Goldsbrough, Caterham 48304 or Mr J Hodges, Caterham 43316.

Chiltern Computer Club meets on 2nd and 4th Mondays monthly at 7.30 in the function room of the Five Bells pub in Eaton Bray. Users of all micros welcome. Contact: Steve Betts, Eaton Bray 220922.

forming a computer club for Hampstead should contact Mr T Kayani at the above address.

Tilbury, Chadwell and Grays area of Essex. Is anyone interested in forming a computer club in this locality! If you're over 16 and would like to run the club or just help out with ideas for discussions, contact John Mayhew on Tilbury 2424. It's hoped that would-be members will help out with their own equipment for demonstrations to non-owners.

Worcester Computer Club meets 2nd Monday in the month 8pm in the Old Pheasant Inn, New St, Worcester. Secretary: John Stafford, 29 Somerville Road, Worcester WR4 9QG. Tel: Worcester 20297.

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ) Tel: 0482 859169, System operator: Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm tp 10.00pm.

Forum-80 London ... Tel: 01-747 3191. System operator: Leon Jay. Electric Mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00pm.

Forum-80 Milton ... (TRS-80 Users Group 80-Nett) Tel: 0908 566660. System operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00pm.

Forum-80 Holland ... Operator: Nico Karssemeyer, Tel: 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours; Tues-Sat 1800-0700 nightly, continuous from 1800 Sat-0700 Tues.

CBBS London ... Operator: Peter Goldman, Tel: 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool ... 051-220 9733. System operator: Peter Toothill, Electronic mail, down-loading TRS-80 information.

ACC ... members bulletin board, Peter Whittle (0908 44262).

ABC-80 ... Stockholm (Sweden). Tel: 010-468 190522.

University Research Computer ... Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa ... Sweden 010-468 7300 706.

Tree Tradet ... Sweden 010-468 190522.

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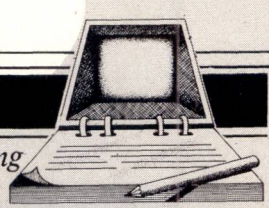

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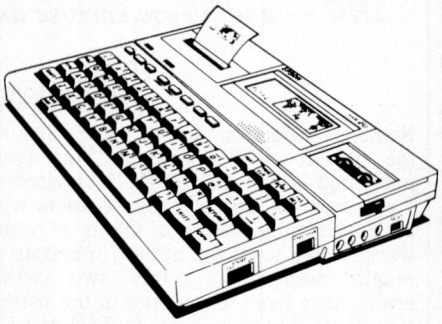

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As all programs in PCW are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in — get a friend to try it out first — and all programs we publish are paid for at a regular rate. Send contributions to: Maggie Burton PCW Programs, 62 Oxford Street, London W1A 2HG — and please enclose an SAE if you want material returned.

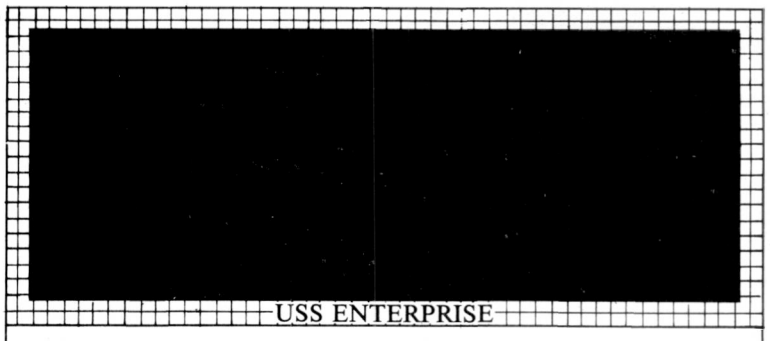
More on Star Trek

Some clarification seems necessary on the subject of the program 'Star Trek' published in October *PCW*. Inundated as I was with phone calls from readers with calloused fingers who'd found it won't work, I contacted the author in a state of manic desperation. Only two actual errors have been discovered in the listing. line 2610 should read IF D THEN LET D=D-10 and the end of line 21000 should read GOTO 2300. I hope that will clear up many readers' problems with this program, but the following points are worth bearing in mind.

It is essential to include the REM statement in line 10 (the program is so long it's possible that a lot of people will have left this out in the interests of saving time), which should contain at least 28 full stops. This is because the machine code routine is loaded into this by lines 20-29. You can check this routine by entering lines 10 to 29 (inclusive), running them, and entering RAND USR 16514, upon which the top ten lines of the screen go black.

The character in lines 520, 540 and 560 which is referred to as 'graphic "H" ' is not the inverse video 'h' but the chequered character on the 'H' key.

This kind of thing has been said before in these pages, but Star Trek contains a lot of POKEs to the display file and a great deal of numbers which must be entered with great care if the program is not to crash. Lines 4180-4264, 5090-



This edging is the chess board type graphic symbol on Key 'H'

Fig 1

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5270, 6030-6302 and 9030-9150 all involve POKEing the display and should be checked carefully. Incidentally, in line 1100 the variable S contains the address in the display file of the top left hand corner black square in the display. It is used as a base address for calculating all the other display POKEs, so a mistake in this line will definitely cause problems.

The two diagrams should help with any problems encountered with the display. Figure 1 is the display as printed by lines 5020-5050. The other squares in the grid shown are black on the actual display. Figure 2 is the display handled by lines 510-610 and through looking at this it should become apparent why using decimal numbers for the warp factor will ruin the display. Care must be taken to ensure that the right amount of spaces are used in any strings — some of them contain two together and this is not always apparent from just reading the listing. It's best to try them with two at first and then if it looks wrong to go back and alter them.

I hope this clears up any problems readers have had with this program. If anyone is still having trouble with it after reading this and they're sure the trouble is in the program rather than in the arduous task of keying in a long listing on that unfriendly ZX81 keyboard, then they are welcome to write in and I'll send a list of variables which should make it easier to understand the program.

Starbase Graphics (lines 5020 - 5050)

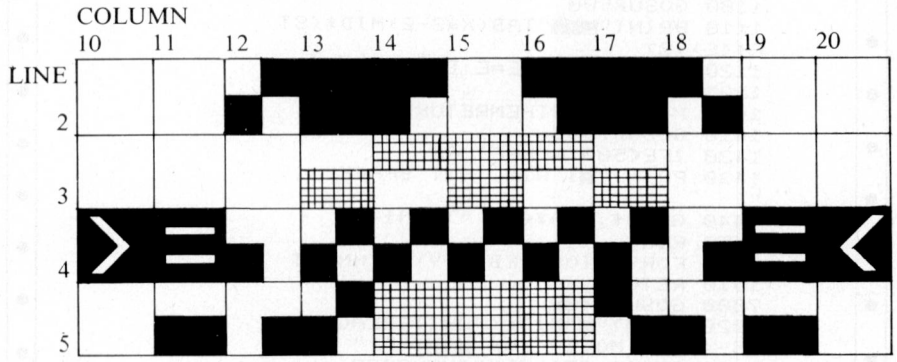

Fig 2

VIC Connect-4

by Adrian Millet

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The reverse video '/' in line 8020 is not directly available from the keyboard and can be left out if desired. I'd like to thank Softex Computer Accessories for this program, which was listed on a ZX Printer using the Softex Printerface.

```
130 DIMB(8,7),E(2,9),Y(3),X(3)
200 GOSUB8000
220 IFNP=1ANDRND(0)>.5THENPRINT"
I'LL GO 1ST THIS TIME":GOTO300
250 C=2:GOSUB7000
300 C=1
310 IFNP=2THENGOSUB7000:GOTO250
350 GOSUB1000:GOTO250
499 REM * EVAL X,Y
500 E=EC(X)
```


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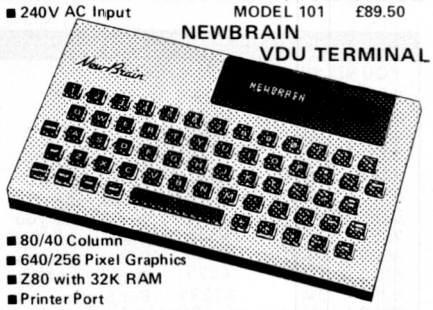

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520 Q=X(D):R=Y(D)
530 FORC1=1TO2
540 N=0:I=X+Q:J=Y+R
550 IFB(I,J)<>C1THEN580
560 I=I+Q:J=J+R:N=N+1
570 IFB(I,J)=C1THEN560
580 O=(B(I,J)=0)
590 I=X-Q:J=Y-R
600 IFB(I,J)<>C1THEN630
610 I=I-Q:J=J-R:N=N+1
620 IFB(I,J)=C1THEN610
630 O=-(B(I,J)=0)-O
640 A=N*3+O:IFA>9THENA=9
645 C2=C1:IFC=2THENC2=3-C2
650 E=E+E(C2,A)
660 NEXT
670 NEXT
890 RETURN
1000 REM COMP MOVE B
1020 B=-1:BE=-1E9
1050 FORX=1TO7
1060 GOSUB1900:IFY>6THEN1200
1100 GOSUB500
1110 PRINT"■■■"TAB(X*3-2)MID$(ST
R$(E),2)
1120 IFE>BETHENBE=E:B=X
1200 NEXTX
1400 X=B:IFX<0THENRETURN
1410 GOSUB7500
1420 IFE<500THENRETURN
1430 PRINT"■I WIN. HIT SPACE
"
1440 GETA$:IFA$<>" "THEN1440
1450 RUN
1900 FORY=1TO6:IFB(X,Y)THENNEXT
1910 RETURN
7000 GOSUB7400
7020 PRINT"■"MID$("WHITEBLACK",C
*5-4,5)" MOVE? (OR ■S■TOP)"
7030 GETA$:IFA$<>""THEN7030
7050 GETA$:IFA$="S"THENRUN
7100 X=VAL(A$)
7110 IFX=0ORX>7THEN7050
7120 GOSUB7500
7150 IFY>6THEN7050
7200 IFE<500THEN7400
7210 PRINT"■YOU WIN. HIT SPACE
"
7250 GETA$:IFA$<>" "THEN7250
7270 RUN
7400 FORA=7680TO7745:POKEA,32
7410 NEXT
7490 RETURN
7500 FORY=1TO6
7510 IFB(X,Y)THENNEXT:RETURN
7550 FORA=X*3+7744TOX*3+8140-Y*6
5STEP22
7555 POKEA-22,32:POKEA-21,32
7560 IFC=1THENPOKEA,233:POKEA+1,
223:POKEA+22,95:POKEA+23,105
7570 IFC=2THENPOKEA,78:POKEA+1,7
7:POKEA+22,77:POKEA+23,78
7600 NEXTA
7610 GOSUB500
7650 B(X,Y)=C
7990 RETURN
8000 REM *NEW GAME
8020 PRINT"■■1 OR 2 PLAYERS ?"
8025 POKE36879,8
8030 GETA$:NP=VAL(A$)
8040 IFNP<1ORNP>2THEN8030
8050 PRINT"■■■"
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PROGRAMS

```
8100 FORX=1TO18:PRINT"|   |   |   |
  |   |   |   |";:NEXT
8120 PRINT"[rvs]   1   2   3   4   5   6
 7 [rvs]"
8200 FORX=1TO7:FORY=1TO6
8205 B(X,Y)=0:NEXT:NEXT
8210 FORX=0TO8:B(X,0)=-1
8215 B(X,7)=-1:NEXT
8220 FORY=0TO7:B(0,Y)=-1
8225 B(8,Y)=-1:NEXT
8400 RESTORE
8410 FORC=1TO2:FORX=0TO9
8415 READE(C,X):NEXT:NEXT
8420 FORX=0TO3:READX(X):NEXT
8430 FORX=0TO3:READY(X):NEXT
8450 FORX=1TO7:READEC(X):NEXT
8490 RETURN
9600 DATA0,2,3,0,4,6,1,12,16,100
0
9620 DATA0,0,0,0,2,3,0,8,11,120
9700 DATA0,1,1,1
9710 DATA1,1,0,-1
9750 DATA0,0,1,3,1,0,8
READY.
```

VICMon

by D M Evers

Here's a program which is really much more interesting than directly useful (I hope the author isn't offended by that statement. . .). I say this because it's a machine code monitor written in Basic. All routines are, therefore, handled through a monitor emulator rather than a monitor proper. The use of Basic for this type of application also detracts somewhat from the speed of execution.

For the novice to machine code it will make a fair introduction to the subject, although a beginner's book on machine code and some instruction material on programming the 6502 processor would be necessary. Machine code aficionados will find its actual uses are rather limited, but it's unusual to see a program like this in the Programs mailbag.

Here is a list of the commands available:

The 'M' command (format M xxxx yyyy) displays memory in hex from xxxx to yyyy, both of which are addresses in hex.

The ';' command (format ;xxxx AA BB CC DD EE) places the byte values shown (AA, BB, etc) into memory starting at xxxx. In fact you should use the 'M' command to display the memory, use the screen editor to alter the bytes and press 'return' to enter them.

The 'G' command (format G xxxx) tells the computer to execute the machine code program starting at xxxx.

The 'L' command (format L "filename") loads byte values into memory from the specified tape file. This subroutine uses data files and these cannot be loaded into memory using the normal Basic LOAD command.

The 'S' command (format S "filename") saves byte values from memory to the tape file specified. This subroutine prompts for start and end addresses which should both be given as four-digit hex numbers.

The 'H' command (format H n) gives the hex value of decimal number n.

The 'D' command (format D xxxx) gives the decimal value of xxxx which must be a four-digit hexadecimal number.

Lastly, but not leastly, the 'X' command (format X) drops you out of the monitor and back into Basic command mode.

Readers who use this program should beware of incorrect syntax on input as this is likely to crash the program. This would, in fact, be quite easy to remedy with some nifty error trapping routines in the appropriate places. Apart from that little complication it is easy to use and well put together.

```
10 POKE 36879,8
20 PRINT"[cls][green]   VICMON.BAS 1.0"
30 PRINT"(c)-1982 BY D.M.EVERS"
40 GOSUB 5000 :GET CMD
50 CM£=MID£(IN£,2,1)
60 IF CM£="M" THEN 400
70 IF CM£=";" THEN 550
80 IF CM£="G" THEN 650
```


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PROGRAMS

```
 90 IF CM£="L" THEN 700
100 IF CM£="S" THEN 1000
110 IF CM£="X" THEN PRINT"[cls]":END
120 IF CM£="H" THEN 1400
130 IF CM£="D" THEN 1200
      ** MUST BE ERROR **
310 PRINT"[rvs][red] ERROR [rvsoff][green]"
320 POKE 36878,10:POKE 36876,215:FOR XX=1 TO 150:NEXT:POKE 36876,0
330 GOTO 40
      ** 'M' COMMAND **
410 ST£=MID£(IN£,4,4)
420 FI£=MID£(IN£,9,4)
430 HX£=ST£:GOSUB 2000:S1=DC:IF ER THEN 300
440 HX£=FI£:GOSUB 2000:FI=DC:IF ER THEN 300
450 AD=S1
455 GET A£:IF A£="[spc]" THEN 40
460 PRINT CHR£(13)">";
470 DC=AD:GOSUB 2200:PRINT HX£"[spc]";
480 SL=AD:FL=AD+5
490 FOR AL=SL TO FL-1
500 DC=PEEK(AL):GOSUB 2100:PRINT HX£;:IF AL<FL-1 THEN PRINT"[spc]";
510 NEXT AL
520 AD=FL:IF AD<FI+1 THEN 455
530 GOTO 40
      ** ';' COMMAND **
560 AD£=MID£(IN£,3,4)
570 HX£=AD£:GOSUB 2000:IF ER THEN 300
575 AD=DC
580 FOR AL=1 TO 5
590 HX£=MID£(IN£,5+3*AL,2):GOSUB 2000
600 IF ER THEN 300
610 POKE AD+AL-1,DC
620 NEXT AL
630 GOTO 40
      ** 'G' COMMAND **
660 HX£=MID£(IN£,4,4)
665 GOSUB 2000:IF ER THEN 300
670 GOSUB 2000:IF ER THEN 300
680 SYS(DC)
690 GOTO 40
      ** 'L' COMMAND **
710 NM£="":PT=5
720 IF MID£(IN£,PT,1)<>CHR£(34) THEN NM£=MID£(IN£,5,PT-4):PT=PT+1:GOTO 720
740 OPEN 2,1,0,NM£
745 PRINT"FOUND ";NM£;CHR£(13)"LOADING "
750 INPUT#2,AD,FI
760 FOR CA=AD TO FI
770 INPUT#2,BT
780 POKE CA,BT
790 NEXT CA
800 CLOSE 2
810 GOTO 40
      ** 'S' COMMAND **
1010 NM£="":PT=5
1020 IF MID£(IN£,PT,1)<>CHR£(34) THEN NM£=MID£(IN£,5,PT-4):PT=PT+1:GOTO 1020
1030 PRINT CHR£(13)"START >";:GOSUB 5010
1040 HX£=MID£(IN£,2):GOSUB 2000:IF ER THEN 300
1050 S1=DC
1060 PRINT CHR£(13)"END   >";:GOSUB 5010
1070 HX£=MID£(IN£,2):GOSUB 2000:IF ER THEN 300
1080 FI=DC
1090 PRINT CHR£(13):OPEN 2,1,1,NM£:PRINT"WRITING ";NM£
1100 PRINT#2,S1
1110 PRINT#2,FI
1120 FOR AD=S1 TO FI
1130 PRINT#2,PEEK(AD)
1140 NEXT AD
1150 CLOSE 2:GOTO 40
      ** 'D' COMMAND **
1210 HX£="":PT=4
1215 IN£=IN£+"[spc]"
1220 IF MID£(IN£,PT,1)<>"[spc]" THEN HX£=MID£(IN£,4,PT-3):PT=PT+1:GOTO 1220
1230 GOSUB 2000
1240 PRINT CHR£(13);DC
1250 GOTO 40
      ** 'H' COMMAND **
1410 DC£="":PT=4
1415 IN£=IN£+"[spc]"
1420 IF MID£(IN£,PT,1)<>"[spc]" THEN DC£=MID£(IN£,4,PT-3):PT=PT+1:GOTO 1420
1430 DC=VAL(DC£):GOSUB 2200
1440 PRINT CHR£(13);HX£
1450 GOTO 40
      ** HEX TO DEC **
2010 ER=0:DC=0:FOR I=0 TO LEN(HX£)-1
2020 D1=ASC(MID£(HX£,LEN(HX£)-I,1))-48
2030 IF D1>22 THEN ER=1:RETURN
2040 IF D1>9 THEN D1=D1-7
2050 DC=DC+D1*16↑I:NEXT I
2060 RETURN
      ** DEC TO HEX (2) **
2110 HX£="":FOR I=1 TO 2
2120 Q=INT(DC/16):R=DC-16*Q+48
```


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PROGRAMS

```
2130 IF R>57 THEN R=R+7
2140 HX£=CHR£(R)+HX£:DC=Q:NEXT
2150 RETURN
     ** DEC TO HEX (4) **
2210 HX£="":FOR I=1 TO 4
2220 Q=INT(DC/16):R=DC-16*Q+48
2230 IF R>57 THEN R=R+7
2240 HX£=CHR£(R)+HX£:DC=Q:NEXT
2250 RETURN
     ** INPUT FROM KEYBD. **
5005 PRINT CHR£(13)">";
5010 OPEN 1,0
5020 INPUT#1,IN£
5030 CLOSE 1
5040 IF LEFT£(IN£,1)<>">" THEN IN£=">"+IN£
5050 RETURN

CONVENTIONS USED IN THE LISTING

[cls]=clearscreen: [rvs] & [rvsoff]= reverse video on & off
[spc]=space      : [green] etc. = colour controls
```

Program of the Month

Atari Character Set Mover

by A Ferguson

Here's an ingenious little routine for the Atari 400/800. As far as I'm aware nothing like it has been published before for this machine — certainly not in the popular micro press, anyway, but I'd stand corrected if this were not so. The whole program serves to demonstrate the Atari's internal register graphics modes which are not documented in the user manuals. In fact, most Atari owners are blissfully unaware of their existence and they cannot be accessed through the normal Basic GRAPHICS statement. If you're an expert you should be able to build on this program and make fuller use of your Atari's hidden potential, and if you're a beginner then looking hard at this program should teach you quite a bit about your micro's internal workings.

Basically, these internal modes centre around the Atari's 'Antic' LSI chip and are numbered 3, 4, 5, 12 and 14. Internal modes 4 and 5, which are dealt with here, are character modes. To use these, the 'display list', a small machine code routine for the Antic processor, has to be altered, which is very slow from Basic. This program does the job much more quickly and efficiently.

The first part of the program loads a small machine code routine into RAM at 'page 6' (hex 600, decimal 1536), which is reserved space. This routine is accessed using the USR function and it loads a redefined character set as five bit-maps into a postion just below memtop. The , $, %, & and ' keys are then found to be altered if you type them.

The second part of the program is a proper demonstration of operating system graphics modes 4 & 5. What actually happens is that the normal graphics square is changed so that you can only work with a 4x8 pixel block. Using the diagram below, this is how the colour controls work: colour location 708 (line 370) controls the colour if B is shaded; colour location 709 (line 350) controls the colour if A is shaded; colour location 710 (line 360) controls the colour if A and B are shaded and colour location 712 (line 380) controls the background colour.

