

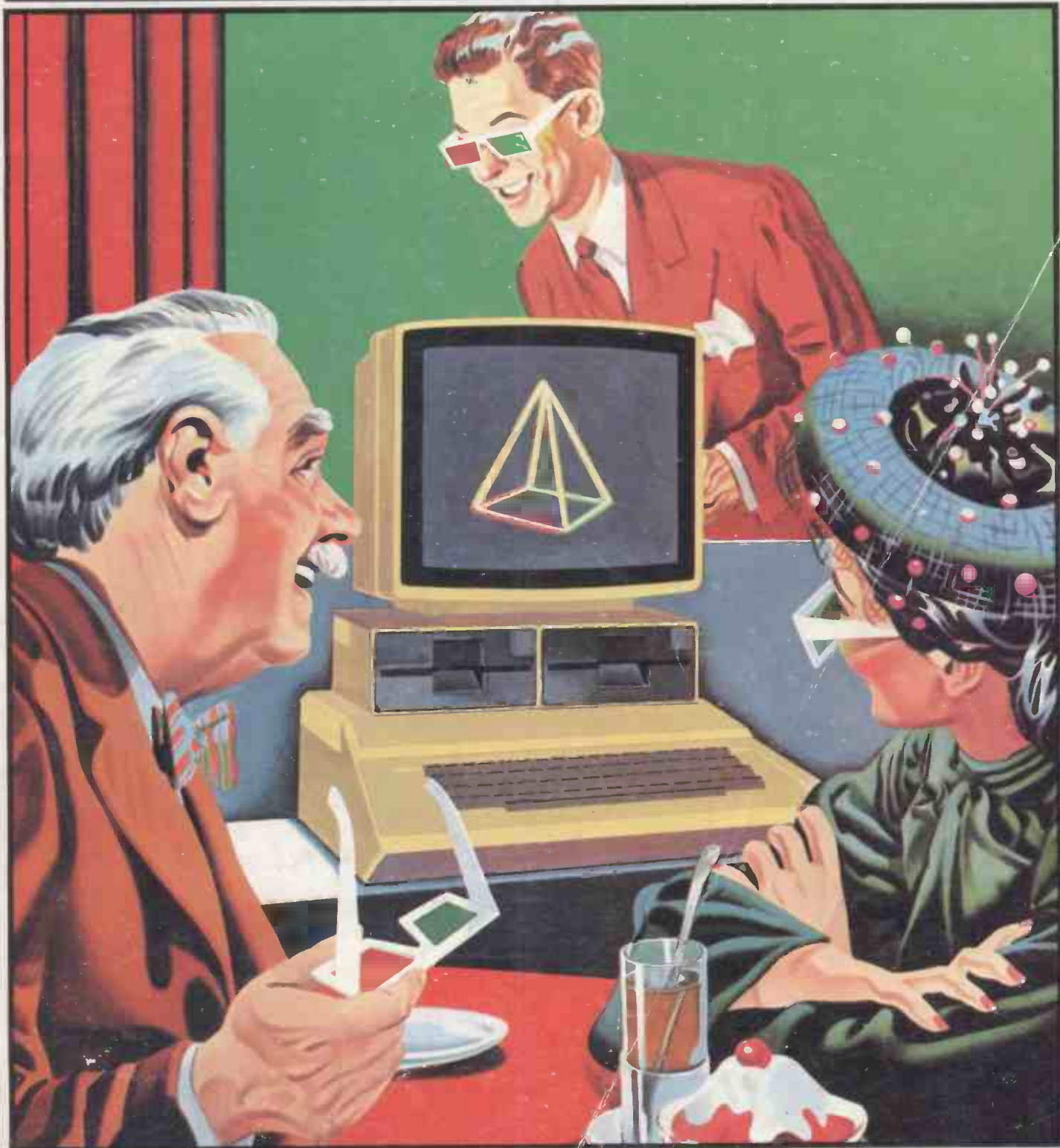
# Personal Computer

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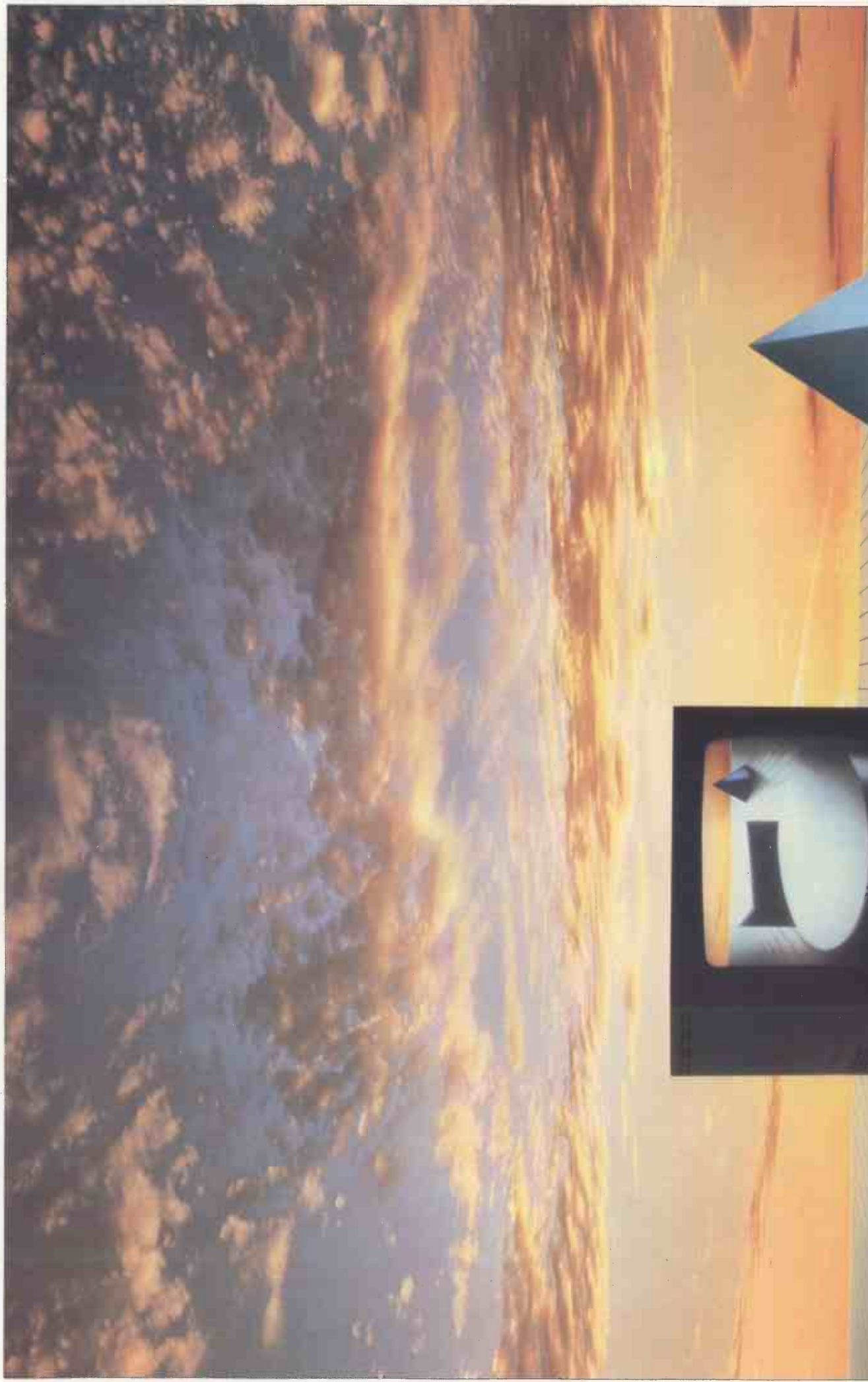
World October 1982 75p

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PCW OCTOBER 1982





The shape of things to come

# The BBC Microcomputer System

## What the BBC Microcomputer gives you



Amongst the shifting sands of computer technology the BBC Microcomputer is here to stay. "Everything possible seems to have been done to ensure that this is not a "dead-end" machine which you will have to throw away after a year or two when its basic technology is, inevitably, superseded," comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

Teachers on the Department of Education and Science 'Microelectronics Education Programme' are being trained in its use. The Department of Industry has recommended it for both primary and secondary schools so children all over the country will find themselves using the BBC Microcomputer.

It has been chosen as the personal computer for the BBC's own Computer Literacy Project, which includes two series of television programmes on the use and application of computers. It has also been used as the basis for many educational courses, including one offered by the National Extension College.

It all adds up to a massive vote of confidence in a microcomputer designed to grow with the needs of the user and with the advances in technology occurring month by month.

The BBC Microcomputer is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech using its own internal speaker. The keyboard has a conventional layout and electric typewriter 'feel'. There are two versions - Model A at £299 offers 16K of Random Access Memory (RAM) and Model B at £399 has 32K of RAM.