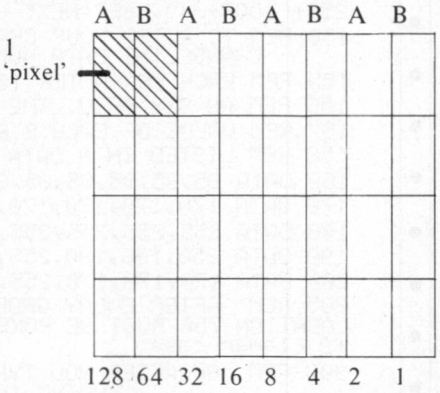

Fig 3 A representation of c character square and how it is changed by using the internal register graphics modes.

When you run the program, first type , $, %, & and '. Then go into inverse video and type the % key again. An explanation of the alteration of the % key can be found by treating a row of pixels in the graphics square as a binary number, each shaded square being a 1. The %'s top row as it now appears in inverse video is 10101010 which, translated into decimal, is 170 (128+32+8+2). This comes from line 170 in which all the data items are 170.

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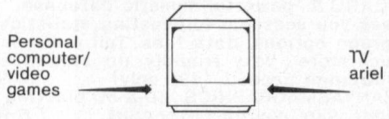

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PROGRAMS

As all the squares which would be marked 'A' if the % character square were labelled as in the program are shaded the colour is controlled by location 709 — green.

To try out operating system mode 5 change the following lines:
310 POKE DL+3,69
320 FOR A= Ø TO 12
330 POKE DL+6+A,5

```
1 REM MACHINE CODE CHARACTER SET MOVER
2 REM A FERGUSON,NEWTON AYCLIFFE
3 REM  CO.DURHAM
4 REM
10 TOP=PEEK(106)-5
20 POKE 106,TOP:GRAPHICS 0
30 TOP=TOP+1
40 Z=TOP%256:REM PAGES INTO BYTES
50 FOR A=0 TO 61:READ LOAD:POKE 1536+A,L
OAD:NEXT A
60 DATA 104,104,133,205,104,133,204,160,
0,185
70 DATA 0,224,145,204,200,192,255,208,24
6,160,0,230
80 DATA 205,185,0,225,145,204,200,192,25
5,208,246
90 DATA 160,0,230,205,185,0,226,145,204,
200,192,255,208,246
100 DATA 160,0,230,205,185,0,227,145,204
,200,192,255,208,246,96
110 X=USR(1536,Z)
120 REM  THIS SECTION ABOVE WILL LOAD YO
UR NEW CHARACTER SET IN  USING
        MACHINE LANGUAGE
130 REM START LOADING CUSTOM SET INTO
R.A.M SET THAT WE HAVE JUST CREATED
140 FOR LOOP=0 TO 39:READ NSET:POKE TOP%
256+(LOOP+24),NSET:NEXT LOOP
150 REM TO ALTER YOUR CHARACTERS
      CHANGE THE DATA NUMBERS BELOW
155 REM EACH CHARACTER IS FORMED FROM
156 REM AN 8X8 GRID. THE DECIMAL
157 REM VALUE OF EACH 8 BIT ROW IS
158 REM LISTED IN A DATA STATEMENT.
160 DATA 85,85,85,85,85,85,85,85
170 DATA 170,170,170,170,170,170,170,170
180 DATA 255,255,255,255,255,255,255,255
190 DATA 250,186,190,255,190,186,250,0
200 DATA 170,170,170,255,255,170,170,170
205 REM  AFTER EVERY GRAPHICS STATEMENT
LOCATION 756 MUST BE POKED TO TOP OR TOP
+2 (lower case)
206 REM  OK AFTER YOU TYPE RUN TRY
                TYPING IN  # $ % &'
300 DL=PEEK(560)+256*PEEK(561):GRAPHICS
0
310 POKE DL+3,68
320 FOR A=0 TO 18:REM CHANGE 18 TO 22 FO
R FULL SCREEN MODE 4
325 REM NOTE THAT INTERNAL REGISTER
      MODE 4 IS not THE SAME AS
    BASIC GRAPHICS 4.
330 POKE DL+6+A,4
340 NEXT A
350 POKE 709,187:REM GREENY
360 POKE 710,54:REM RED
370 POKE 708,117:REM BLUE
380 POKE 712,11:REM BACKGROUND COLOUR
                          REGISTER
```

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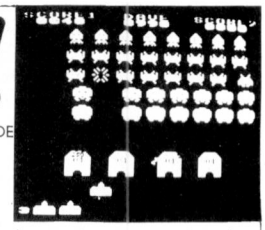

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PROGRAMS

```
1000 POKE 756,TOP:REM POKE 756 WITH
     TOP AFTER EVERY GRAPHICS COMMAND
2000 REM ***************************
2001 REM MEANING OF MEMORY LOCATIONS
2002 REM ***************************
2003 REM
2004 REM 106= ACTUAL TOP OF RAM
       MEMORY IN PAGES (MULTIPLES
     OF 256 BYTES).
2005 REM 560,561= LO BYTE & HI BYTE
       VALUE WHICH POINTS TO THE
     ADDRESS OF DISPLAY LIST.
2006 REM 756= CHARACTER BASE REGISTER
2007 REM 708-712= COLOR SHADOW
       REGISTERS
```

VIC UFO

by David Taylor

Unfortunately there are no instructions contained within this program as the VIC-20 doesn't have enough memory to incorporate them alongside the game. Readers with expanded VICs should have no trouble in coding these if they want to.

Custom-made graphics characters and effects are used to give some really interesting effects at the beginning. The object is to shoot down a squadron of UFOs and then to land safely. Keys S, F, E and C are used to line up your sights (left, right, up and down respectively) and function 5 controls your gun.

What actually happens when you 'line up your sights' is that the UFO moves in relation to them — although the end result is exactly the same. As the UFOs move randomly it's no easy job to get them lined up long enough to be shot, and the more you destroy the more unreliable your gun becomes although your chances of landing safely increase.

When you're ready to land you have to 'drop down' using the sights until your instruments pick up the ground, which is indicated by a flashing green 'land' in the top left hand corner of the screen. The frequency with which it flashes indicates how near you are to the ground. When you are directly above a dot between two men, you hand control over to the automatic pilot by pressing 'return' until your amount of fuel is printed on the screen in red. If there are still UFOs on the screen you shouldn't land as you can't shoot them once the automatic pilot has taken over and they will bomb your ship. If you crash when landing you lose 5 points. A landing cannot be aborted once it has begun.

Finally, 3.5k VIC owners should avoid using too many spaces as this will cause 'out of memory' errors. If David Taylor is reading this, could he please contact me as I have mislaid his address.

```
1 PRINT"(CLS)":POKE36869,255:POKE36879,14Ø
2 FORI=7168TO7679:POKEI,255:NEXT
3 FORI=1TO16:PRINTTAB(I)"U.F.O.":POKE646,I:NEXT
4 POKE52,28:POKE56,28:POKE657,128
5 FORI=7679TO7169STEP-1:POKEI,PEEK(I+25600)
6 FORL=1TO5Ø:NEXT:NEXT:CLR
7 FORF=ØTO63:READJ
8 POKE7344+F,J:NEXT
9 M(1)=-1:M(2)=1:M(3)=22:M(4)=-22:M(5)=-23
1Ø M(6)=23:M(7)=-21:M(8)=21
11 S(1)=-1:S(2)=1:S(3)=-1:S(6)=1:S(7)=1:S(8)=-1
12 FU=8ØØØ:AM=15:SO=2Ø5:SP=129:RA=66
13 SD=8:F=7954:F1=38674:Q=INT(RND(1)*22)+1:C=922Ø+Q:PRINT"(CLS)"
14 MH=INT(RND(1)*22)+1:A=7943+MH
15 POKE36879,8:GOTO24
16 IFC<8186ANDQ>-1ANDQ<23THENPOKEC,32:POKEC-1,32:POKEC+1,32
17 RETURN
18 IFC<8186ANDQ>ØANDQ<21THENPOKEC,46:POKEC+1,28:POKEC-1,28
19 RETURN
2Ø POKEA-M(D),32:POKEA-M(D)+1,32:POKEA-M(D)-1,32
21 POKEA-M(D)-22,32:RETURN
22 A1=A+3Ø72Ø:POKEA1-22,5:POKEA1,5:POKEA1-1,5:POKEA1+1,5
23 POKEA,23:POKEA-1,22:POKEA+1,24:POKEA-22,25:RETURN
24 D=INT(RND(1)*8)+1:H=INT(RND(1)*3)+3
25 FORB=1TOH
26 POKE36875,80:POKE36877,SP:POKE36878,3
27 X=INT(RND(1)*3Ø)+1:PRINT"(CURSOR HOME,CURSOR DOWN)    "
28 IF(C-F)/22<XTHENPRINT"(CURSOR HOME,CURSOR DOWN,CTRL6)LAND"
29 IFR=1ANDA<7680THEN75
3Ø IFA=F-1ORA=F+1ORA=F-22ORA=F+22THEND=INT(RND(1)*8)+1
```


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PROGRAMS

```
 31 A=A+M(D):MH=MH+S(D)
 32 PRINT"(CTRL7,CURSOR HOME)SCORE(CURSOR RIGHT,CTRL2)"SC;"(CTRL7) FUEL(6 SPACES,
    5 CURSOR LEFTS,CTRL2)";FU;"(CURSOR HOME,CURSOR DOWN,7 CURSOR RIGHTS,CTRL 7)
    AMMO(5 SPACES,5 CURSOR LEFTS,CTRL 2)";AM
 33 GOSUB18
 34 IFPEEK(197)=15AND(C-F)/22=INT((C-F)/22)ANDNB=ØTHEN66
 35 IFPEEK(197)=15ANDNB=ØTHEN75
 36 IFNB=1THENGOSUB2Ø
 37 NB=Ø:IFA>7724ANDA<8185ANDMH>1ANDMH<22THENGOSUB22:NB=1
 38 IFR=ØANDPEEK(197)=55THEN54
 39 IFC<=FTHEN75
 4Ø POKEF-1,26:POKEF+1,31:POKEF-22,27
 41 POKEF+22,3Ø:POKEF1-1,3:POKEF1+1,3
 42 POKEF1-22,3:POKEF1+22,3
 43 IFR=ØTHENFU=FU-5:GOTO46
 44 SO=2Ø5:SP=129:NEXT
 45 GOTO24
 46 V=PEEK(197)
 47 IFV<>41ANDV<>42ANDV<>49ANDV<>34THEN44
 48 H=1:GOSUB16:FU=FU-1Ø
 49 IFV=41THENC=C+1:Q=Q+1:D=2
 5Ø IFV=42THENC=C-1:Q=Q-1:D=1
 51 IFV=49THENSO=SO+.2:C=C+22:D=3
 52 IFV=34THENC=C-22:SO=SO-.2:D=4
 53 IFFU<=ØTHENH=26:R=1:D=4:GOTO25
 54 ONINT(RND(1)*2)+1GOTO25,24
 55 RD=RND(1)*SD:IFRD>8ORAM=ØTHEN39
 56 POKE36875,Ø:POKE36878,15:FU=FU-1Ø:FORS=1TO3
 57 POKE36877,2Ø4:FORW=1TO5Ø:NEXT:POKE36877,Ø
 58 FORI=1TO15:NEXT:NEXT:AM=AM-1
 59 IFA=FTHENSC=SC+5:GOSUB92:AM=AM+5:GOTO62
 6Ø IFF<>A-1ANDF<>A+1ANDF<>A-22THEN24
 61 SC=SC+1:GOTO39
 62 SD=SD+.5:IF(SD-8)/2.5=INT((SD-8)/2.5)THENFU=FU+1ØØØ
 63 POKEF,32:GOTO14
 64 M=INT(RND(1)*(SD-8)):IFM=ØTHEN76
 65 RA=22:GOSUB76:POKE36878,Ø
 66 S$="YOU LANDED!-"
 67 S$=S$+"YOU SHOT"+STR$((SD-8)/.5)+" UFOS-SCORING "+STR$(SC)+" POINTS"
 68 PRINT"(CLS)":POKE36869,24Ø:FORZ=1TOLEN(S$):POKE646,INT(RND(1)*7)+1
 69 IFMID$(S$,Z,1)="-"THENPRINTCHR$(13);:GOTO71
 7Ø PRINTMID$(S$,Z,1);
 71 FORK=1TO15Ø:NEXT:NEXT
 72 PRINT:PRINT"ANOTHER GO?"
 73 GETD$:IFD$<>"Y"ANDD$<>"N"THEN73
 74 IFD$="Y"THENPRINT"(CLS)":CLR:POKE36869,255:GOTO9
 75 SYS648Ø2
 76 POKE646,2:FORA=FTO C-22STEPRA
 77 GOSUB 16
 78 IFU>OTHENFU=FU-2Ø
 79 PRINT"(CURSOR HOME)";TAB(16);"(5 SPACES,6 CURSOR LEFTS)"FU
 8Ø FORMH=1TO5ØØ:NEXT:C=C-RA:GOSUB18
 81 IFFU<=ØTHENRA=66
 82 NEXT:IFRA=22THENRETURN
 83 POKEF1-1,2:POKEF1,2:POKEF1+1,2
 84 POKEF,127:POKEF+1,29:POKEF-1,29
 85 GOSUB92:POKE36878,Ø
 86 S$="YOU CRASHED!-":SC=SC-5:GOTO67
 87 DATAØ,Ø,19,63,234,63,3,Ø,6Ø,126,255,255
 88 DATA17Ø,255,255,6Ø,Ø,Ø,2ØØ,252,171,252,224,Ø
 89 DATAØ,Ø,Ø,129,66,36,24,24,Ø,Ø,Ø,4,2,127,2
 9Ø DATA4,Ø,8,8,8,8,8,42,28,8,28,28,8,28,42,73,2Ø,54
 91 DATAØ,Ø,16,5Ø,63,63,127,255
 92 POKE36877,21Ø:FORB=16TOØSTEP-1:POKE36878,B
 93 FORK=1TO8Ø:NEXT:NEXT:RETURN
```

PET Forth Teacher

by Andrew Ashwood

This program, which runs in about 16k on 4000 series PETs, is meant to show a model of the Forth language for the beginner. As it's a bit mean on instructions, a book on the lines of *Starting Forth* (author Lee Brodie, Forth Inc. Publishers Prentice-Hall International. ISBN 0 13 842922 7) would be invaluable as a supplement to using this model.

It gives a visible display of the stack contents at each operation, so demonstrating the effects of a word, a number of which are provided in the program. It also allows the compilation of additional words in the Forth fashion and checks for illegal operations.

```
100 REM          FORTH TEACHER
110 REM
120 REM       (C)  ANDREW ASHWOOD
130 REM
140 REM            13/5/82  5:24
150 REM
160 D=18:DIMC(500),D$(21),P(21),R(100),S%(100),W(21):D$=" ":IL$="ILLEGAL "
170 FORL=1TOD:READD$(L),I1$:W(L)=Ø:P(L)=L*2-1:IFI1$="S"THENW=W+1:W(L)=W
180 C(L*2-1)=-L:C(L*2)=Ø:NEXTL
```


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PROGRAMS

```
190 S$="                                                    "
200 DE=10:C=D*2+1:P$="[illegible]":P$=P$+S$+S$+P$
210 PRINT"□":GOSUB1070
220 GOSUB1610
230 SC$=P$+"SO COMPILE IT":SU$=P$+"STACK UNDERFLOW ERROR"
240 GOSUB1210:W$=LEFT$(W$,7)
250 IFMTHEN320:** COMPILE
260 GOSUB1380:REM SEARCH DICT
270 IFNTHENPC=P(N):PRINTP$"SO EXECUTE IT":GOSUB1040:GOTO520
280 PRINTP$"IS "W$" A NUMBER?":GOSUB1040:N=VAL(W$)
290 IFN<>0ORW$="0"THENPRINTP$"YES IT IS":GOSUB1040
300 IFNORW$="0"THENPRINTP$"SO PUSH IT":GOSUB1040:GOSUB1450:GOTO240
310 PRINTP$W$" IS UNDEFINED":I$="":NL=0:GOTO240
320 GOSUB1380
330 IFN=12ANDNL=0THENPRINTP$"I OUTSIDE LOOP ERROR":M=0:I$="":GOTO240
340 IFN>0ANDW(N)>0THENPRINTSC$:GOSUB1040:GOTO400:** SPECIAL WORDS
350 IFN>0THENPRINTSC$:GOSUB1040:C(C)=P(N):C=C+1:GOTO240
360 PRINTP$"IS "W$" A NUMBER?":GOSUB1040:N=VAL(W$)
370 IFN<>0ORW$="0"THENPRINTP$"YES IT IS":GOSUB1040:PRINTSC$:GOSUB1040
380 IFN<>0ORW$="0"THENC(C)=,5:C(C+1)=N:C=C+2:GOTO240
390 PRINTP$W$" IS UNDEFINED":M=0:I$="":NL=0:GOTO240
400 ONW(N)GOTO410,420,440,470,480,510
410 PRINTP$IL$"IN COMPILE MODE":M=0:I$="":NL=0:GOTO240
420 IFNLTHENPRINTP$"MISSING 'LOOP'":I$="":NL=0:M=0:GOTO240
430 D=D+1:M=0:C(C)=0:C=C+1:N=D:GOSUB1630:GOTO240
440 D$=CHR$(34):GOSUB1210:D$=" "
450 C(C)=15:C(C+1)=LEN(W$):FORL=1TOLEN(W$):C(C+1+L)=ASC(MID$(W$,L,1))
460 NEXTL:C=C+L+1:GOTO240
470 C(C)=19:PC=C:GOSUB1520:C=C+1:NL=NL+1:GOTO240
480 IFNL=0THENPRINTP$"'LOOP' WITHOUT 'DO' ERROR":I$="":NL=0:M=0:GOTO240
490 GOSUB1540:AD=PC:NL=NL-1
500 C(C)=21:C(C+1)=AD:C=C+2:GOTO240
510 PRINTP$IL$"IN COMPILE MODE":M=0:I$="":NL=0:GOTO240
520 IFCL(1)*256+CL(0)+CL(2)>32767+6*40THENGOSUB1560
530 IFPEEK(158)>0THENIFPEEK(PEEK(158)+622)=18THENPOKE158,0:GOTO240
540 IFC(PC)<0THEN590:** SYSTEM WORDS
550 IFC(PC)=0ANDRP=0THEN240
560 IFC(PC)=0THENGOSUB1540:GOTO610
570 IFC(PC)=.5THEN740
580 GOSUB1520:PC=C(PC):GOTO520
590 ONABS(C(PC))GOTO620,640,650,660,670,700,730,750,780,790
600 ONABS(C(PC))-10GOTO830,870,900,920,940,970,980,1020
610 PC=PC+1:GOTO520
620 GOSUB1490:IFERTHENI$="":NL=0:GOTO240
630 GOSUB1060:PRINTN;:GOSUB1050:GOTO610
640 GOSUB1490:N1=N:GOSUB1490:N=N+N1:GOSUB1450:GOTO610
650 GOSUB1490:N1=N:GOSUB1490:N=N-N1:GOSUB1450:GOTO610
660 GOSUB1490:N1=N:GOSUB1490:N=N*N1:GOSUB1450:GOTO610
670 GOSUB1490:N1=N:GOSUB1490
680 IFN1<>0THENN=N/N1:GOSUB1450:GOTO610
690 PRINTP$"DIVISION BY ZERO":I$="":GOTO240
700 IFD=21THENPRINTP$"DICTIONARY OVERFLOW":I$="":GOTO240
710 GOSUB1210:D$(D+1)=LEFT$(W$,7):P(D+1)=C:M=1:PRINTP$"COMPILING "W$
720 GOSUB1040:GOTO610
730 PRINTP$IL$"IN IMMEDIATE  MODE":I$="":GOTO240
740 N=C(PC+1):GOSUB1450:PC=PC+1:GOTO610
750 GOSUB1060:IFRPTHENN=R(RP-1)+2:N1=C(N-1)+N:R(RP-1)=N1-1:GOTO770
760 D$=CHR$(34):GOSUB1210:D$=" ":PRINTW$;:GOSUB1050:GOTO610
770 FORL=NTON1:PRINTCHR$(C(L));:NEXT:GOSUB1050:GOTO610
780 GOSUB1060:PRINT:GOSUB1050:GOTO610
790 IFRP=0THENPRINTP$"SORRY NO LOOPS IN IMMEDIATE MODE":I$="":GOTO240
800 SC=PC:GOSUB1540:S2=PC:GOSUB1490:N1=N:GOSUB1490
810 IFERTHENPRINTP$"NOT ENOUGH PARAMETERS FOR A LOOP":I$="":GOTO240
820 PC=N:GOSUB1520:PC=N1:GOSUB1520:PC=S2:GOSUB1520:NL=NL+1:PC=SC:GOTO610
830 IFRP=0THENPRINTP$"SORRY NO LOOPS IN IMMEDIATE MODE":I$="":GOTO240
840 SC=PC:GOSUB1540:S2=PC+1:AD=C(S2):GOSUB1540:LO=PC:GOSUB1540:UP=PC
850 LO=LO+1:IFLO>=UPTHENPC=S2:GOSUB1520:NL=NL-1:PC=SC:GOTO610
860 PC=UP:GOSUB1520:PC=LO:GOSUB1520:PC=AD:GOTO610
870 IFRP=0THENPRINTP$"'I' NOT ALLOWED IN IMMEDIATE MODE":I$="":GOTO240
880 IFNL=0THENPRINTP$"NO LOOP FOR 'I' TO BE IN":M=0:I$="":GOTO240
890 N=R(RP-2):GOSUB1450:GOTO610
900 IFSP=0THENPRINTP$SU$:I$="":NL=0:GOTO240
910 N=S%(SP-1):GOSUB1450:GOTO610
920 IFSP<2THENPRINTP$SU$:I$="":NL=0:GOTO240
930 N=S%(SP-1):S%(SP-1)=S%(SP-2):S%(SP-2)=N:GOSUB1640:GOTO610
940 IFSP<3THENPRINTP$SU$:I$="":NL=0:GOTO240
950 N=S%(SP-3):S%(SP-3)=S%(SP-2):S%(SP-2)=S%(SP-1):S%(SP-1)=N
960 GOSUB1640:GOTO610
970 GOSUB1490:GOTO610
980 GOSUB1210:GOSUB1380
990 IFND>17THEND=N-1:GOTO210
1000 IFN=0THENPRINTP$W$" IS NOT IN THE DICTIONARY":M=0:I$="":GOTO240
1010 PRINTP$"PLEASE DO NOT FORGET THAT":GOTO240
1020 GOSUB1490:IFERTHENDE=10:GOTO610
1030 DE=N:GOTO610
1040 FORL=1TO100*DE:NEXT:RETURN
1050 FORL=196TO198:CL(L-196)=PEEK(L):NEXT:CL(3)=PEEK(216):RETURN
1060 GOSUB1570:FORL=196TO198:POKEL,CL(L-196):NEXT:POKE216,CL(3):RETURN
1070 M1$="|         |         |         |         |"
1080 M2$="├─────────┼─────────┼─────────┼─────────┤"
1090 B$="└─────────┴─────────┴─────────┴─────────┘"
1100 T$="┌─────────┬─────────┬─────────┬─────────┐"
```