## The BBC Microcomputer System Plan

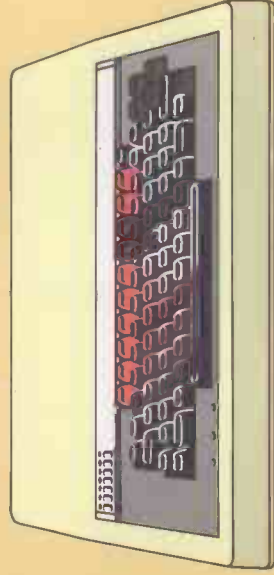
Available internally

16K language ROMs  
Pascal, FORTH, LISP

Word processing software ROM

Speech synthesis circuits

Business Planning ROM



Available externally requiring internal additions

## Software



The Machine Operating System, occupying 16Kbytes, has in-depth facilities for handling all normal requirements, for example keyboard and Visual Display Unit (VDU), which can be your own television, and in addition has many more advanced features such as network handling (linking several computers together), teletext operating system and speech, disc and cassette filing (very similar to the filing which takes place in an office).

The ROM paging system makes it possible to change instantly between high-level languages. A sophisticated version of BASIC has been chosen for the BBC Microcomputer, which incorporates features normally found only in other high-level languages, but you can have up to four different 16Kbyte interpreters inside the machine, allowing access through a simple command to another language - for example, Pascal, FORTH and LISP.

Applications software for the BBC Micro-computer is being developed alongside the hardware, to stringent specifications with wide support from totally independent software houses.

Already a number of packages covering games, educational and business applications are available on cassette.



Versions of many compulsive arcade type games exist; a simulation package called Flight Deck and one to help Rubik Cube addicts are around the corner.

On the educational side creative graphics, graphs and charts, algebraic manipulation and the Peeko-computer pack,

# Room for expansion

The most attractive and exciting feature of the BBC Microcomputer is its enormous potential for expansion. *Which Micro?* May/June 1982.

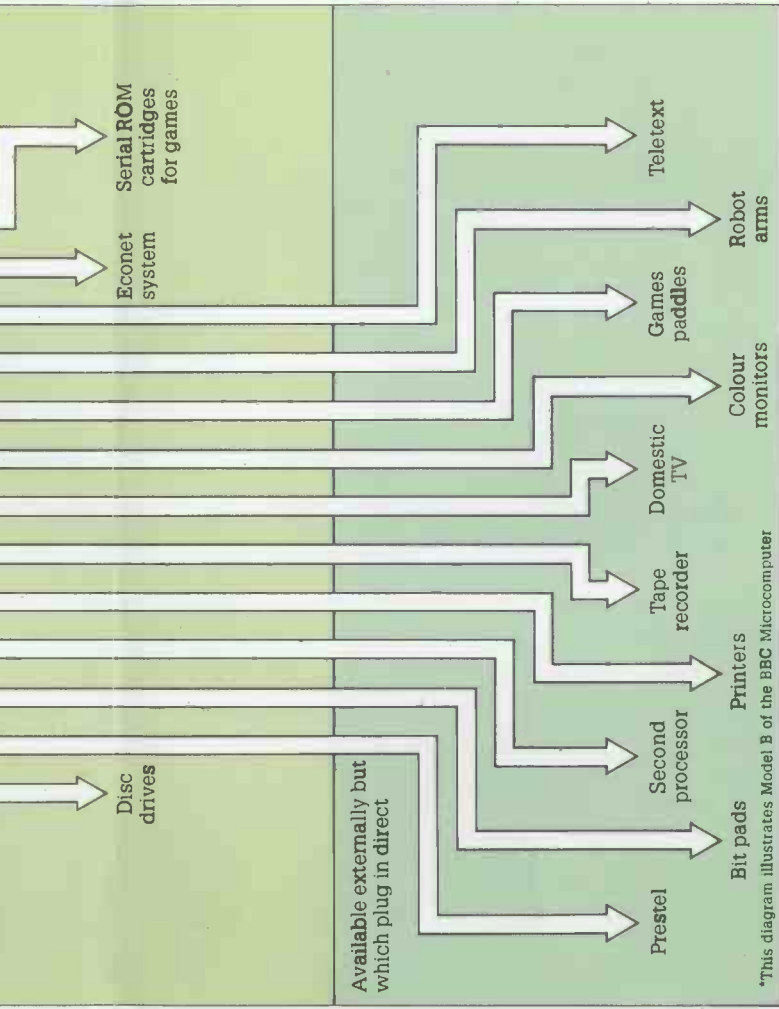
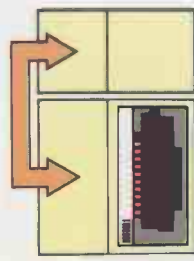
The diagram opposite shows the numerous options for expansion. Developments will undoubtedly bring more. Model B incorporates interface sockets (RS423, analog inputs, Centronics and User port) to allow you to connect directly to cassette recorder, your own television, video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.

A special interface socket can also be fitted to take plug-in Read Only Memory (ROM) cartridges containing games or specialist application programs. Model A can be adapted to include these facilities.

A feature of the BBC Micro-computer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances

the expandability of the system by providing, via a high speed data channel, for the addition of a second processor.

The addition of a second 3MHz 6502 processor with 64K of RAM doubles processing speed. A Z80 second processor with 64K of RAM opens the door to a fully CP/M compatible operating system, with all the benefits for business applications. A 16-bit processor with 128K of RAM is now being developed which will give the machine a processing power similar to present day minicomputers.



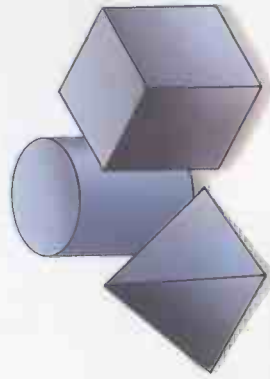
Another first for the BBC

Microcomputer is that it can take information direct from Prestel and Teletext services (telesoftware), using the necessary adaptors and store it for later use.

An expansion facility of immense use to schools, colleges and businesses is the Acorn Econet® - a simple to use yet highly sophisticated system, which by using ordinary 4 core telephone cable links together over 100 computers. A number

of machines can share the use of expensive disc drive and printer facilities.

'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.



The shape of things to come

which explains the workings of a micro-processor, are available. Other Computer Aided Learning packages are being developed.

For business uses there is a desk diary cassette and nominal ledger, payroll and stock control packages will be available shortly on disc.

ROM based software (fitted inside the machine) includes powerful word processing, business planning and Computer Aided Design packages.

A wide range of software is already on sale at dealers throughout the country and new packages are becoming available almost daily.

## Technical support and after-sales service



Your BBC Microcomputer comes complete with the backing of the BBC itself and one of the most extensive dealer and service networks available. Each approved dealer is able to offer advice and carry out expansion work and repairs. In addition Acorn Computers offers maintenance contracts and has a specialist service centre which undertakes warranty work.

The Government's Microelectronics Education Programme has set up 14 regional information centres in England, Wales and Northern Ireland. These provide technical and educational support for teachers. The Scottish Microelectronics Development Programme offers a similar service as do many local education authorities throughout the United Kingdom.

You can subscribe to a special monthly magazine, *Acorn User*, which carries regular news and features to help you make the best possible use of your machine.

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## **Cromemco System One**

MicroCentre introduce Cromemco's new System One computer, available with an integral 5 megabyte Winchester hard disk, at a new low price.

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# MICRO TRAINING FOR COMPUTER USERS

# 6Micro courses



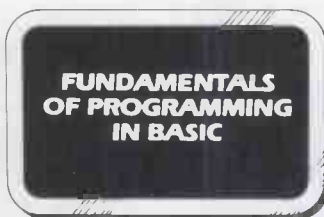
Which would you like to attend?

Digitus is running a number of courses to train users and potential users in the basic skills of micro-computing. Conducted at our Central London Workshop, the courses provide hands-on experience of microcomputers, demonstrations of working systems and tutorials on your particular needs.



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PCW/9/82

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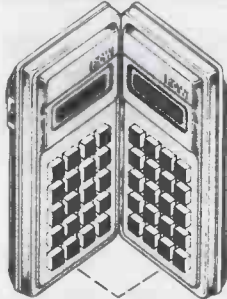