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PROGRAMS

```
1110 T1$="├──────────────────────────────────────────┤"
1120 S$="                                          "
1130 PRINT"■■■■■■■■■T$M1$"■■"LEFT$(S$,38)"■■■■■■■■■■■■DICTIONARY";
1140 PRINT"          |   STACK"
1150 PRINTT1$;
1160 FORL=1TO6:PRINTM1$"■■■■■■■■■■■■■"MID$(STR$(L),2)")":PRINTM2$;:NEXT
1170 PRINTM1$"■■■■■■■■■■■■■7)":PRINTB$"■";
1180 POKE33767,125:GOSUB1640:RETURN
1190 DATA",",N,"+",N,"-",N,"*",N,"/",N,":",S,";",S,,",S,CR,N,DO,S
1200 DATALOOP,S,I,N,DUP,N,SWAP,N,ROT,N,DROP,N,FORGET,S,DELAY,N
1210 REM******* GET WORD **********
1220 IFLEN(I$)=0THEN1280
1230 IFLEFT$(I$,1)=D$THENI$=MID$(I$,2):GOTO1220
1240 FORL=1TOLEN(I$)
1250 IFMID$(I$,L,1)=D$THENW$=LEFT$(I$,L-1):I$=MID$(I$,L+1):GOTO1270
1260 NEXTL:W$=I$:I$=""
1270 RETURN
1280 PRINT"■"S$S$;:GOSUB1050:PRINT"■";
1290 PRINT"■ ■■";
1300 GETI1$:IFI1$=""THEN1300
1310 N=ASC(I1$):IFN=13THENPRINT" ":GOSUB1560:GOTO1210
1320 IFN=34THENPRINTI1$"■";
1330 IFN=19THENI$="":GOTO1210
1340 IF(N=200RN=157)ANDLEN(I$)>0THENI$=LEFT$(I$,LEN(I$)-1):PRINT"■";:GOTO1290
1350 IF(NAND127)<32THEN1290
1360 PRINTI1$;:I$=I$+I1$:IFLEN(I$)<80THEN1290
1370 GOTO1210
1380 REM********** SEARCH DICT *******
1390 PRINTP$"IS "W$" IN THE DICTIONARY?"
1400 FORN=DTO1STEP-1
1410 IFDE>0THENGOSUB1620
1420 IFD$(N)=W$THENGOSUB1630:PRINTP$"YES IT IS":GOSUB1040:RETURN
1430 IFDE>0THENGOSUB1630
1440 NEXTN:PRINTP$"NO IT ISN'T":GOSUB1040:RETURN
1450 REM******** PUSH PARAMETER *******
1460 IFSP=101THENPRINTP$"STACK OVERFLOW":N=0:ER=-1:RETURN
1470 IFABS(N)>32767THENPRINTP$"OUT OF RANGE ERROR":I$="":M=0:GOTO240
1480 ER=0:S%(SP)=N:SP=SP+1:GOTO1640
1490 REM******** PULL PARAMETER *******
1500 IFSP=0THENPRINTP$SU$:N=0:ER=-1:RETURN
1510 ER=0:SP=SP-1:N=S%(SP):GOTO1640
1520 REM******** PUSH ADDRESS *********
1530 R(RP)=PC:RP=RP+1:RETURN
1540 REM******** PULL ADDRESS *********
1550 RP=RP-1:PC=R(RP):RETURN
1560 PRINT"■■■";:FORL=1TO5:PRINTS$;:NEXT:PRINT"■■■";:GOSUB1050
1570 FORL=224TO230
1580 POKEL,128:NEXT:PRINT"■";:RETURN
1590 N=N-1:PRINT"■";:FORL=1TO11+INT(N/3)*2:PRINT"■";:NEXT
1600 FORL=1TO2.1+(N/3-INT(N/3))*27:PRINT"■";:NEXT:N=N+1:RETURN
1610 FORN=1TOD:GOSUB1590:PRINTD$(N):NEXT:RETURN
1620 GOSUB1590:PRINT"■"D$(N):RETURN
1630 GOSUB1590:PRINTD$(N):RETURN
1640 PRINT"■■■■■■■■■■■";:IFSP=0THEN1670
1650 FORL=1TO(7+SP-ABS(SP-7))/2:PRINTSPC(31)"■      ■■■■■■"S%(SP-L)
1660 NEXT
1670 IFSP<7THENPRINTSPC(31)"■      ";
1680 RETURN
READY.
```

VIC Doppler

by Quentin Gore

If you fancy yourself as a space traveller blasting your way through the galaxy, then this program is for you — but it's not a game. To the fanciful, it turns your TV into a window onto the stars, as seen from a high speed spaceship. It will also make a useful demonstration of the effects of high speed travel to eager physics students.

The program starts by plotting the sky with the zenith in the centre of the screen and the sun behind your back. You then have to select which of 93 stars you want to travel to and this is done by pressing 'A' repeatedly until the star you want to go to is highlighted, in which case you press 'F'. The distance to the destination and projected journey time are printed on the screen and then two superimposed graphs are plotted. A yellow curve represents the distance travelled and a blue curve represents velocity, both of which are plotted against time from inside the ship (remember that, according to the theory of relativity, time flows faster outside a supposed spaceship). This use of relativity is based on the assumption that the ship is travelling at a constant acceleration and that it turns round half way to start braking. The user should press 'C' when the plot is complete.

The sky is then plotted again as at the start of the voyage. Pressing 'C' starts a new graph plot, representing the situation a month later (shiptime). Each time you

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press 'C' you are told how much longer the voyage has to run.

As the voyage draws on, three effects can be seen. The first, stellar aberration, makes the stars seem to draw together around the destination star, so that even the sun (which is actually behind you) becomes visible ahead. Doppler shift is best known within the confines of earth for the fall in pitch of the sound made by a speeding object as it passes you (listen to police sirens and car horns), but astronomers know that Doppler shift can be seen in the spectra of stars either when they are travelling fast or, as in this case, when you are travelling fast past them.

It manifests itself as a 'colour shift' in the spectrum in which one end of the spectrum is effectively lost to the eye and the red end (if something is moving towards you) or the blue end (if something is moving away) increase in prominence and size. Here, stars red-shift or blue-shift into invisibility. The colours used here are representative and in reality they depend on the colour of the star. Bear in mind that Doppler shift can only be seen on the spectrum of a star which is moving very fast — close to the speed of light, in fact, which gives an idea of how fast you are meant to be travelling in this simulation. The last effect that can be seen is that of Parallax, in which close objects move past faster than those further away.

When the voyage is over you are put back to the beginning, except that you are in a new location. Before loading or keying in the program, it is necessary to type in the following two direct commands to allow for the graphics: POKE 32*256,0 and then POKE 44,32 then NEW. The program runs on a VIC with either an 8k or a 16k memory expansion.

```
1 REM***INITIALISATION***
2 W=104:NS=94:FF=.2459Ø2:DIMR(1Ø1),PH(1Ø1),TH(1Ø1)
3 FORI=1TONS:READR(I),TH,PH,:TH(I)=TH*π/18Ø:PH(I)=PH*π/18Ø:NEXT
4 GS=256*18:TA=3.7
5 POKE51,18Ø:POKE55,18Ø:POKE52,63:POKE56,63
6 FORI=ØTO72:READA:POKE16328+I,A:NEXT
1Ø POKE36879,15:POKE36864,18:POKE36865,26:POKE36866,17:POKE36867,27:POKE36878,6*16
2Ø SYS16331:SYS16328:SYS16372Ø
3Ø POKE36869,2Ø4
9Ø REM***INITIAL PLOT***
1ØØ TM=Ø:GOSUB11ØØ:I=Ø
1Ø2 REM***HIGHLIGHT STARS***
11Ø I=I+1:GOSUB214Ø:CL=255-CL:IFABS(PX)<WANDABS(PY)<WTHENGOSUB1ØØØ
12Ø GETA$:IFA$<>"A"ANDA$<>"F"THEN12Ø
125 IFA$="F"THEN136
13Ø CL=255-CL:IFABS(PX)<WANDABS(PY)<WTHENGOSUB1ØØØ
132 GOTO11Ø
136 POKE36869,192:POKE36867,52:PRINT"DISTANCE":PRINT"R(I)"LTYRS"
137 DI=R(I):NM=23.28*LOG(.515*DI+1+SQR(.515*DI*(.515*DI+2)))
138 PRINT"JOURNEY TIME";"INT(NM)"MONTHS"
139 REM***LINE UP WITH DESTINATION***
14Ø SI=SIN(TH(I)):CS=COS(TH(I)):PG=PH(I):FORJ=1TONS
15Ø S1=SIN(TH(J)):C1=COS(TH(J)):C2=COS(PH(J)-PG):S2=SIN(PH(J)-PG)
152 CC=C1*CS+S1*SI*C2
16Ø TH=ATN(SQR(1/CC↑2-1)):IFCC<ØTHENTH=π-TH
17Ø X=S1*C2*CS-C1*SI:Y=S1*S2:IFX=ØTHENPH=π/2:GOTO18Ø
175 PH=ATN(Y/X):IFX<ØTHENPH=PH+π
18Ø TH(J)=TH:PH(J)=PH:NEXT
19Ø GOSUB8ØØ
2ØØ GETA$:IFA$<>"C"THEN2ØØ
215 FORTT=ØTONM
216 POKE36869,192:POKE36867,52:PRINT"MONTH"TT:FORI=1TO6ØØ:NEXT
218 POKE36867,27:SYS16328:SYS16331:SYS16372:POKE36869,2Ø4
22Ø GOSUB11ØØ
23Ø GETA$:IFA$<>"C"THEN23Ø
24Ø NEXT
248 REM***AFTER VOYAGE,CALCULATE NEW RELATIVE STAR POSITIONS***
25Ø FORI=1TONS:XO=R(I)*COS(TH(I))-X:CO=1/SQR(1+(R(I)*SIN(TH(I))/XO)↑2)
26Ø IFXO<ØTHENCO=-CO
27Ø R(I)=XO/CO:TH(I)=ATN(SQR(1/CO↑2-1)):IFCO<ØTHENTH(I)=π-TH(I)
28Ø NEXT:SYS16328:GOTO1ØØ
7ØØ REM***PLOT DISTANCE AND VELOCITY GRAPHS***
7Ø2 FORI=ØTO2Ø4STEP4
71Ø POKEGS+I,64:POKEGS+3328+I,2:NEXT
72Ø FORI=ØTO3328STEP2Ø8
74Ø POKEGS+2Ø7+I,1Ø2
75Ø NEXT:RETURN
8ØØ POKE36869,2Ø4:POKE36867,27:SYS16328:SYS16331:SYS16372Ø
8Ø6 GOSUB7ØØ:TD=1.94*LOG(.515*DI+1+SQR(.515*DI*(.515*DI+2))):SG=1.Ø3*TD/2Ø8:HG=201
8/DI
81Ø FORI=ØTO1Ø4
82Ø EX=EXP(SG*I):MC=4815
83Ø PX=I:PY=HG*((EX+1/EX)/2-1):CL=85:GOSUB1ØØØ
84Ø PX=2Ø7-PX:PY=2Ø7-PY:GOSUB1ØØØ
85Ø PX=I:PY=2Ø7*(EX-1/EX)/(EX+1/EX):CL=17Ø:GOSUB1ØØØ
86Ø PX=2Ø7-PX:GOSUB1ØØØ
87Ø NEXT:RETURN
1ØØØ REM***GENERAL PURPOSE PLOTTING ROUTINE***
1ØØ2 M=MC+INT(PX/12.2)*2Ø8-PY:MP=3*2↑(INT((12.2-PX+12.2*INT(PX/12.2))*FF+.5)*2)
1Ø1Ø POKEM,(PEEK(M)AND(255-MP))OR(MPANDCL)
1Ø2Ø RETURN
11ØØ REM***CALCULATE DISTANCE AND VELOCITY SO FAR***
```


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PROGRAMS

```
1102 TM=TT:IFTM>NM/2THENTM=NM-TT
1110 EX=EXP(.0858*TM):SH=(EX-1/EX)/2:CH=(EX+1/EX)/2:TH=SH/CH
1120 X=.97*(CH-1):IFTT>NM/2THENX=DI-X
1130 FORI=1TONS:GOSUB2140
1132 IFABS(PX)<WANDABS(PY)<WTHENGOSUB1000
1140 NEXT:RETURN
2140 REM**CALCULATE PARALLAX,STELLAR ABERRATION AND DOPPLER EFFECT***
2141 XO=R(I)*COS(TH(I))-X
2142 CO=1/SQR(1+(R(I)*SIN(TH(I))/XO)↑):IFXO<0THENCO=-CO
2150 CD=(CO+TH)/(1+CO*TH):MU=600*(CH-SH*CO)
2160 AG=ATN(SQR(1/CD↑2-1))*208/π:IFCD<0THENAG=208-AG
2170 PX=AG*COS(PH(I))+6:PY=AG*SIN(PH(I))
2180 CL=85:IFMU>650THENCL=170
2190 IFMU>700THENCL=0
2200 IFMU<500THENCL=255
2210 IFMU<400THENCL=0
2220 MC=6376:RETURN
2800 REM***STELLAR DATA***
3000 DATA 900,98.5,12,520,83,1.6,470,83.5,9
3010 DATA 1600,91.25,6,1600,92,5.4,2100,99.25
3020 DATA 3.6,1500,90.75,7.5
3030 DATA 68,34,258,107,27.5,285,210,40,243
3040 DATA 88,35,249,78,33.5,285,90,35.5,272.3
3050 DATA 680,1.5,45,105,15,228.75
3060 DATA 150,34,81.2,45,31.5,88.2,96,28.5,77
3070 DATA 43,30,69
3080 DATA 9,106,349.1,680,118.6,345.7,2100,116,343.5
3090 DATA 750,106,5,355.4,2700,119,339.8
3100 DATA 11,85,336.7,210,83,339.4
3110 DATA 35,62,334.1,45,57.5,337,105,73,351.3
3120 DATA 160,67.5,355,1080,69.5,344
3130 DATA 570,40.5,38.9,105,48.5,43.8,1000,59
3140 DATA 31.9,680,50,31.9
3150 DATA 68,75,21.9,300,61.5,8.2,541,67,37.7
3170 DATA 36,70,236.25,103,62.5,229,32,71,242
3180 DATA 118,51,233.3
3190 DATA 220,100.5,249.2,32,91.5,259.7,90
3200 DATA 78.5,255
3210 DATA 21,151.5,60.8,31,167.4,183.8
3220 DATA 650,155.9,315,86,159.3,311.8,340,148.9,325.2,750,148.9,310.9,710,155.5,289.6
3230 DATA 340,156.5,303.3
3240 DATA 2400,130,329.5,105,114.1,328.8,140,127,340.9,124,140.4,349
3250 DATA 520,137,328.3,76,144.4,319.4,750,133.3,313.2,470,144.8,309.8,108,139.3,288.8
3260 DATA 4.3,150.4,231,490,150,240,55,126.2,239.1,160,138.5,250.2,570,143.3,245.6
3270 DATA 390,132.2,233,520,137.4,241.7,370,140.4,268.8,71,126.7,250.8
3280 DATA 84,81,298.5,190,70,296.3,43,74.5,278.5,82,69.5,287.5
3290 DATA 140,99,221,66,105.5,227.5
3300 DATA 16,81,152.5,340,79,153.9,90,77,163.9
3310 DATA 124,125,174.5,300,116,167,140,120,165,84,120,175.7,71,115,173.5
3320 DATA 124,120.5,179.1,250,111.1,163.4
3330 DATA 50,106.7,123.8
3340 DATA 780,80.5,124.3,210,62.5,104.1,109,75,103.8,570,75,86.9,360,60,112
3350 DATA .01,180,0
3800 REM**MACHINE CODE***
4000 DATA 169,18,133,1,169,0,133,0,168,145,0,200,208,251,230,1,166,1,224,32,208,243,96
4010 DATA 169,32,133,2,169,16,133,1,169,0,133,0,168,165,2,145,0,230,2,152,24,105,17,16
8
4020 DATA 201,221,208,241,160,0,230,0,165,0,201,17,208,231,96
4030 DATA 169,10,162,0,157,0,148,232,208,250,96
```

BBC Gomoku

by Jeff Aughton

Although, in days of yore, *PCW* published a Gomoku game for PET, this program bears very little resemblance to it.

It runs on a BBC Model B in about 6k and includes instructions. It takes the computer a maximum of eight seconds to make its moves, which compares very favourably with some games of this type written in assembler. Certainly it's fast for a Basic program. Part of the reason for this speed is that the computer looks only one move ahead. In spite of this it plays a reasonable game and often makes seemingly peculiar moves which turn out to be sensible on analysis. It makes a worthy opponent.

Draws are spotted immediately — ie, as soon as the computer knows neither player can win and not before. This is announced and the game can be finished without having to be played to an uninteresting end.

Should any reader require details of the author's algorithm — which can be applied to almost any two-player strategy game — they are welcome to get in touch with me (enclosing an SAE) and I will supply them with a flowchart.

```
10 REM GO-MOKU BY J.AUGHTON
20 MODE7
30 PROCinitial
40 REPEAT
50 MODE5:PROCgame
60 MODE7:PROCgover
70 UNTIL Done
80 PRINT
```


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PROGRAMS

```
 90 END
100
110 DEF PROCinitial
120  PROCrules
130  READ W1%,W2%,W3%,W4%,W5%,W6%
140  DIM Table% 2541,W%(252),Cell%(121)
150  PROCreadtable
160  VDU 23,224,16,56,124,124,124,124,56,16
170  @%=2:Att%=W1%
180  Mwin%=0:Ywin%=0:Draw%=0
190  PRINT'"  PLEASE PRESS THE SPACE BAR TO START"
200  REPEAT UNTIL GET$=" "
210 ENDPROC
220
230 DEFPROCreadtable
240  FOR I%=0 TO 2541
250  ?(Table%+I%)=0:NEXT
260  Win%=1
270  FOR I%=1 TO 4
280  READ P1%,P2%,P3%,P4%,P5%
290  FOR J%=1 TO P2%
300  FOR K%=1 TO 7
310  X%=P1%
320  FOR L%=1 TO 5
330  Y%=Table%+21*X%-22
340  REPEAT Y%=Y%+1
350  UNTIL ?Y%=0
360  ?Y%=Win%
370  X%=X%+P3%
380  NEXT
390  P1%=P1%+P4%
400  Win%=Win%+1
410  NEXT
420  P1%=P1%+P5%
430  NEXT J%,I%
440 ENDPROC
450
460 DEF PROCgame
470  PROCstart
480  PROCboard
490  REPEAT
500  M%=1-M%
510  IF M% THEN PROCme ELSE PROCyou
520  IF N%>0 THEN PROCplay
530  UNTIL M%>1
540  PROCcomments
550 ENDPROC
560
570 DEF PROCstart
580  Win%=252:M3s=0:Y3s=0:Err%=0:First=1:Done=0
590  Lb%=34:Ub%=88
600  VDU 19,2,2,0,0,0
610  VDU 28,0,31,19,26
620  FOR I%=1 TO Win%
630  W%(I%)=0:NEXT
640  FOR I%=1 TO 121
650  Cell%(I%)=0:NEXT
660 ENDPROC
670
680 DEF PROCboard
690  GCOL0,3:GCOL0,130
700  COLOUR 0:COLOUR 131
710  CLG:CLS:VDU 5
720  FOR I%=192 TO 1072 STEP 80
730  MOVE I%,288:DRAW I%,992
740  NEXT
750  FOR I%=288 TO 992 STEP 64
760  MOVE 192,I%:DRAW 1072,I%
770  NEXT
780  GCOL0,0
790  FOR I%=65 TO 75
800  MOVE 80*I%-5E3,264:VDU I%
810  NEXT
820  FOR I%=1 TO 11
830  MOVE 32,1024-64*I%:PRINT I%
840  NEXT:VDU 4
850  REPEAT
860  PRINTTAB(0,1)"WANT TO START?  ";
870  VDU 8:PROCinput(1,77,90)
880  UNTIL In$="Y" OR In$="N"
890  IF In$="Y" THEN M%=1 ELSE M%=0
900 ENDPROC
910
920 DEF PROCyou
930  REPEAT
940  CLS
950  PRINT'"LETTER? ";
960  PROCinput(1,64,76)
```


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PROGRAMS

```
 970  X%=ASC(In$)-64
 980  REPEAT
 990  PRINTTAB(0,3)"NUMBER?   ";
1000  VDU 8,8
1010  PROCinPut(2,47,58)
1020  Y%=VAL(In$)
1030  UNTIL Y%>0 AND Y%<12
1040  N%=FNsquare
1050  IF N%=0 THEN PROCabuse
1060  UNTIL N%
1070 ENDPROC
1080
1090 DEF PROCinPut(L%,Lo%,Hi%)
1100  K%=0:In$=""
1110  REPEAT
1120  Z%=GET
1130  IF Z%=127 AND K%>0 THEN PROCdel
1140  IF Z%>Lo% AND K%<L% AND Z%<Hi% THEN PROCadd
1150  UNTIL Z%=13 AND K%>0
1160 ENDPROC
1170
1180 DEF PROCdel
1190  K%=K%-1:In$=LEFT$(In$,K%):VDU Z%
1200 ENDPROC
1210
1220 DEFPROCadd
1230  K%=K%+1:In$=In$+CHR$(Z%):VDU Z%
1240 ENDPROC
1250
1260 DEF PROCabuse
1270  CLS:Err%=Err%+1
1280  ON Err% GOSUB 1320,1340,1360,1380,1400,1420
1290  PROCwait(350)
1300 ENDPROC
1310
1320 PRINT'"You can't play there"'"It's already taken":RETURN
1330
1340 PRINT'"That square is taken"'"Please try another":RETURN
1350
1360 PRINT'"That's your third"'"mistake . Think!!!!":RETURN
1370
1380 PRINT'"I'm getting tired"'"of this.Concentrate!":RETURN
1390
1400 PRINT'"That was your fifth"'"idiotic mistake...":RETURN
1410
1420 PRINT'"RIGHT!,THAT'S IT!!"'"YOU LOSE A TURN !!"
1430 N%=-1:Err%=0:RETURN
1440
1450 DEF PROCme
1460  CLS:PRINT'"Let me think..."
1470  IF First THEN PROCguess ELSE PROCthink
1480  CLS:PRINT'"I WILL PLAY ";
1490  VDU 64+X%,32,7:PRINT Y%
1500  PROCwait(200)
1510 ENDPROC
1520
1530 DEFPROCguess
1540  First=0
1550  REPEAT
1560  X%=3+RND(5):Y%=3+RND(5)
1570  N%=FNsquare
1580  UNTIL N%
1590  PROCwait(280)
1600 ENDPROC
1610
1620 DEF PROCthink
1630  IF M3s<=Y3s AND Y3s>1 THEN Def%=W2% ELSE Def%=W3%
1640  IF RND(1)<.9 THEN P1%=W4% ELSE P1%=W5%
1650  V%=-9999
1660  FOR I%=Lb% TO Ub%
1670  IF Cell%(I%)=0 THEN PROCeval
1680  NEXT
1690  N%=K%:K%=K%+10
1700  X%=1+(K% MOD 11)
1710  Y%=K% DIV 11
1720 ENDPROC
1730
1740 DEF PROCeval
1750  T%=0:Twos%=0:L%=Table%+21*I%-21
1760  REPEAT
1770  Z%=W%(?L%)
1780  IF Z%=9 THEN 1840
1790  IF Z%=4 THEN T%=9999:GOTO 1840
1800  IF Z%=-4THEN T%=999
1810  IF Z%=-2THEN Twos%=Twos%+1
1820  IF Z%<0 THEN 0%=Def% ELSE 0%=Att%
1830  T%=T%+0%*(Z%+1)-P1%*(Z%=3)
1840  L%=L%+1
```

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TRS80

PROGRAMS

```
1850  UNTIL ?L%=0
1860  IF Twos%>4 THEN T%=T%+W6%
1870  IF T%>V% THEN V%=T%:K%=I%
1880 ENDPROC
1890
1900 DEF PROCplay
1910  VDU 5
1920  MOVE 128+80*X%,1036-64*Y%
1930  FOR I%=1 TO 5
1940  GCOL0,2:VDU 224,8
1950  PROCwait(30)
1960  GCOL0,M%:VDU 224,8
1970  PROCwait(30)
1980  NEXT:VDU 4
1990  PROCupdate
2000 ENDPROC
2010
2020 DEF PROCupdate
2030  P%=2*M%-1:Cell%(N%)=P%
2040  K%=Table%+21*N%-21
2050  Q%=?K%
2060  REPEAT
2070  V%=W%(Q%)
2080  IF V%=9 THEN 2150
2090  IF V%*P%<0 THEN W%(Q%)=9:Win%=Win%-1 ELSE W%(Q%)=V%+P%
2100  IF V%=-3 THEN Y3s=Y3s-1
2110  IF V%=+3 THEN M3s=M3s-1
2120  IF V%=-2 AND P%<0 THEN Y3s=Y3s+1
2130  IF V%=+2 AND P%>0 THEN M3s=M3s+1
2140  IF ABS(W%(Q%))=5 THEN M%=(P%+5)/2:Win%=Q%
2150  K%=K%+1:Q%=?K%
2160  UNTIL Q%=0
2170  IF Win%=0 THEN M%=4
2180  N%=N%-23
2190  IF N%>0 AND N%<Lb% THEN Lb%=N%
2200  N%=N%+46
2210  IF N%<122 AND N%>Ub% THEN Ub%=N%
2220 ENDPROC
2230
2240 DEF PROCcomments
2250  IF M%<4 THEN PROCshowin
2190  IF N%>0 AND N%<Lb% THEN Lb%=N%
2200  N%=N%+46
2210  IF N%<122 AND N%>Ub% THEN Ub%=N%
2220 ENDPROC
2230
2240 DEF PROCcomments
2250  IF M%<4 THEN PROCshowin
2260  ON M%-1 GOSUB 2310,2350,2390
2270  CLS:PRINTTAB(T%,1)A$
2280  PROCwait(400)
2290 ENDPROC
2300
2310 Ywin%=Ywin%+1:A$="You win!!"
2320 B$="Well Played - but you were lucky !!"
2330 T%=5:RETURN
2340
2350 Mwin%=Mwin%+1:A$="I've won!!!!"
2360 B$="WOW!! -I really enjoyed that!!!"
2370 T%=4:RETURN
2380
2390 Draw%=Draw%+1:A$="It's a draw!!"
2400 B$="No-one could have won that."
2410 T%=3:RETURN
2420
2430 DEF PROCshowin
2440  X%=152+80*X%:Y%=1020-64*Y%
2450  P1%=80:P2%=64
2460  IF Win%<204 THEN P1%=-80
2470  IF Win%<155 THEN P1%=0
2480  IF Win%<78  THEN P1%=80:P2%=0
2490  REPEAT
2500  X%=X%+P1%:Y%=Y%+P2%
2510  UNTIL POINT(X%,Y%)<>M%-2
2520  MOVE X%-P1%,Y%-P2%
2530  GCOL0,3:DRAW X%-5*P1%,Y%-5*P2%
2540 ENDPROC
2550
2560 DEF PROCgover
2570  PRINT'B$
2580  PRINT'"The score is now:"'
2590  PRINT"     You  =";Ywin%
2600  PRINT"     Me   =";Mwin%
2610  PRINT"     Drawn=";Draw%
2620  REPEAT
2630  PRINTTAB(0,9)"Do you want to play again?  ";
2640  VDU 8:PROCinput(1,77,90)
2650  UNTIL In$="Y" OR In$="N"
```


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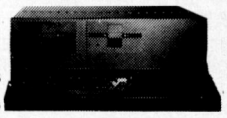

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PROGRAMS

```
2660  IF In$="N" THEN Done=1
2670 ENDPROC
2680
2690 DEF PROCwait(W%)
2700  T%=TIME
2710  REPEAT UNTIL TIME>T%+W%
2720 ENDPROC
2730
2740 DEF PROCrules
2750  PRINTTAB(14)CHR$141;CHR$134"CO-MOKU"
2760  PRINTTAB(14)CHR$141;CHR$134"GU-HURO"
2770  PRINT'"  This game is similar to noughts-and-"
2780  PRINT"crosses,the object being to create a"
2790  PRINT"straight line of";CHR$131;"FIVE OR MORE";CHR$135;"Pieces"
2800  PRINT"either horizontally,vertically or"
2810  PRINT"diagonally."
2820  PRINT"  Notice that,unlike some versions of"
2830  PRINT"this game,a winning line need not"
2840  PRINT"contain";CHR$129;"EXACTLY";CHR$135;"5 pieces and that I"
2850  PRINT"treat any move into an unoccuPied"
2860  PRINT"square as legal-however many lines"
2870  PRINT"of 3 are created."
2880  PRINT"  My Pieces are";CHR$130;"RED";CHR$135;
2890  PRINT"and yours are";CHR$132;"BLACK"
2900  PRINT"(OoPs,I seem to have got my colours a"
2910  PRINT"bit mixed uP !!)"
2920  PRINT"  You may choose who starts but remember";
2930  PRINT"that the first Player has an advantage"
2940  PRINT"and so I expect to have first go at"
2950  PRINT"least";CHR$133;"SOME";CHR$135;"of the time !!!"
2960 ENDPROC
2970
2980 DEF FNsquare
2990  N%=11*Y%-11+X%
3000  IF Cell%(N%) THEN N%=0
3010  =N%
3020
3030 REM TPIDTPKO7BA,S.HT!-J.
3040
3050 DATA 10,-61,-20,220,55,135
3060
3070 DATA 1,11,1,1,4,1,11,11,11,-76,1,7,12,1,4,5,7,10,1,4
```

HOW TO MAKE EPSON, WORDSTAR AND OSBORNE

SING AND DANCE

Continued from page 147

Supercalc models with Wordstar has forced me to make full use of this. I also prepare documents with a right margin at column 50 and reformat before the final print. Hence the following patches.

Default right margin 50	0380	33
Set screen size to 120	0249	78

Now let's put the icing on the cake by utilising the function keys of the Osborne. These can be used to make life very simple by merely transferring the ^ P options directly to each function key. This reduces key strokes and you can put a prompt card behind the numbers on the alpha pad. But remember, the aim is flexibility. I have used the function keys firstly to combine couples of ^ P options, and secondly to store sequences I may send directly from the keyboard (because I can't remember them).

To configure the function keys use SETUP, which is located on your CP/M system diskette. I won't explain how to use this. The Osborne manual does it far better than I could. Figure 2 shows my function key template.

Table 4 shows the values entered for each number. I have called the combination of Double Strike and Emphasised 'Super Bold' and the Enlarged/Condensed combination 'Style 66'. Using these different options to the full, the screen can get cluttered with control characters (roll on the day when screens emulate printers!). I have put ^OD on the templeplate, becaue I find it useful to be able to turn these control characters on and off easily. To achieve a zero with a slash through it is also cumbersome, hence function key 0.

We could put a few cherries on top of the icing by redesigning the print menu to reflect the changes we've made. Use DDT on WSMSGS.OVR — consider this one your project.

I have enjoyed giving these three world-beaters a thorough bashing. However, my investigation has highlighted some areas of frustration. On the Wordstar front — wouldn't it be super if there were more ^ P function keys available for us to access? Unfortunately ^ PB ^ PD and ^ PS are now virtually redundant, but we're unable to amend them fully so that we can use them for something else. It would also be nice if there were some user-definable dot commands. I would use these for selecting line heights. On the Epson front — having a different deselect sequence for each option doubles the number of function keys needed. Also, most of my deselecting merely sets the printer back to its default

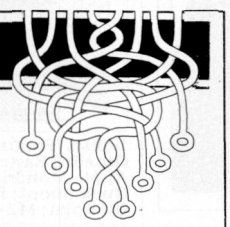
values. I have tried using the initialisation string, but this is no good in the middle of a document. It sends a line-feed and a carriage return.

What about the Osborne? Well Adam, the pencil tray in the new case is a splendid idea, but where do I stick my template?

Stepping aside for a moment, I hear that Epson will soon be launching a new, super dot-matrix printer that will knock spots off the daisywheels. I can't wait to get my hands on it.

Lastly, the MX-80 I have been using is a type III. It has some differences to the type II. Notably, the lack of true sub/superscripts and proper underlining on the earlier version. I am also told that the sequences may be different on the MX-100. Compare closely the relevant sections of your manual with the procedures herein. You should be able to establish the correct sequences for your printer. On some earlier MX-80s, using select and deselect in the same line cancelled the option before printing. The Osborne uses Wordstar version 2.26. Version 3 allows lines to continue beyond column 120 without wrapping round on the screen. if you're not using the Osborne the keyboard direct-entry sequences may be different. There is a good chance that the relevant memory addresses will be the same.

LEISURE LINES



646 entries were received to October's puzzle — either the puzzles are just too easy or the readership is growing at an astonishing pace. If we get that number of entries for the Manhunt competition, then we'll know that it's the latter reason!

Anyway it was a fairly easy puzzle and the answer was 29031 — most readers got it right. The winner, chosen by a random number generated on an HP41CV, was entry number 492 which came from Switzerland — E R Fulton. Congratulations! We hope you won't have to pay duty on your prize.

Incidentally we have not yet received acknowledgments for all prizes which have been sent out. Winners should have received their prizes by, at the latest, one month after their names are published. If you have not yet received your prize, please let us know.

Quickie

There are two stalls in a market selling apples. Stall A sells them at three for 10p, the other stall B at two for 10p. On Monday each stall sells 300 apples, therefore stall A collects £10 and stall B £15 — a total of £25.

On Tuesday each stall again has 300 applies, but both stalls decide to combine and sell at five for 20p. At the end of the day, however they find that there is only £24 to be shared between them. What happened to the other £1?

Prize Puzzle

Runners in a marathon race are assigned consecutive numbers starting at one. One runner with a mathematical bent notices that the sum of the numbers less than his is equal to the sum of the numbers greater than this.

If there are more than 100 runners, but less than 1000, what number is he and how many runners are in the race?

J J Clessa

BLUDNERS



In December's 'Newsprint', under the heading 'Prizes, prizes', we inadvertently gave a Peterborough telephone number for Micronet 800. We are advised that this was incorrect, and is in fact a private residence. . . For details of the Micronet 800 service, please write to Petersham House, 57a Hatton Garden, London EC1B 1DT, enclosing details of your interests — home uses, business, or educational uses and stating the type of computer you use.

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Volume 4 No 8
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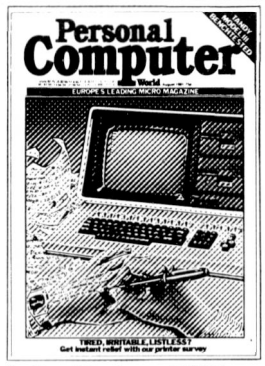
Benchtest: TandyModel III/ Viewdata update/WP Benchtest: Spellbinder/ Printer survey/Micro-holism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.





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Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

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Volume 4 No 11
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Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. PCW Show report, Benchmark Summary, Euro Micro Chess Championship report. Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.



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Vol 5 No 1 January 1982
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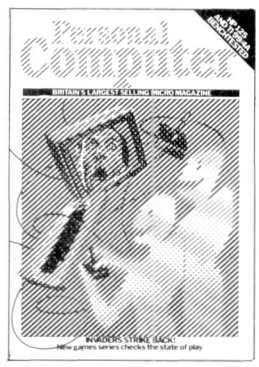

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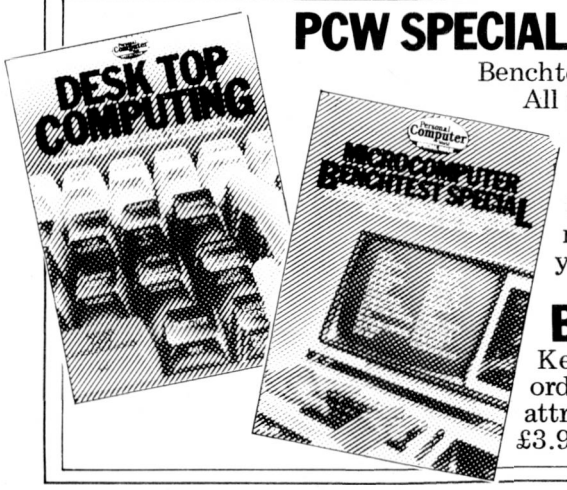

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Next-to-Last-One/MZ-80K Tarot.

Vol 5 No 7
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Benchtests: Mimi 801/ Newbrain/Database Benchtest: Silicon Office/UCSD p-System/BBC Computer In-Depth/Apple II games/ Calc Corner: TI88/ Programs: ZX81 Hypocycloids/BBC Character Generator/TRS-80 Truth/ PET Doc/TRS-80 Screen Dump/UK101 Screen Converter/PET boxes/Atari Earth.

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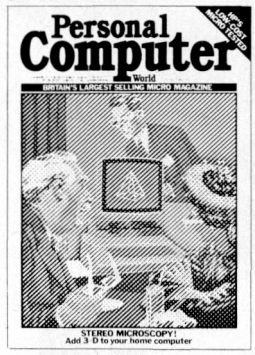
Vol 5 No 9
September 1982
Benchtest: Olivetti M20/ Word Processor Benchtest: Select for NEC/Database Benchtest: Aquila/Checkouts: Microwriter Revisited, E40 Data Compression/Screenplay: ZX81 Pt II/DIY Logo/P for Perfect/ Beeb Colour Hi Res/ RS232/Calc Corner: HP15 and 16C reviewed/Programs: Video Genie Extended Basic, ZX81 Alphabetising, PET File Comparison, BBC Music Player, PET Virus, BBC Radar, PET German Game, TRS-80 Cardshuffler.



Vol 5 No 10
October 1982
Benchtests: HP-86; Positron 9000/Database Benchtest; Personal Pearl/3D Graphics for BBC Computer/Hashing Techniques/Designing Your Own Database/CP/M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.



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Benchtests: Canon CX-1; Hewlett Packard HP75/ Database Benchtest: Condor/Apple II Clock Calendar Card Part — Algebra checking/ Benchmarks summary/Bit Stik graphics for Apple/ Calc Corner — HP41C, Casio fx702p programs/ *PCW* Show report/Tiny printing on Centronics 739/Screenplay — Acorn Atom/Programs: Apple Piano; Apple Moon Module; PET Letterwriter; UK101 Logic; Atari Walls. Sharp MZ80K Area-filling;



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December 1982
Benchtest: Epson HX-20/ Database Benchtests comparison/Pluto Board/ Walters 100 printer/ Motorola MC68000/Ada/ Intelligence test for computers/European Micro Chess Championship/ Computer Scrabble/ Spectrum books/Calc Corner — complex arithmetic on Sharp PC1211/Screenplay — TRS-80 Colour Computer/ Programs — PET Firebird/ Teepee Textpro/PET Search and Rescue/Atari Colour Selector.