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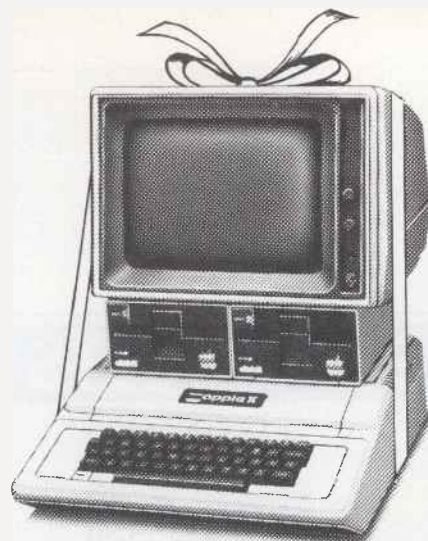
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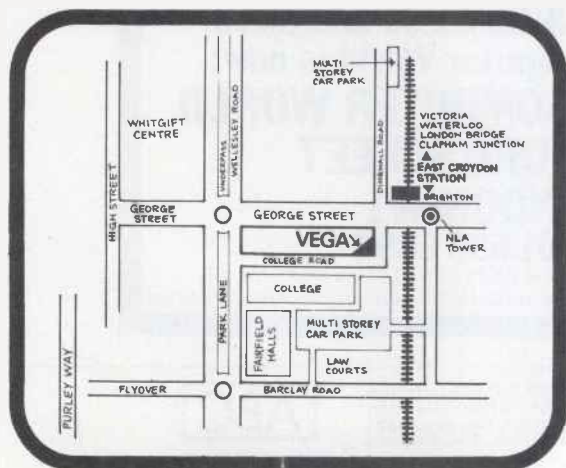
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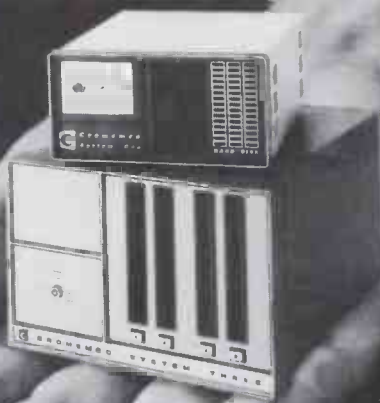
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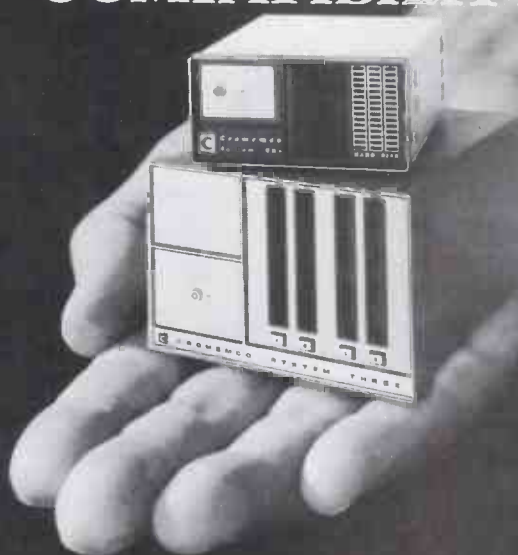
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Its use of the MC68000 processor adds new found freedoms to microcomputer systems development. To start with it is fast. Benchmark tests showed it four times as fast as the Z80A, and twice as fast as the PDP11\*. It offers superb software performance without having to resort to expensive memory management techniques. The 1000 plus instruction set offers the widest options for producing compact efficient code. Its 32 Bit Architecture offers full 16MByte direct memory addressing. It all adds up to the promise of larger, more efficient software programs, executed in a highly controlled and managed environment.

But it takes Cromemco to put promise on the path to reality. So to support MC68000 processing power there is a new concept in memory cards, full S100 and IEEE 696 compatibility, and a new software library based on 16 Bit Code to optimise the new found processing power.

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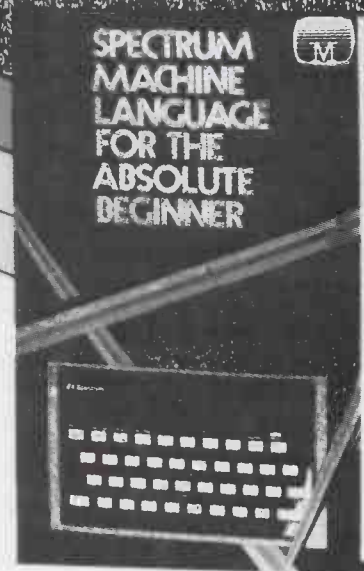
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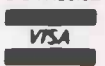
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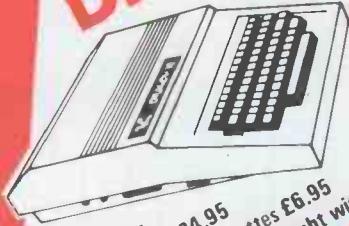
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**See next page**

# SPECTRUM

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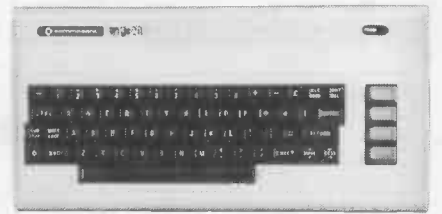


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- Add Disk Drive & Printer for impressive 170K Byte system
- Can act as an intelligent terminal for a larger computer.