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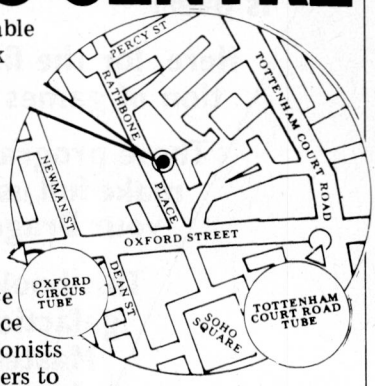



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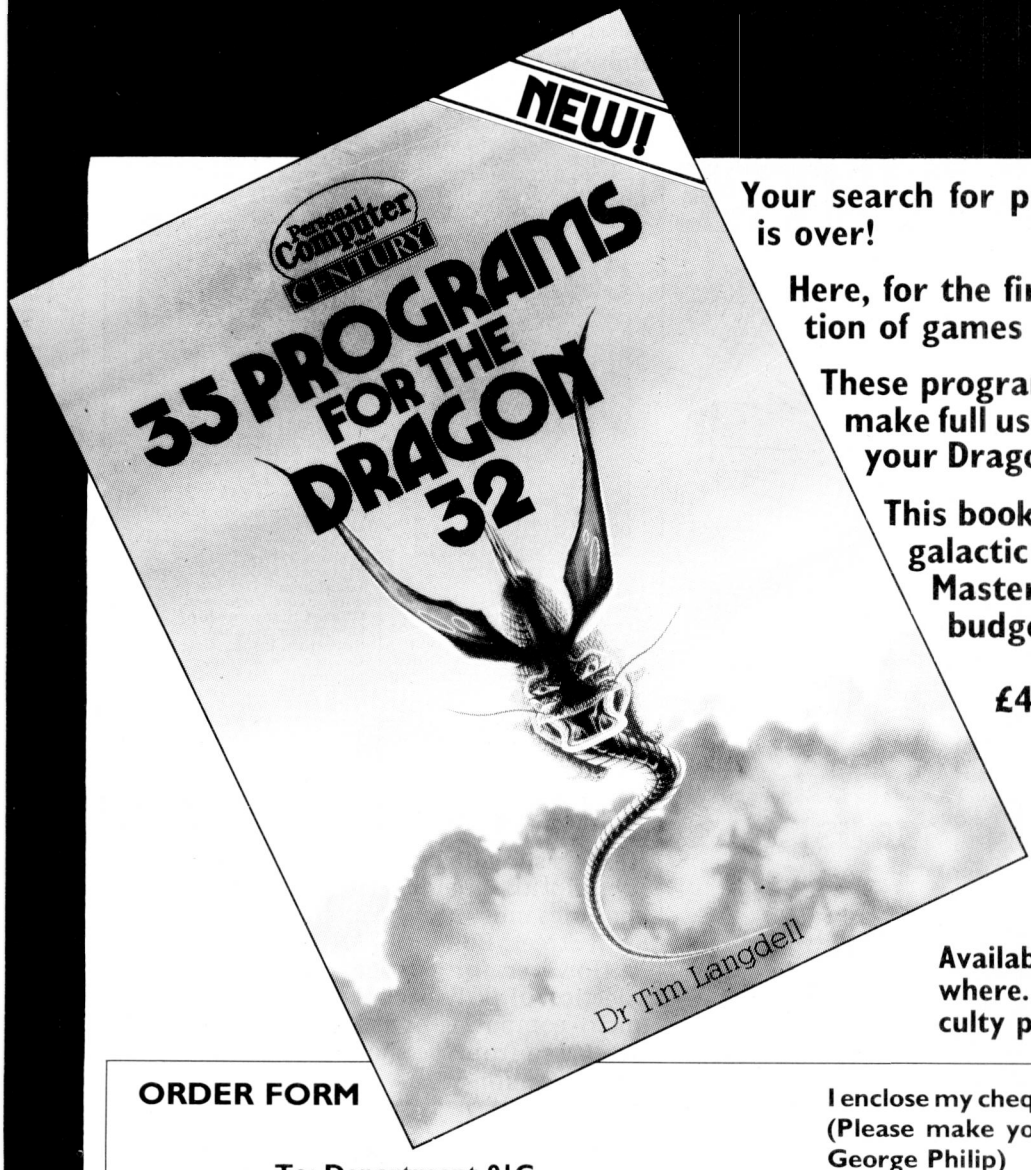

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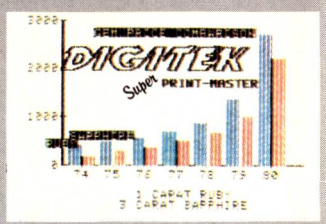

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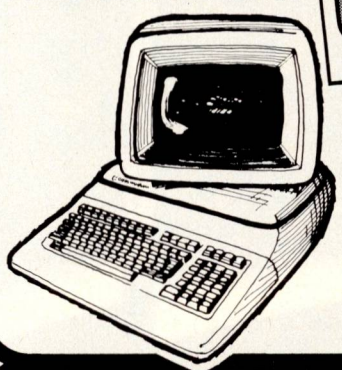

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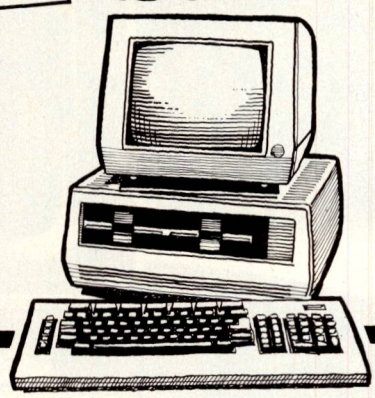

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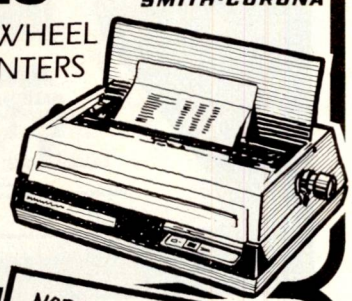

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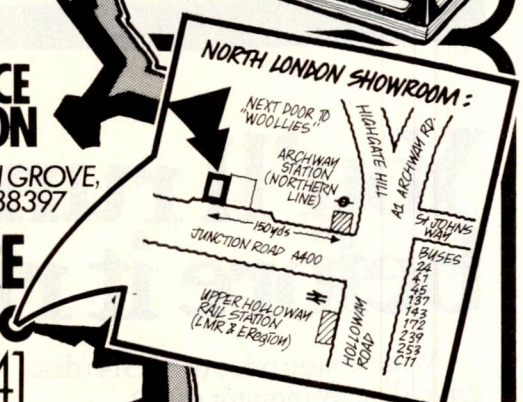

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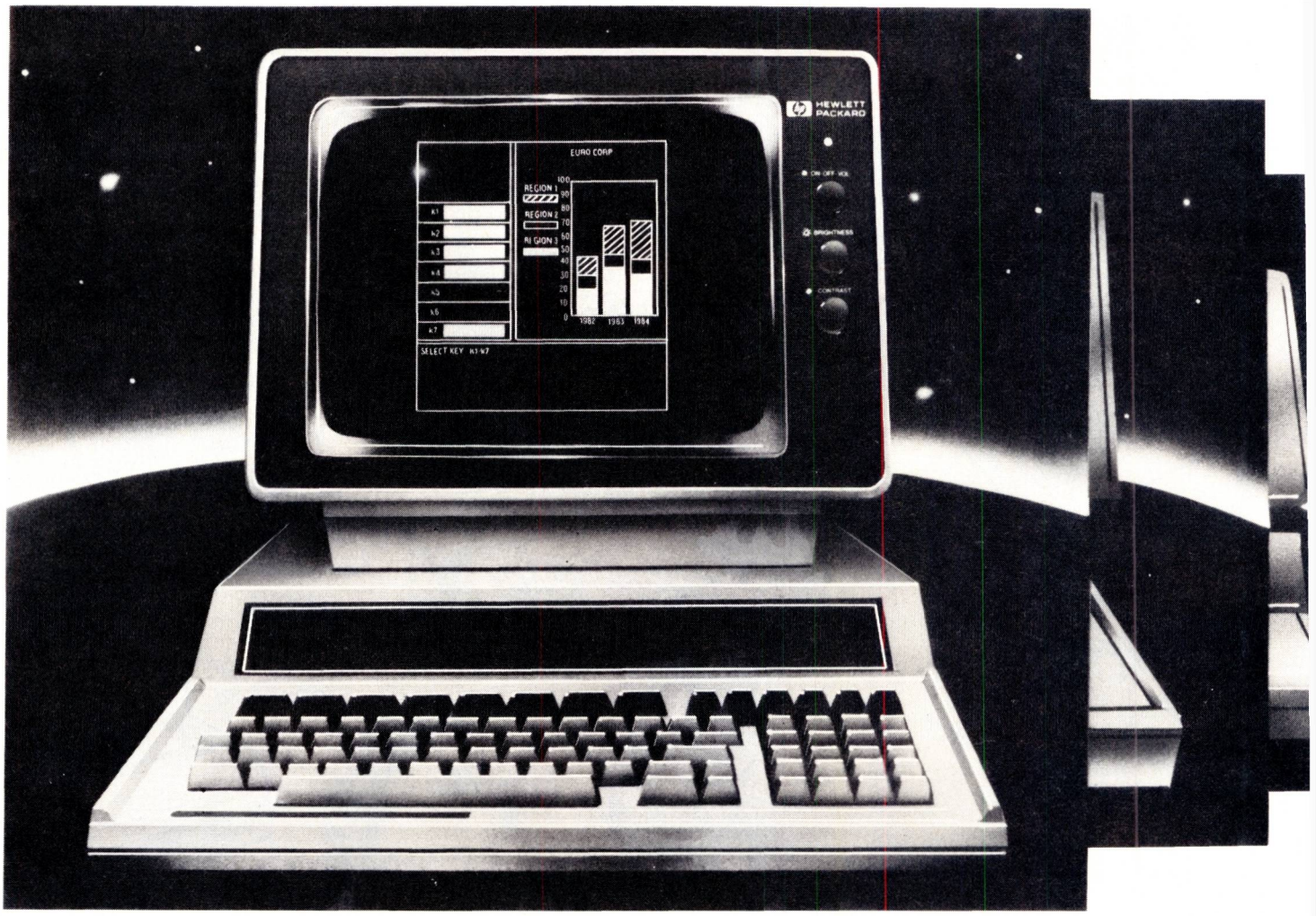

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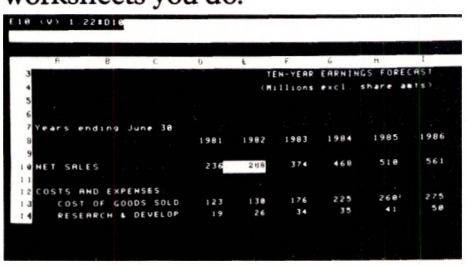

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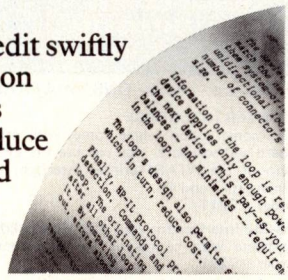

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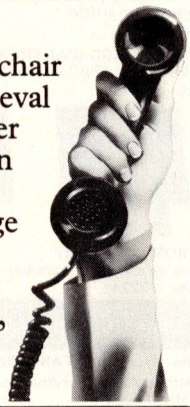

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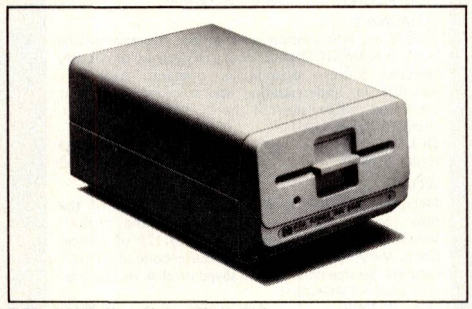

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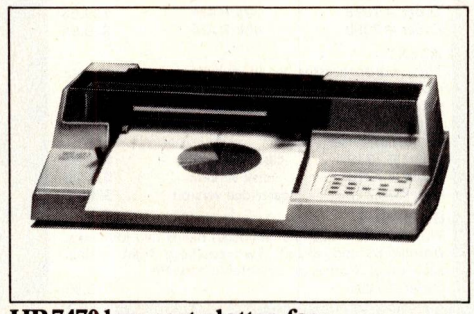

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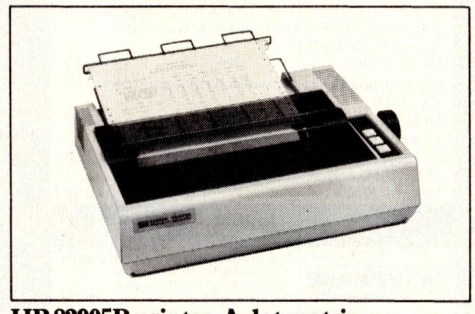

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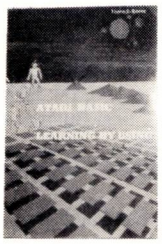

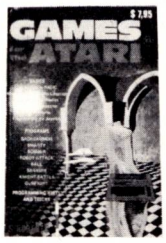

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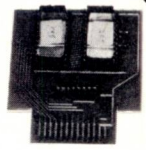

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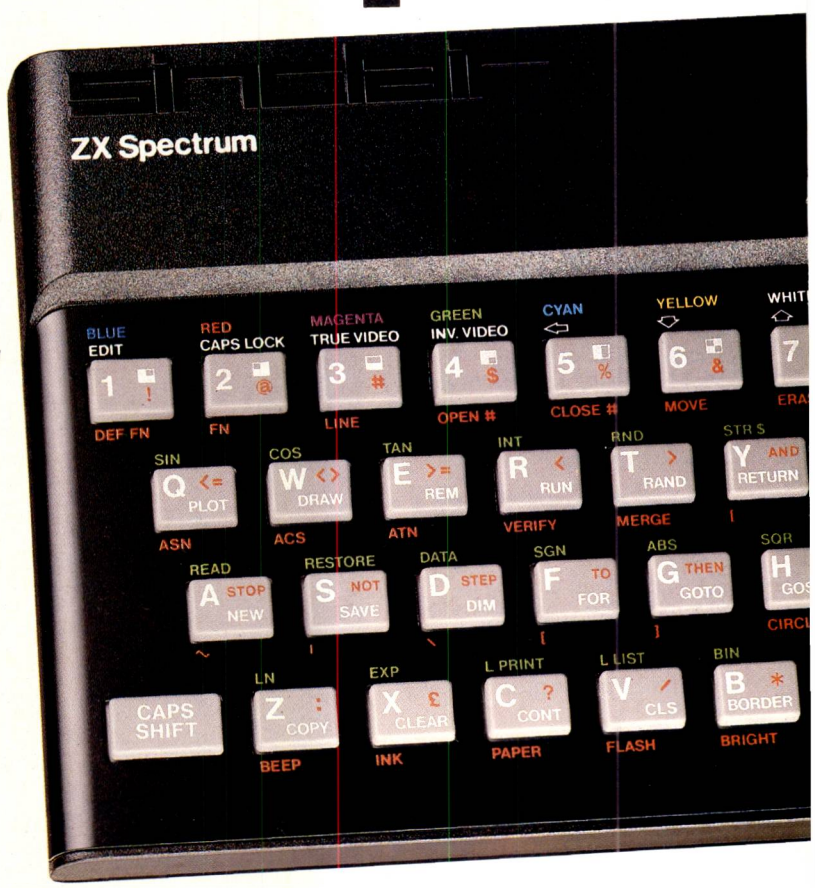

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

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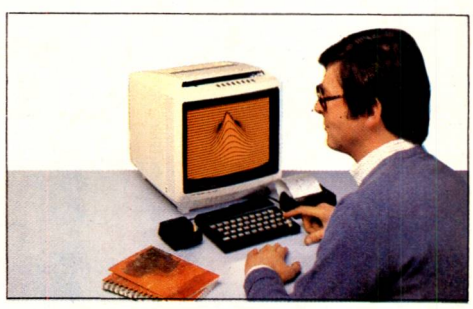
You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
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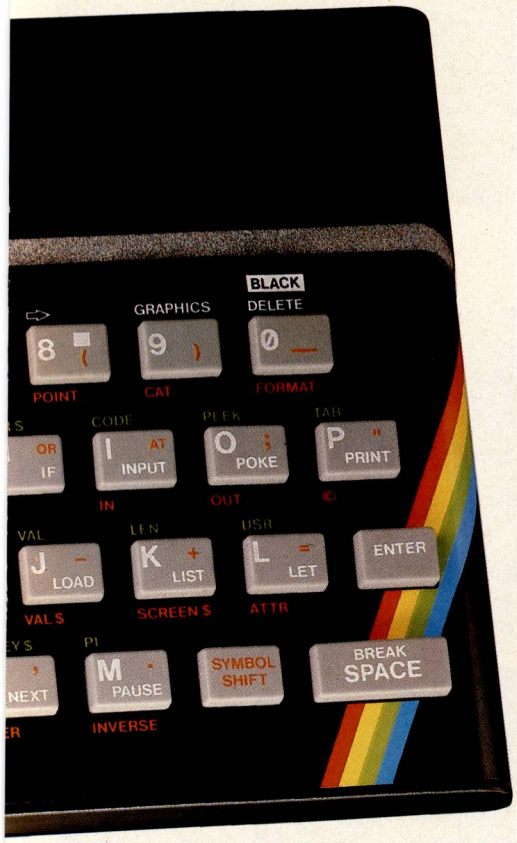

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

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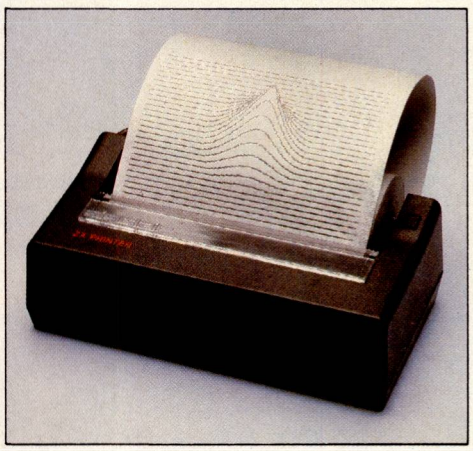
A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.





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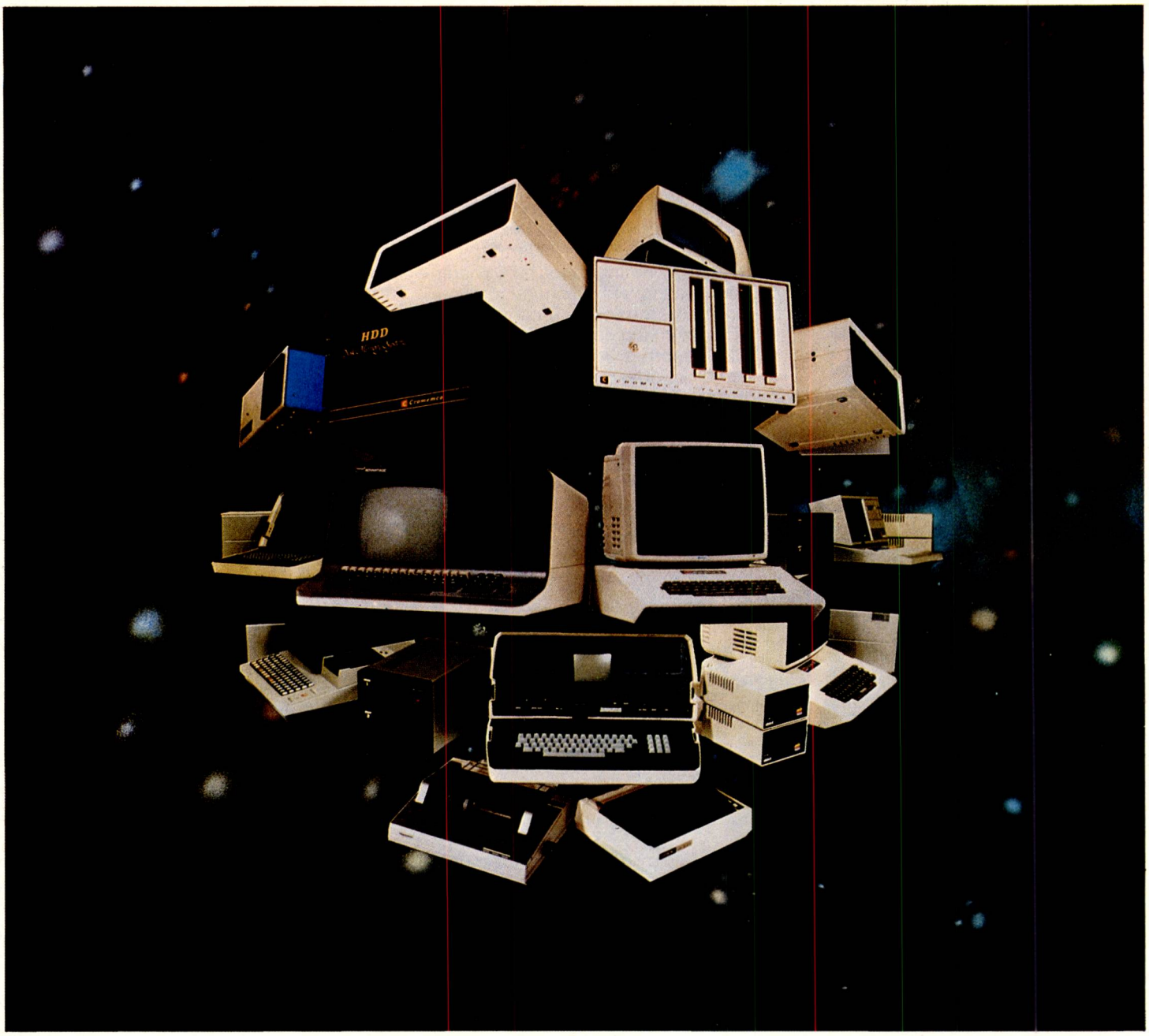

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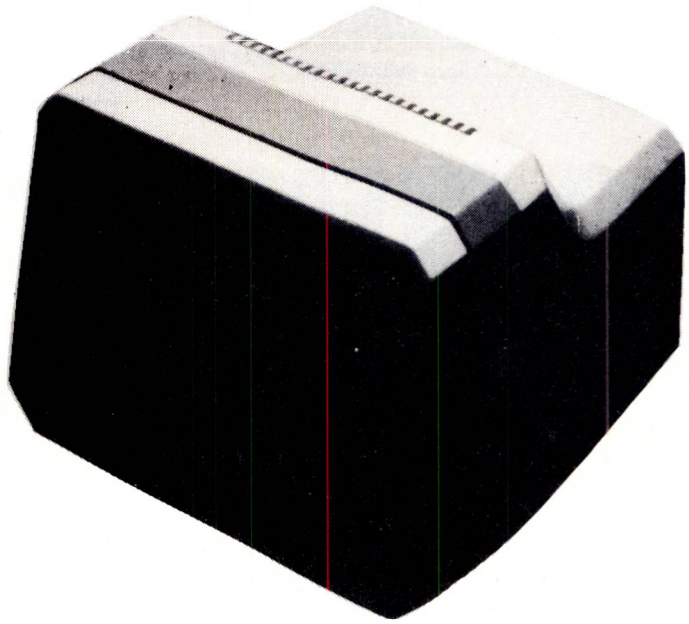

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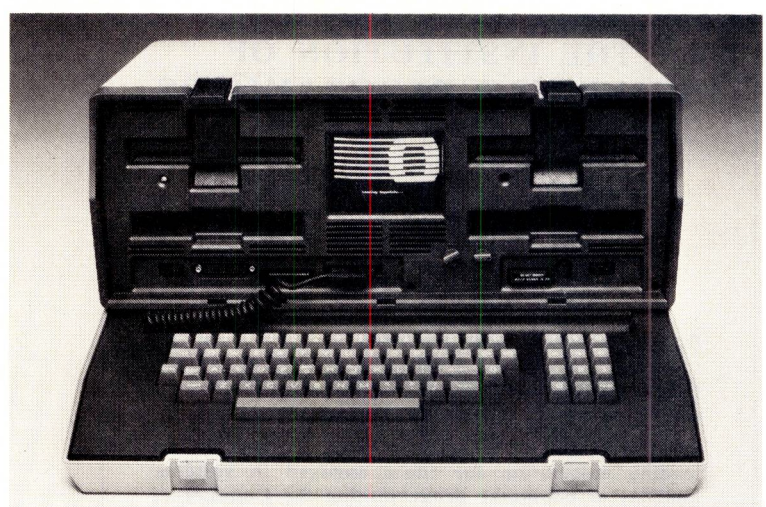

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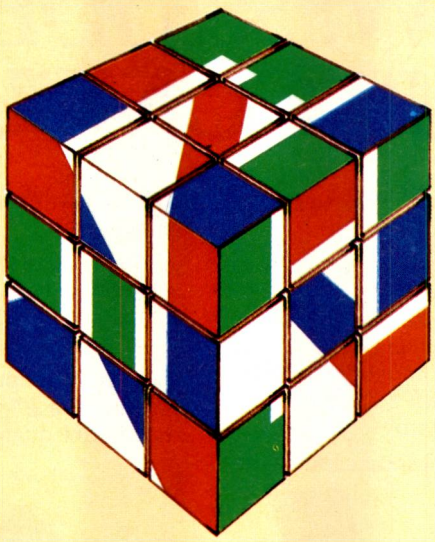

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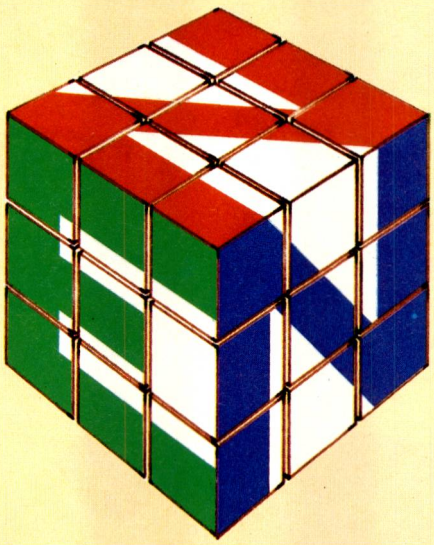

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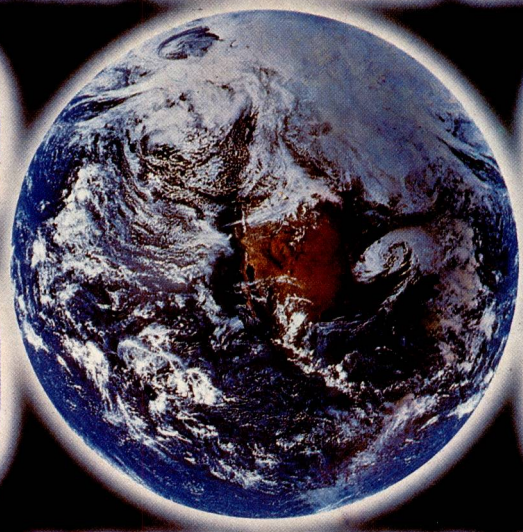

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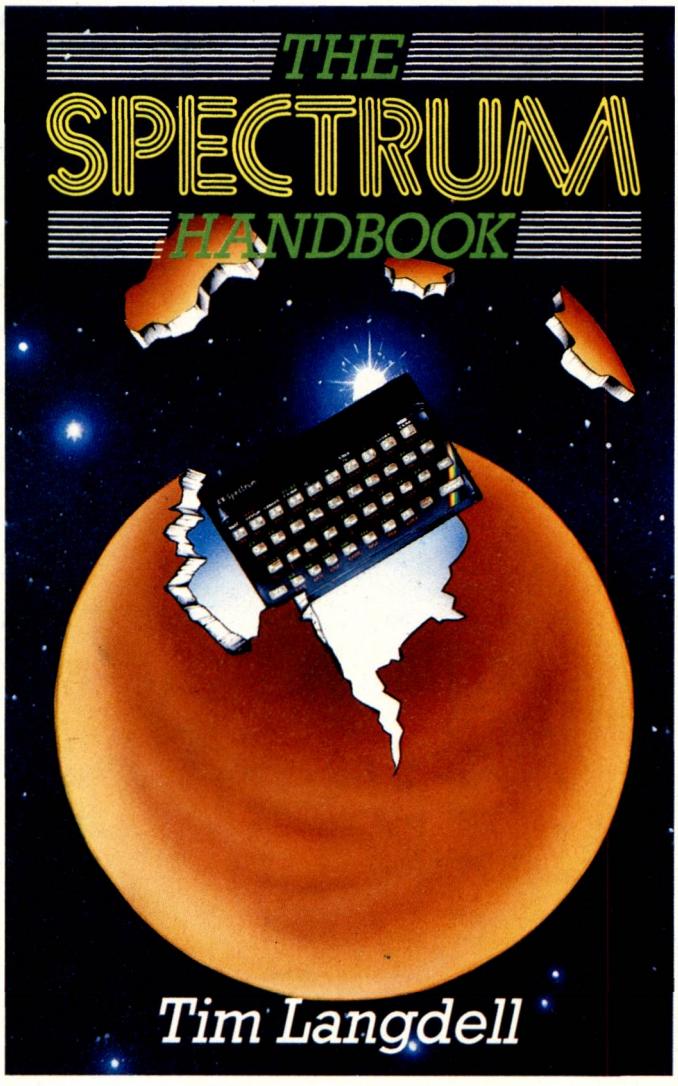

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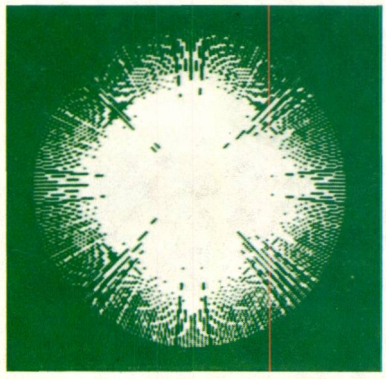

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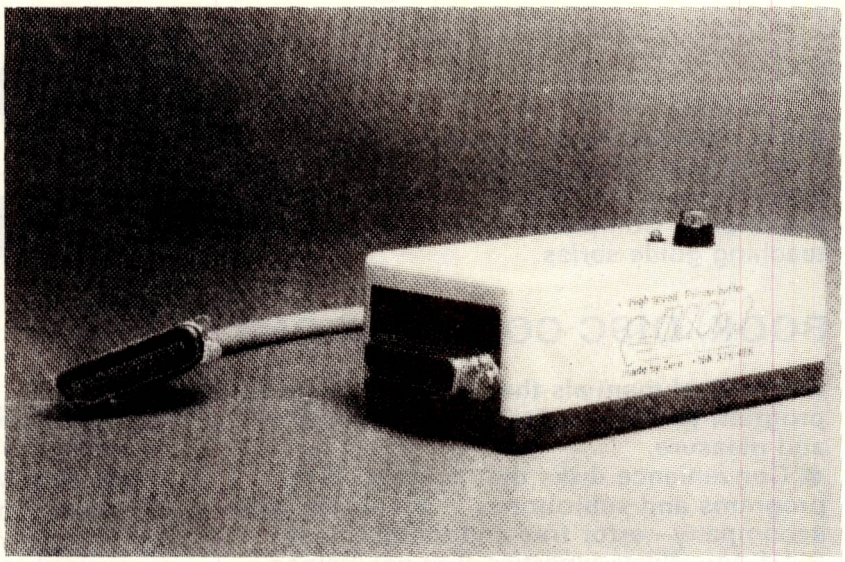

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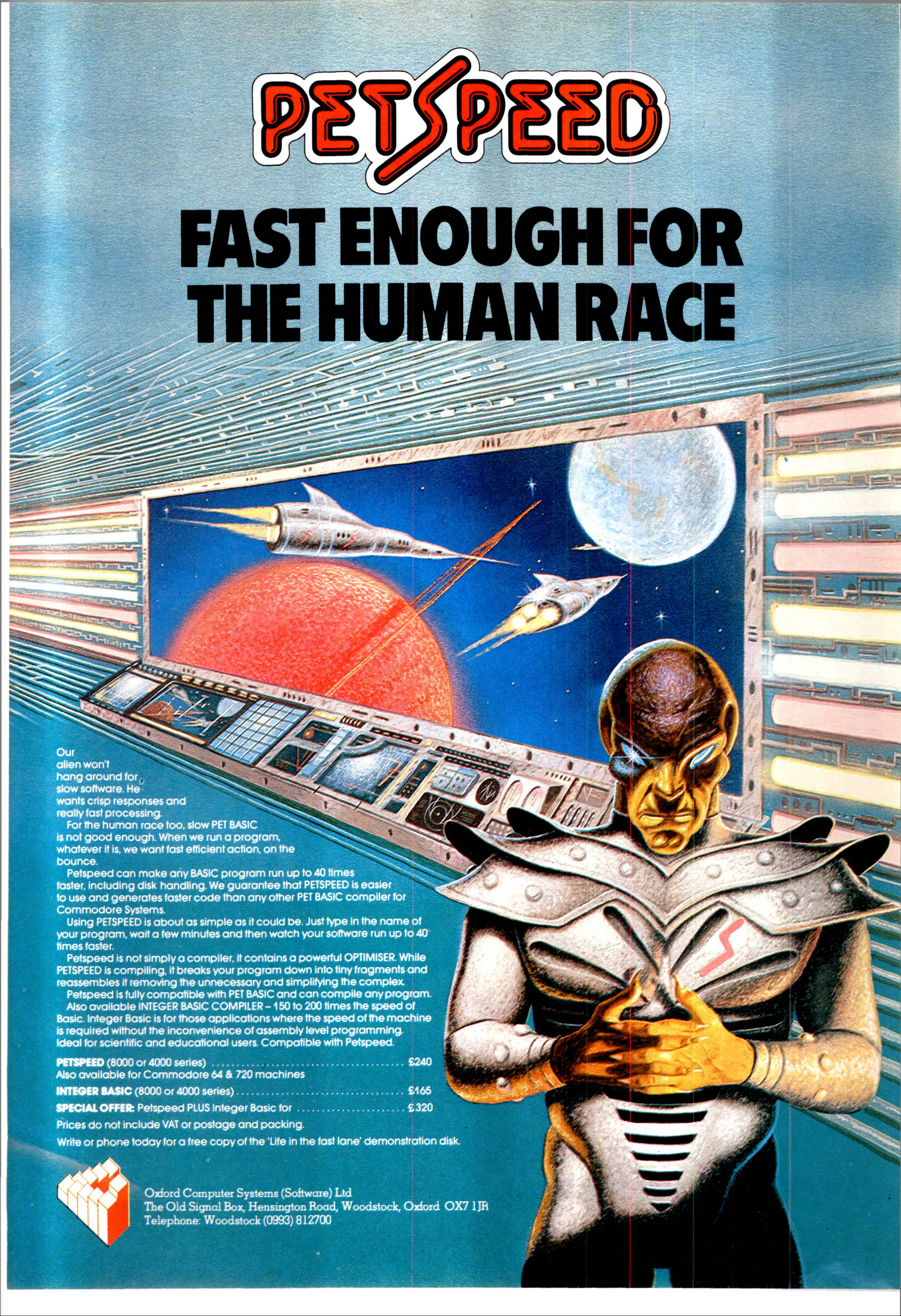

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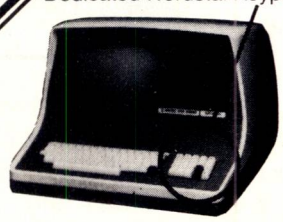

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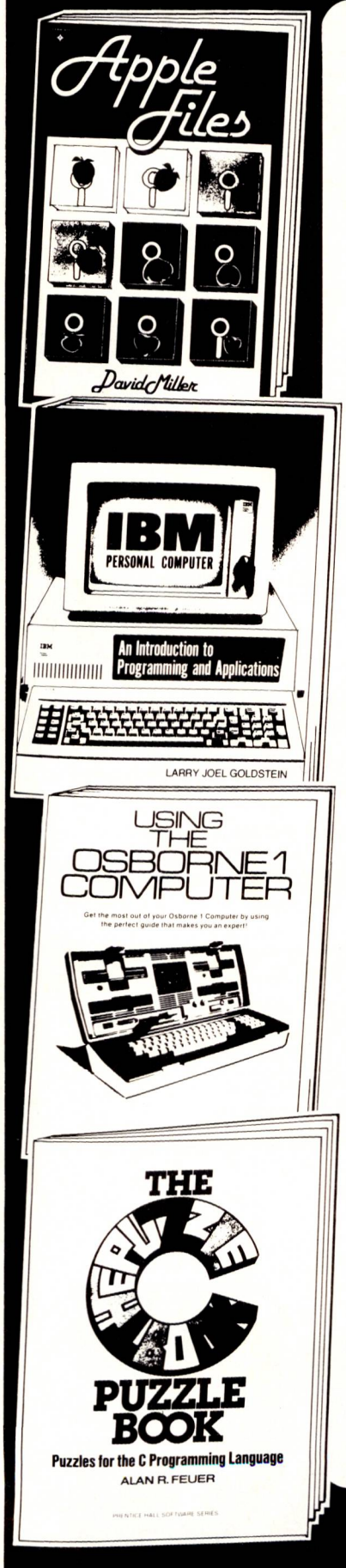

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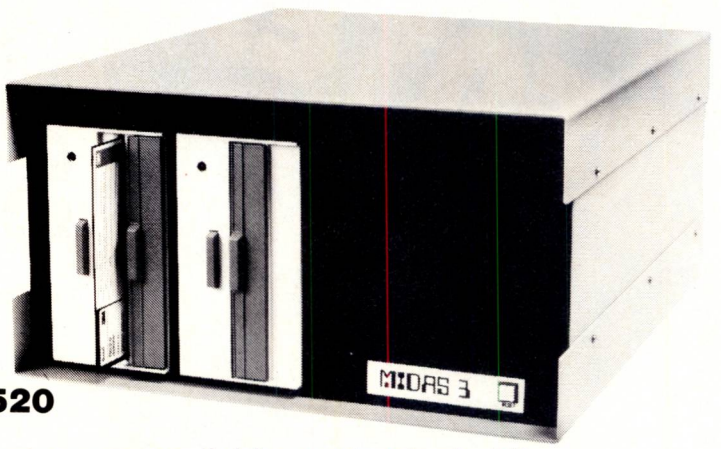

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Previous issues showed examples of 'employees-short-list', 'garage stock re-order', 'sales analysis'. Here is an example of a garage librarian's index and some reports it might generate.

The record may look like this:
1- record number (23)
2- author (Shakespeare)
3- date of pubn (1981)
4- title (Hamlet)
5- selling price (38.00)
6- minimum stock (5)
7- maximum stock (12)
8- current stock (3)
9- publisher (Oxford University Press)
10- binding (Imperial leather)

One report might be: select??
all records where the current stock is lower than the minimum stock. When found, subtract current from maximum, and produce a printed list of the manufacturer's name; title; and re-order quantity

Another report might be: select??
all records in the file where the author is either Shakespeare or Milton or Byron. Output the records to another 'short-disk-file'. Sort them by author into alphabetic order. Take this file and print a list of all works in order Byron/Milton/Shakespeare that are only published in leather bindings.

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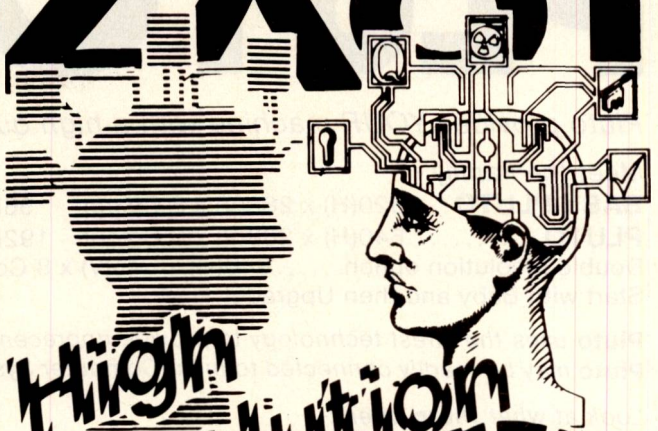
ZX81



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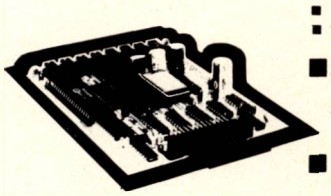

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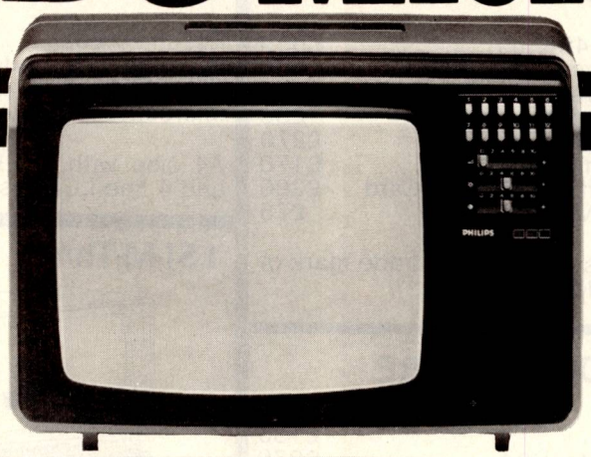

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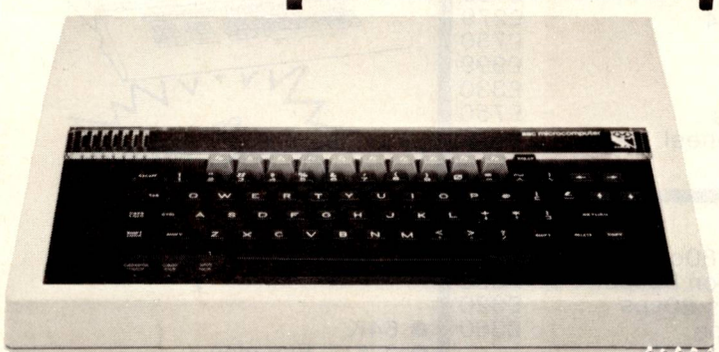

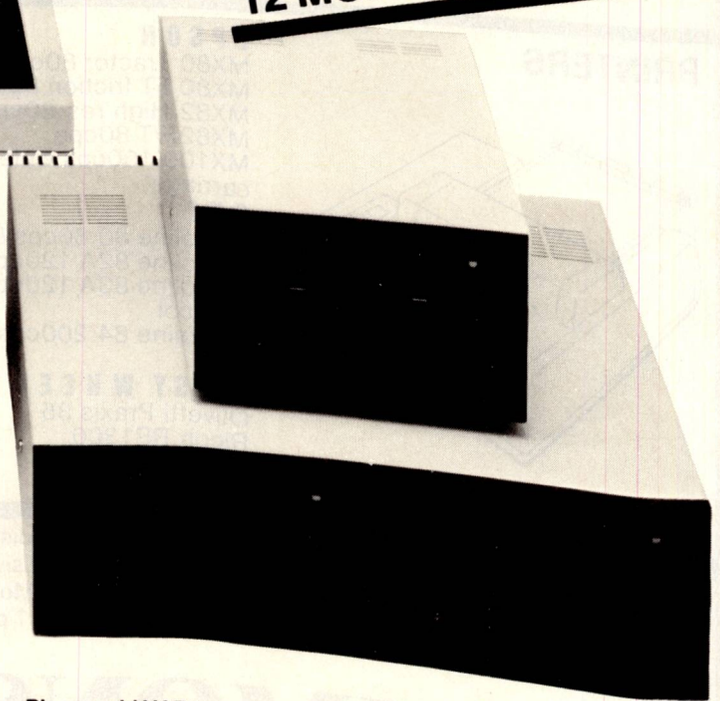

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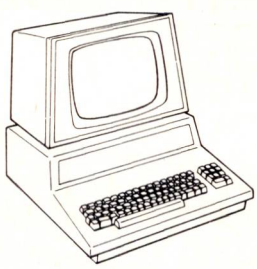