**Spectrum SENSATIONAL price only**

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Price Inc. of VAT £169.63

| VICC2N                                | Exc. VAT | Inc. VAT | GAMES   | Exc. VAT | Inc. VAT |
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12 PCW

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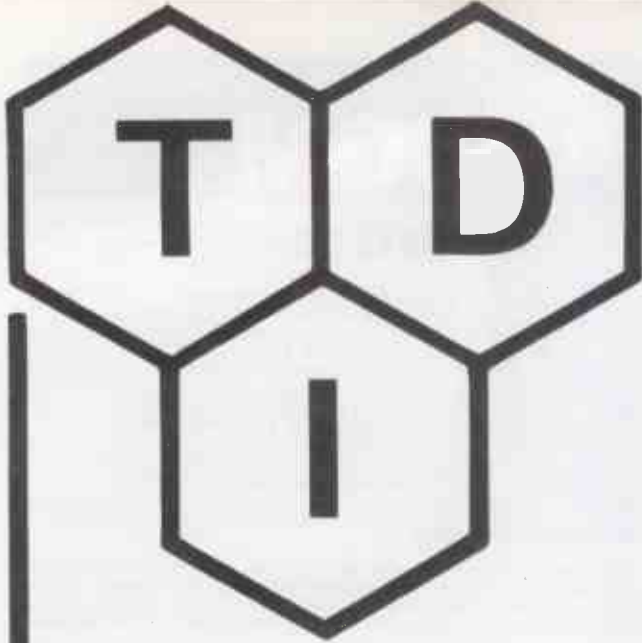
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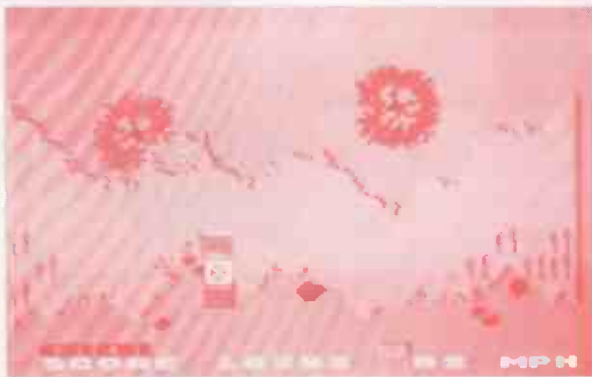
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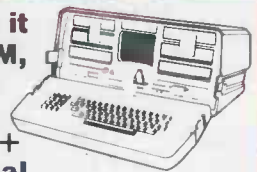
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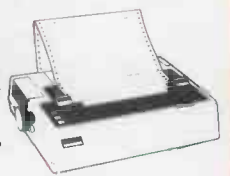
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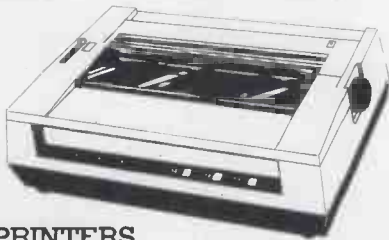
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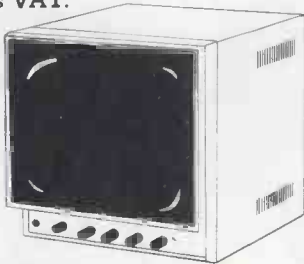
## Genie I and II accessories



### PRINTERS

The EG 3085 is quiet, fast and efficient. Printspeed is 100 characters per second and printing is bi-directional at 80 or 136 characters per line. Suitable for use with other systems, it has three tpestyles, adjustable pin or friction feed and single sheet or roll paper facilities. **£425 plus VAT.**

If you don't want to pay that much for a printer, consider the EG 603. It doesn't match the EG 3085 in certain areas, but you will still get 100 c.p.s. bi-directional, a range of character styles, forward and reverse feed and pin/friction feed, with 96 characters and 64 graphic patterns. **£235 plus VAT.**



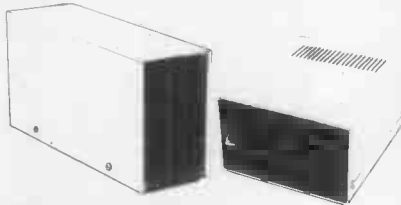
### MONITORS

Available in 9" and 12" sizes, with white, green or amber display, Lowe A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. **From £75 plus VAT.**

### EQUIPMENT COVERS

Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black leather covers.