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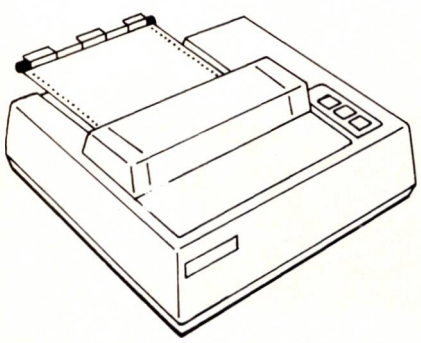

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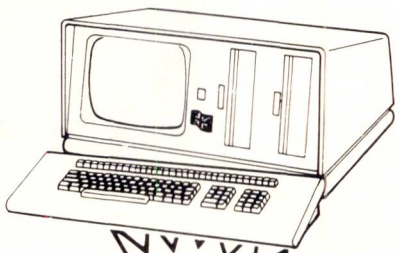

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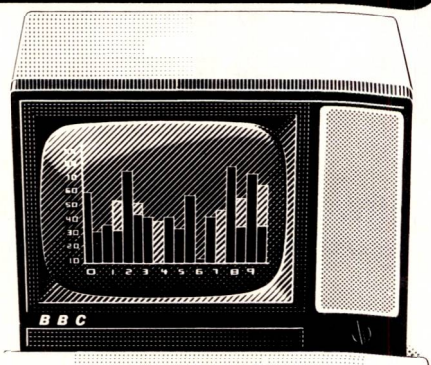

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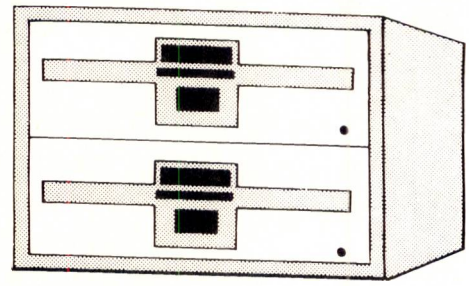

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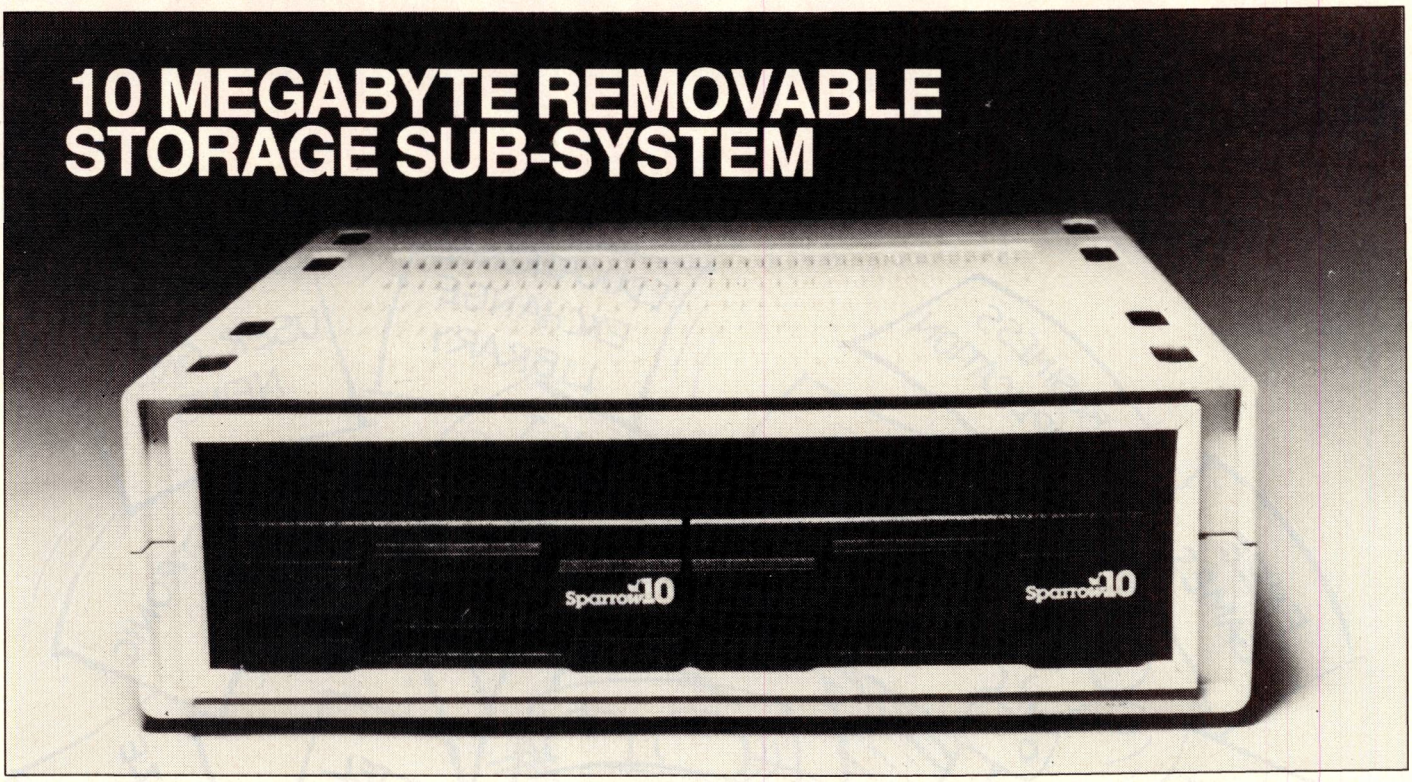

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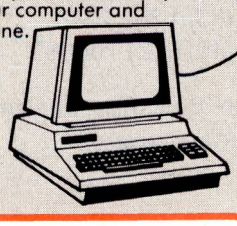



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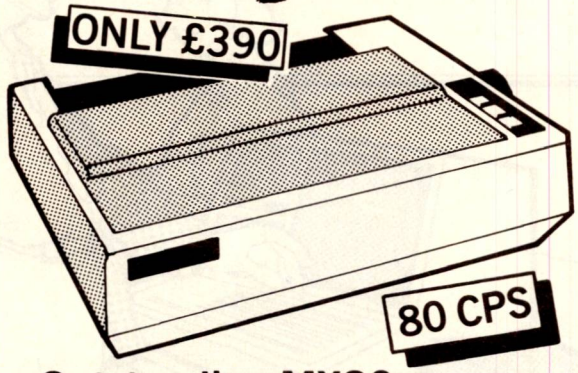

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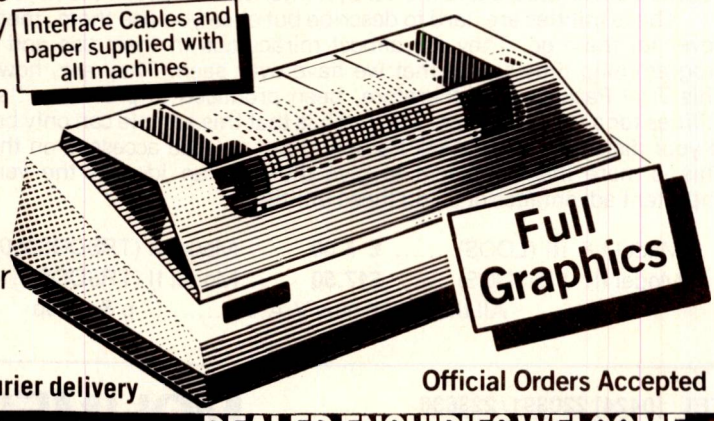

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TRIAL PACKAGE



The Snapp utilities Extended Basic, Built In Functions, Mapping Support, Autofile and the Garbage Collector are all described in our catalogue. Literature is also available from us on request. These programs are available for the machines listed below.

All of this software is installed into the Disk Basic interpreter of the host machine and thereafter is fully integrated into TRSDOS Basic. Once installed it is entirely transparent to the user.

Extended Basic has six separate utilities within it, including cross reference; variable dump (including values), compression, string and keyword find.

Built In Functions contains a large number of new commands and utilities to aid the programmer, the exact number depending on the machine. For instance, one can POKE up to 255 bytes at one time, sort a number of arrays, erase any or all arrays from the Array Table, PEEK multiple bytes at one time, calculate passwords, exchange the contents of variables and so on.

The Garbage Collector gets over that big failing of Microsoft Basic whereby the machine appears to hang from time to time whilst it sorts out its string area.

Automap is a product designed to automate for the Basic programmer the tasks of presenting information on the VDU and accepting information from the keyboard operator.

Autofile carries out very similar tasks to Automap, but instead of interfacing between the keyboard and the VDU, it interfaces between the keyboard and a file.

These utilities are hard to describe but once you use them, then like us, you will never let them go. They are almost miraculous in their use and are the greatest programming time savers that we have ever seen. They are, however, expensive. This Trial Package has, therefore, been produced to provide a "sample" of these utilities for a very low price. The catch is that this sample can only be installed on one of your disks containing Disk Basic and can only be accessed on that disk 99 times. This is more than sufficient to give the user an idea of the very real and very important advantages of using these utilities.

Model I & III (LDOS)	**£ 7.00**	Model II (TRSDOS 2.0)	**£25.00**
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DATA-WRITER

Data-Writer is, for most microcomputers, a new concept in Database Management. It adapts techniques which have been known and used on mainframe computers for quite a long time. A "normal" microcomputer Database Management program constructs its file in a single plane and is probably more accurately described as a file handling system. All of the data written into each record is filed away on disk in the same place, and it is all recalled and acted upon by the computer as one chunk of data.

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a **Management** program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 240. In the former it is 35. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 16 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be of any length up to 6,000 characters, which we believe is about two and a half A4 sheets.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 10 sections or sub-programs as follows:

Entry	Manage	Maths	Sort	Letters
Edit	Statistics	Select	Labels	Reports

We have aleady mentioned many of them, others such as Edit are self-explanatory. The Labels section enables you to create pretty well any form of label required, including the ability to have them printed up in a from one to four across format. The Letters section enables you to create a form letter in Data-Writer if you do not wish to use an external word processor. Statistics is a method for searching the database for errors, and as the title suggests, extracting essential statistics from it.

The important sections not yet touched upon are Manage and Select. Taking the latter first, this section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. Furthermore, the two logical relationships AND and OR may be used freely. In this way one can Select from the database to pretty well any specification required. The Management section of the program enables the user to completely re-structure his database without having to Edit it manually. New fields may be added or old ones deleted. They may be re-arranged or even appended one field to another. Indeed, this can be taken even further in that the whole database may be merged or split as required.

The Reports section enables the user to write reports such as inventories, accounts, bibliographies, insurance coverage report, in fact an endless list of applications. Because the Report section contains its own Text Editor, the report contents and format can be controlled at will and literally an infinite number of formats may be adapted.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DOS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DOS apart from TRSDOS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDOS or LDOS on the Model I and the proprietary DOS supplied on Data-Writer for the Model III. Other DOS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

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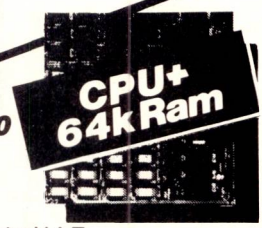

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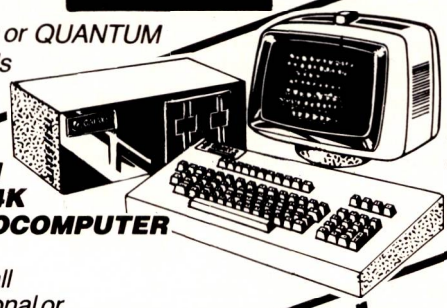

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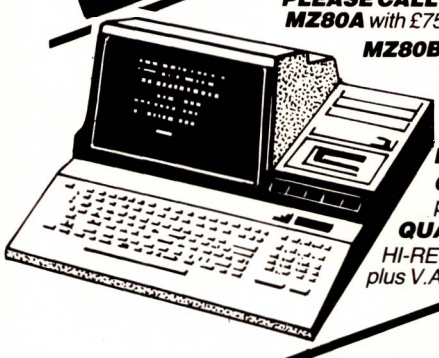



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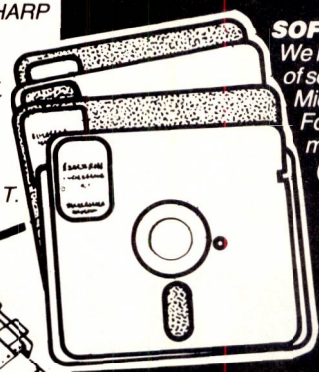

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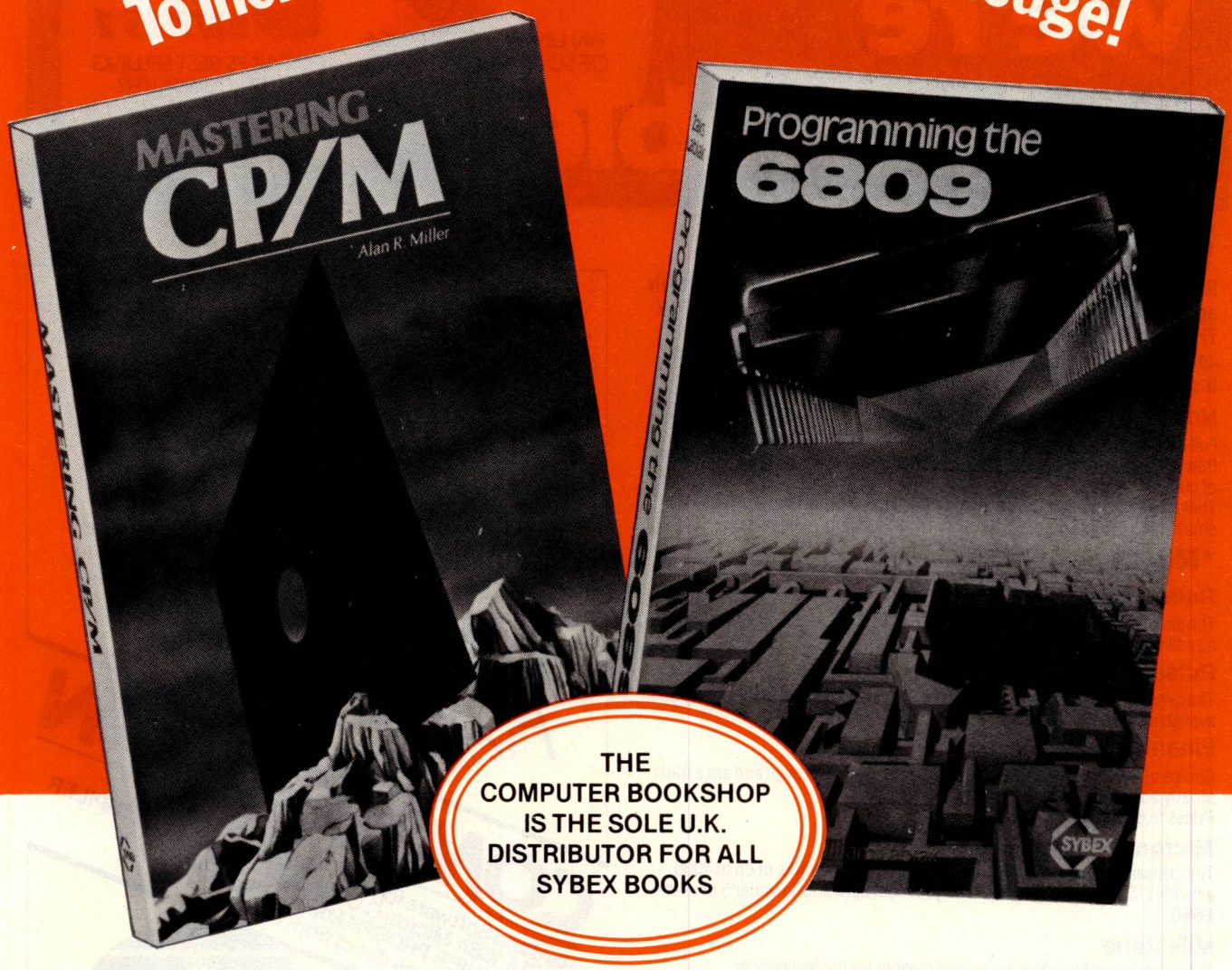

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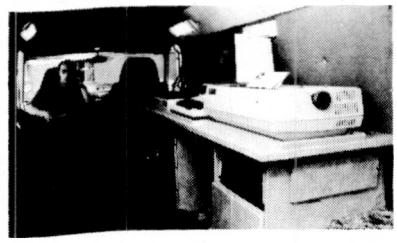



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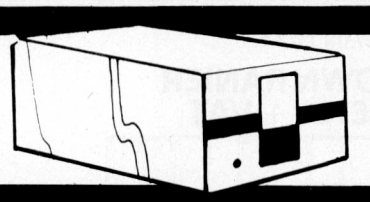

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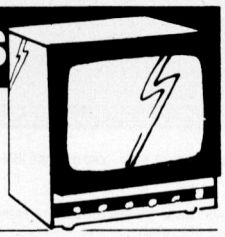

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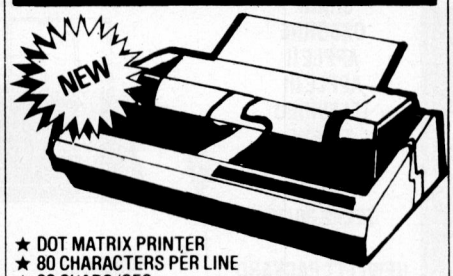

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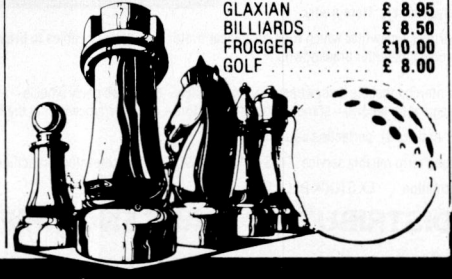

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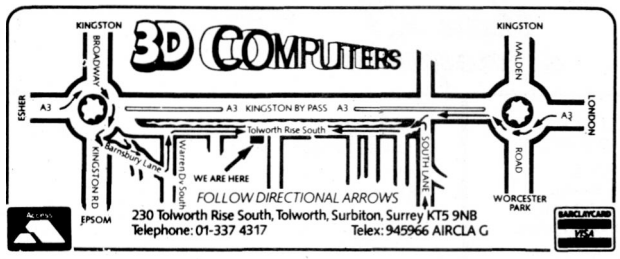

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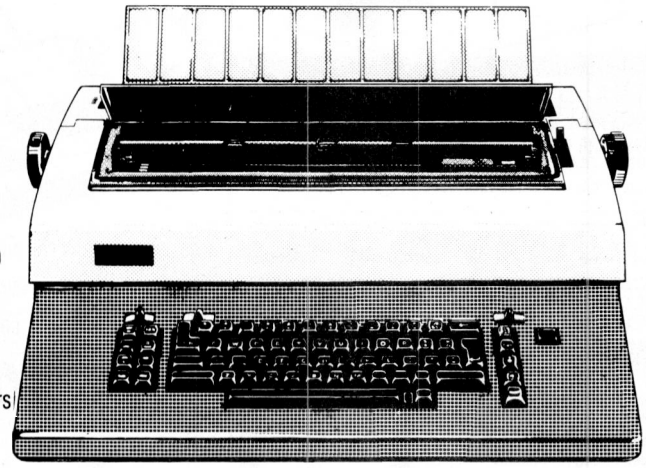

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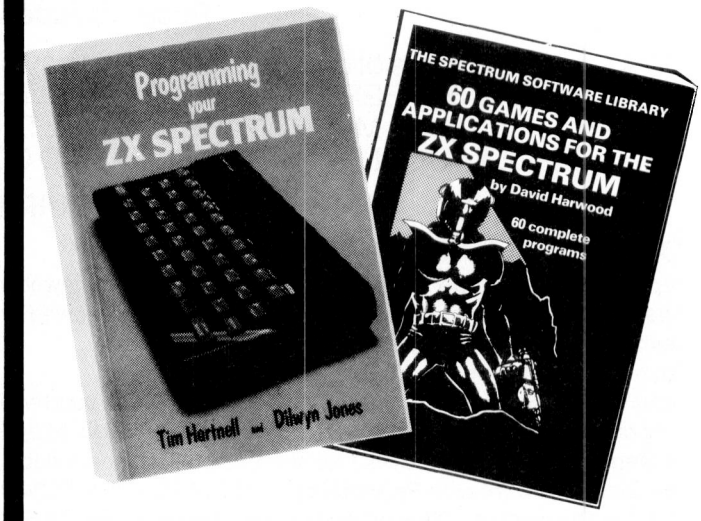

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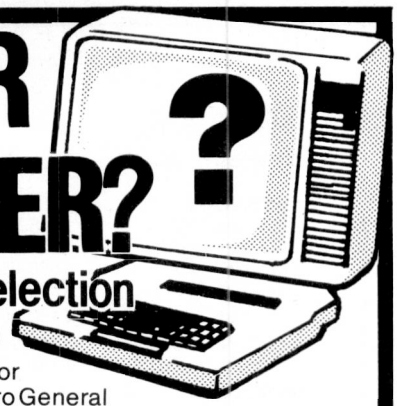

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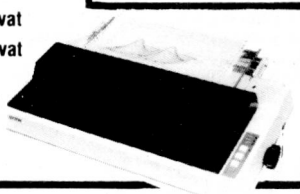

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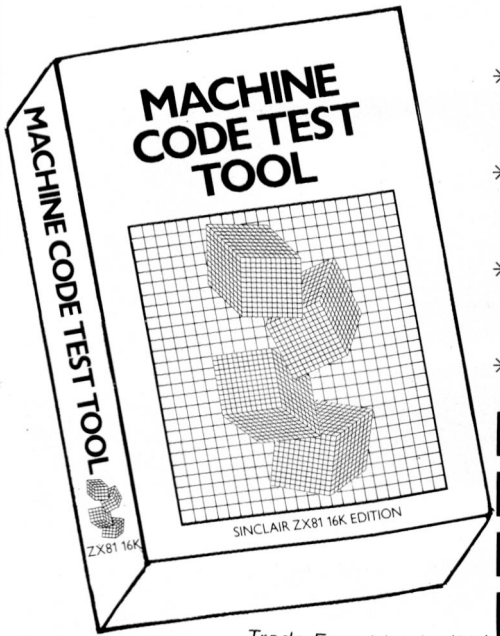

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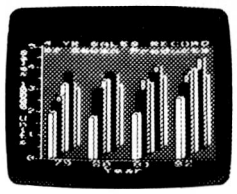

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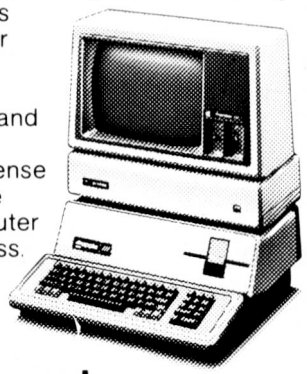

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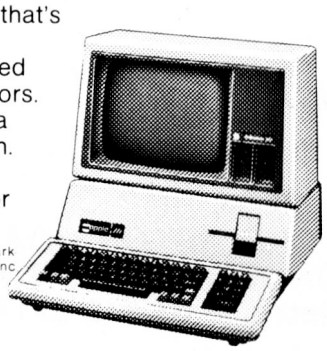

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June Issue: Mazetrap, Mini Text Editor, Polygon; plus articles on upgrading, The User Port, TV set and Monitor review, Graphics part II, More Assembler Hints, Structuring in BBC Basic, plus BBC Bugs.