Genie CV1 **£5 plus VAT.**  
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### DISK DRIVES

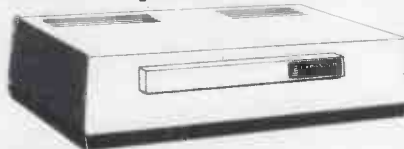
If you want fast, reliable program storage, true random access file handling and access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested, in a stylish colour matched cabinet. **£220 plus VAT.**

The EG 401 AT offers dual disk drive with 368640 bytes of useable storage and comes complete with a power supply ready to connect to an expander box. **£365 plus VAT.**

### DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double the storage capacity. The EG 3021 is equally at home in the Genie or TRS-80 expander boxes.

A double density disk operating system will be needed, such as smallDOS provides. **£72 plus VAT.**



### EXPANDER BOX

The updated EG 3014 expander box allows for up to four disk drives with optional double density. It connects to a printer, or RS 232 interface, or S100 cards. Not bad value at **£190 plus VAT (16K version) or £200 plus VAT (32K version)**

\*The EG 3014 will work with TRS 80 by using the EG 3023 Tandy Adaptor.

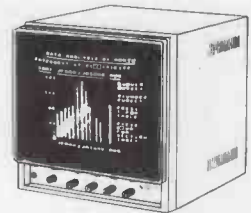
### TECHNICAL MANUALS

Full technical details of Genie Hardware (all you ever wanted to know about Genie).

Genie I/II Technical Manual  
**£10 - No VAT.**  
Expander and accessories (EG3014)  
**£10 - No VAT.**

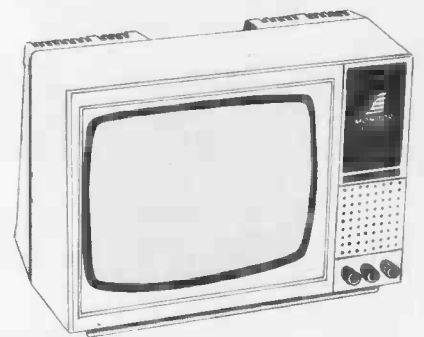
### smallDOS

Powerful, yet reasonably priced, the Genie smallDOS contains 21 library commands, 7 utilities, LBasic, disk basic and bags of information, including a reference manual and 40 page beginners guide to disk usage. **£35 plus VAT.**



### HIGH RESOLUTION GRAPHICS

Increase graphic resolution capabilities on your Genie seventy-three fold with the LE18 HI-RES unit. It offers bit image graphics of 73,728 points, a resolution of 384 x 192, and uses a separate 16K of video memory to achieve its resolution. Graphics are intermixable with text or existing pixtel graphics, and animation, reverse video displays and use of programmable graphic characters are possible. **£86 plus VAT.**



### GENIE MONITORS

Two good performance, low priced 12" monitors, either to match your Genie or compatible with a wide range of other systems. Good resolution and band width and, of course, they free your television set for the other type of programmes you like to watch!

The EG 100 12" in black & white costs **£69 plus VAT.**  
The EG 101 12" with green phosphor is **£79 plus VAT.**

## BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL. Each package is a very reasonable £175 plus VAT. Full details are available on request.



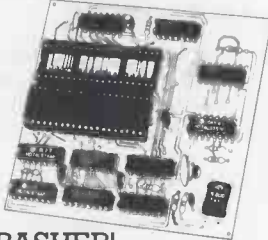
## SYSTEMS DESK

Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD-1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. £81.40 plus VAT.

## FRED MUSIC SYNTHESISER

Beethoven might well roll over at this stereo music synthesiser. It can produce six simultaneous notes over the whole audio range and provide sound effects. FRED comes complete with a software compiler, full instructions and a demo tune.

It is simply plugged onto the Genie 50 way bus and has two outputs for an audio amplifier. £51 plus VAT.



## EG 3203 TANDY-BASHER!

If you are a TANDY user, read on! The EG 3203 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. £18.40 plus VAT.

(Just in case there might be a few strange souls who want to convert in the opposite direction, there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie.) £34 plus VAT.

## EG 3016 PARALLEL PRINTER INTERFACE

The EG 3016 is a simpler interface allowing a Centronics parallel compatible printer (EG 603, EG 3085) to be connected directly to the Genie keyboard without the need for an expander box. £38 plus VAT.



## BUS EXTENDER

A most useful accessory, allows two bus using devices to be connected simultaneously to the Genie - when using the Hi Res and expander for instance. £21 plus VAT.

## EP1, EP2, EP3

Genie I and Genie II have ROMS offering 13.5K Microsoft BASIC, of which the final 1.5K BASIC are custom written extensions contained in EPROMs.