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September Issue: High/Low Card Game, and Hangman Programs. Articles on Logic on the Beeb, Debugging, Moving multicoloured characters, creating new colours, Operating system 1.1. Plus Postbag, Hints and Tips, and Procedure Library.

October Issue: Program Features: Alien Attack; Calendar Generator; Union Jack; Memory Display utility. Plus articles on Beebugging; Improving Key Detection; Acorn Press Release on O.S.H.2; and Issue II Basic; The Tube and Second Processor Options; or New Series for less experienced users; and Software Reviews.

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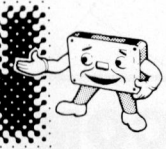

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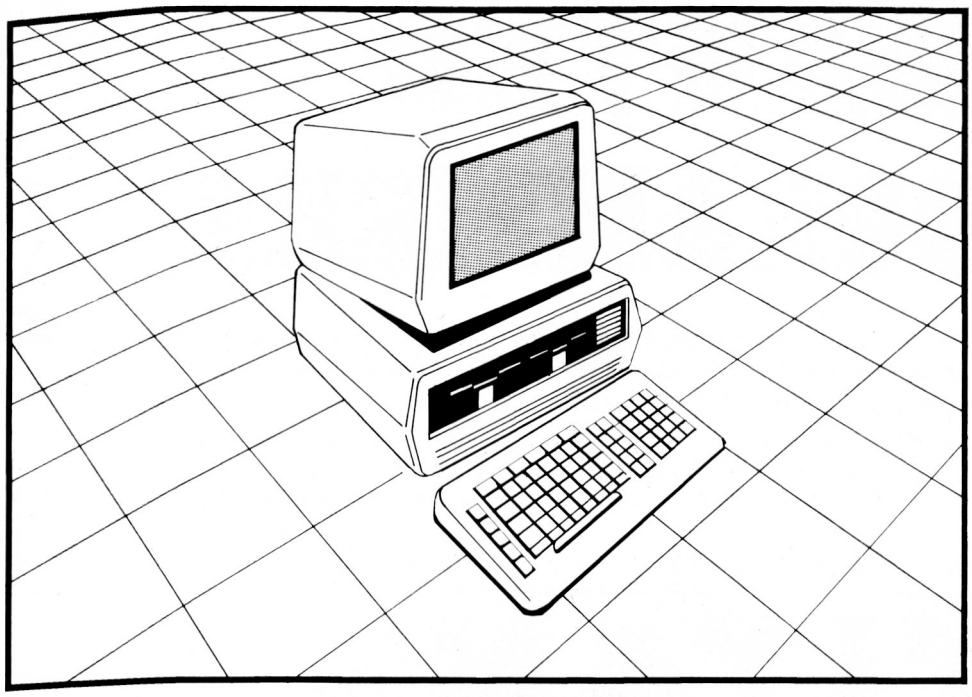

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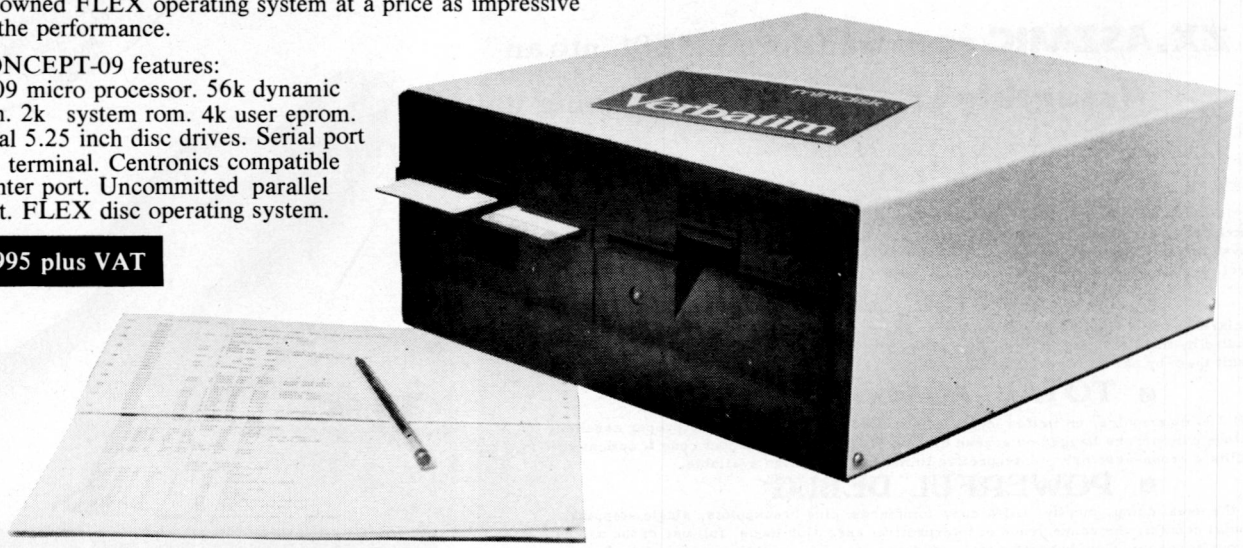

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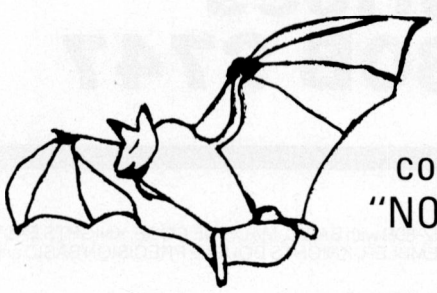

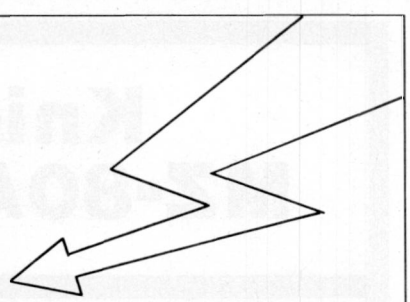

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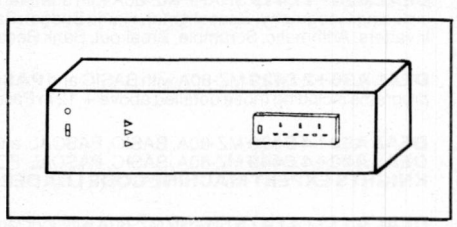

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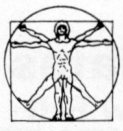

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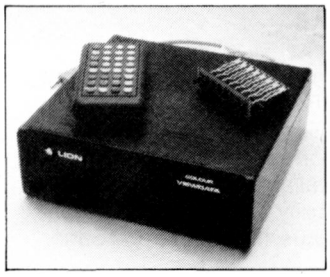

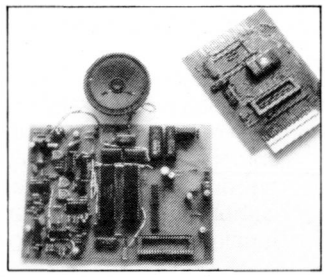

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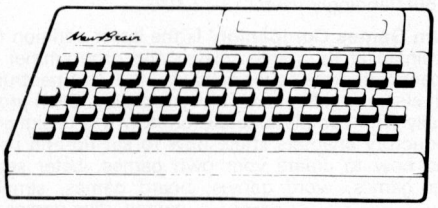

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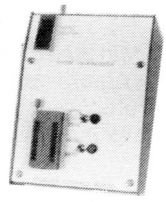

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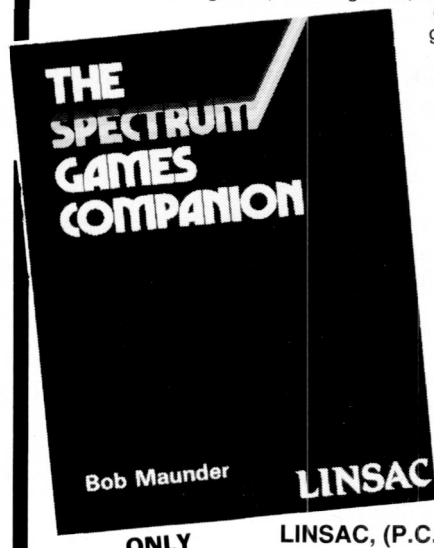

Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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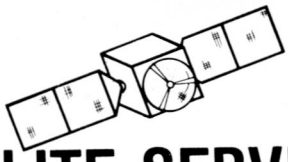

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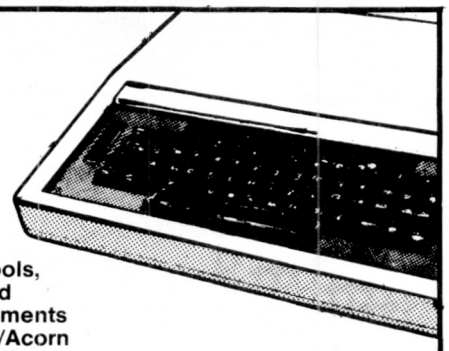

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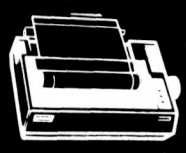

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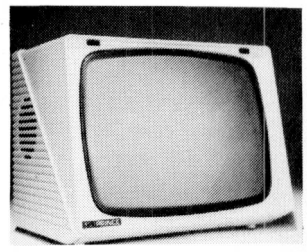

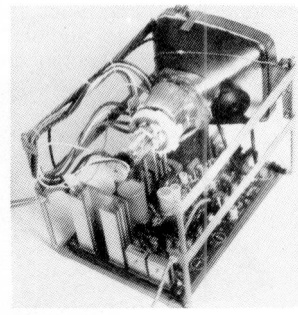

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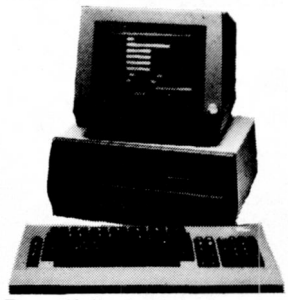

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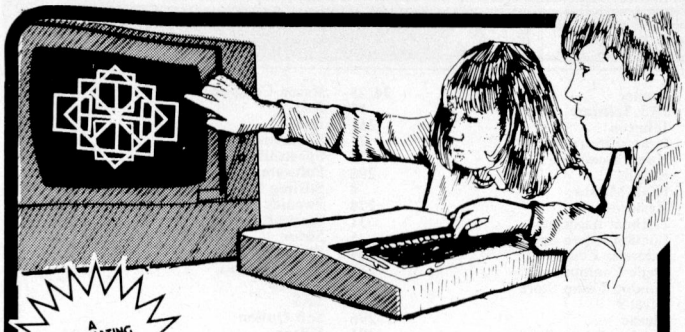

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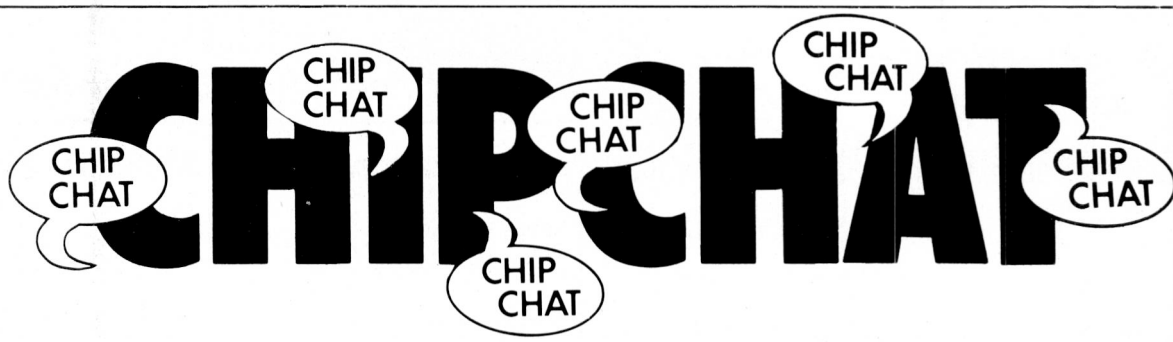
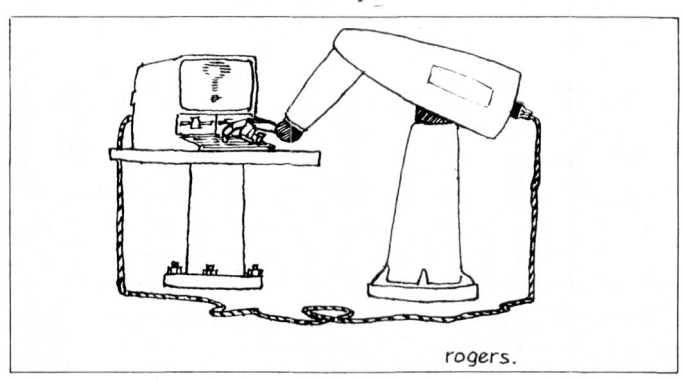


We hear that the erstwhile editor of a certain other micro magazine was running a talking database at Compec. This is great, fine etc, but the speech synthesis was related to spelling. Imagine, then, the confusion when, the poor overworked machine tried its best to say 'Cholmondeley'; and just think of the incredible verbal gymnastics had the machine been told to read 'Mr St John Beauchamp, 122 Beaulieu Avenue, Gloucester' ... Our handsome Editor was spirited off to Madrid recently by Philips (the makers of that good-looker, the P2000) for the launch of the P3000. After having spent some time watching a show in which "chimpanzees were hurled around" (to quote another member of the party), and even more time on the traditional ceremony of the bottle (getting drunk to you) everyone who went was presented with an ashtray bearing their picture at the bottom of it. We plan to use this particular ornament as a spittoon if Rodders ever lets us see it... Rumours are circulating in the busy microcomputer world that CP/M is not a registered trademark in the UK. This leads us on to two points: a) how many other American companies have made this same mistake? and b) how long will it take for some shark to register CP/M in the UK and sell it for a ridiculous sum to Digital Research? ...

Peachtre Software is certainly 'blossoming', as its recent advertising says (see Dec *PCW*, page 33). Those who have read this ad will know that it's directed at hardware and software suppliers, encouraging them to enter into a Peachtree 'software partnership'. Perhaps the partnership here is actually the one that involved Peachtree's partnership manager and his assistant leaving but a fortnight before this column was written. They'll have to change the photo in that ad now...



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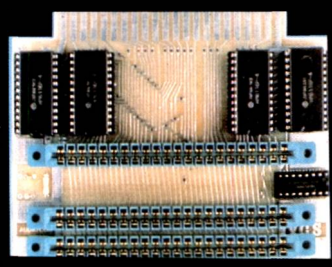

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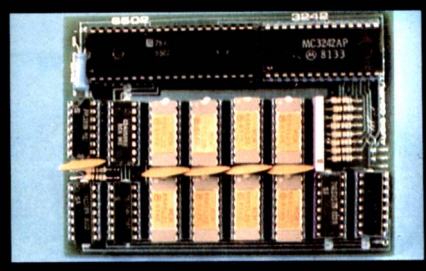

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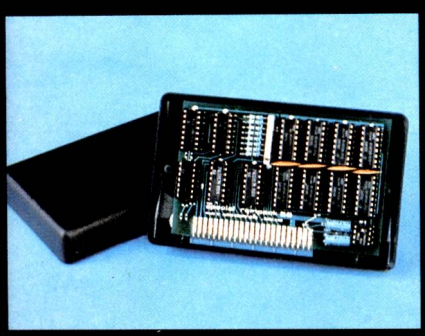

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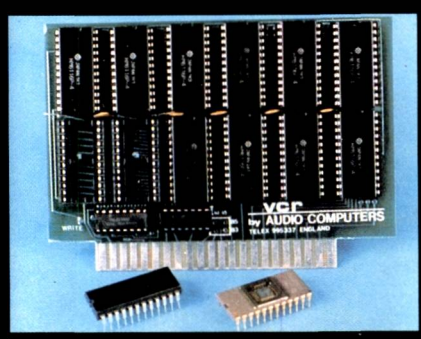

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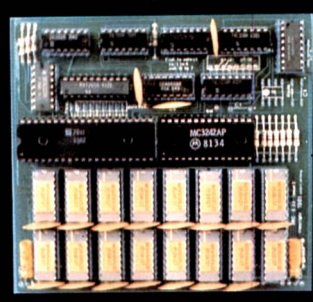

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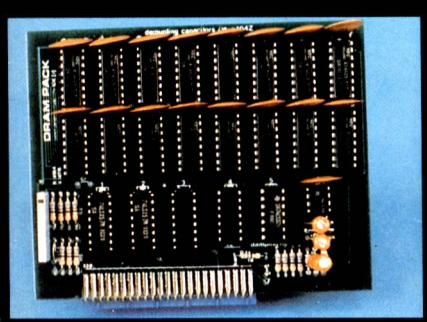

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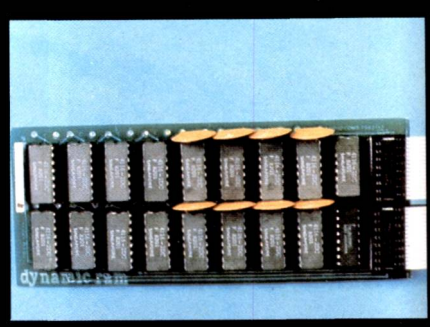

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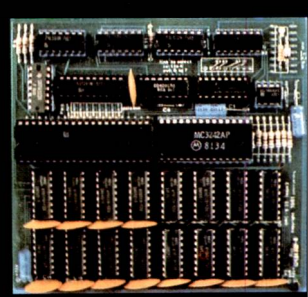

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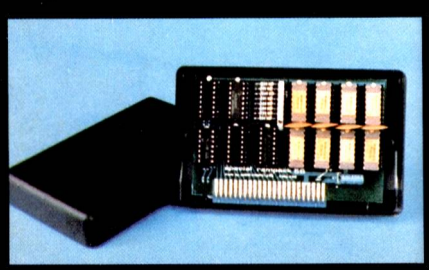

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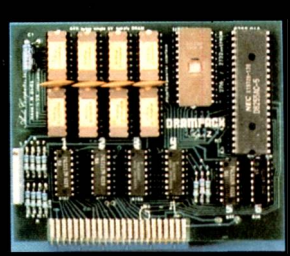

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