You can change these as follows:

### EP1

Adds all Genie I software facilities to other Genies, lower case driver, machine language monitor, renumber facility, keyboard repeat and screen print.

### EP2

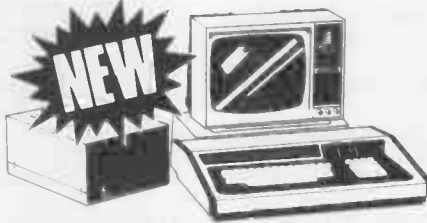
Has improved M.L. monitor, can load and save programs. Defined function keys (list, load, save etc.) for Genie II and lower case driver.

### EP3

Has HI-RES driver software with 10 extra HI-RES commands which prevent need to load HI-RES software from tape.

All at £12 plus VAT.

For Video Genie Systems, the LE-19 connects direct to the Genie bus and allows one of these EPROMs to be fitted externally. £26.50 plus VAT.



## NEW! A 64K CP/M computer for less than £1,000!

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The dual disk version will cost £1,175 plus VAT.

Both are compatible with existing Genie I software and are supplied with the Genie SmallDOS. A breakthrough for Lowe Electronics customers that should not be missed.

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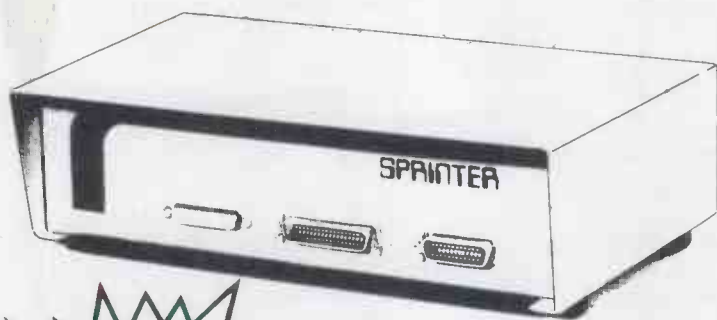
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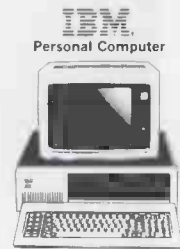
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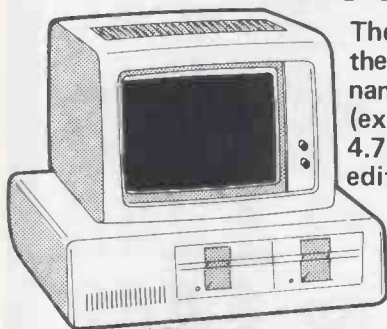
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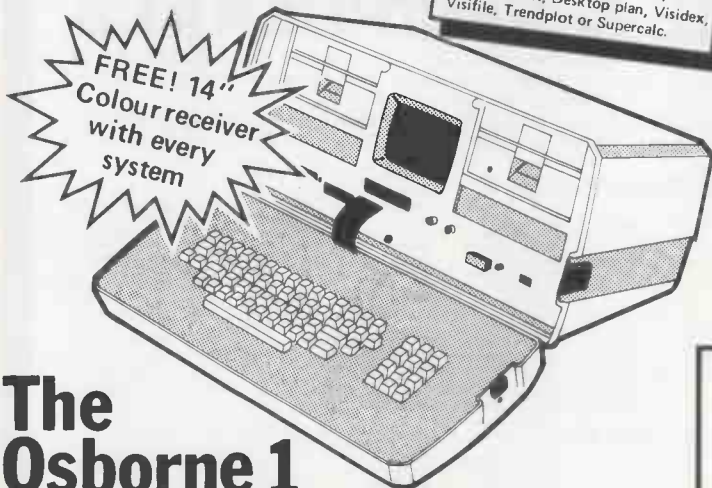
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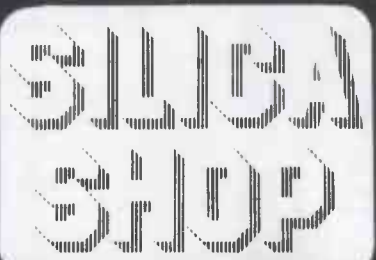
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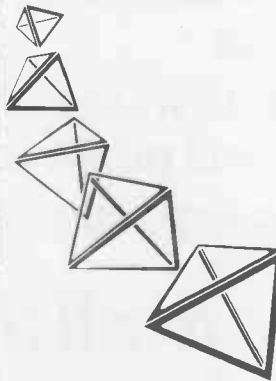
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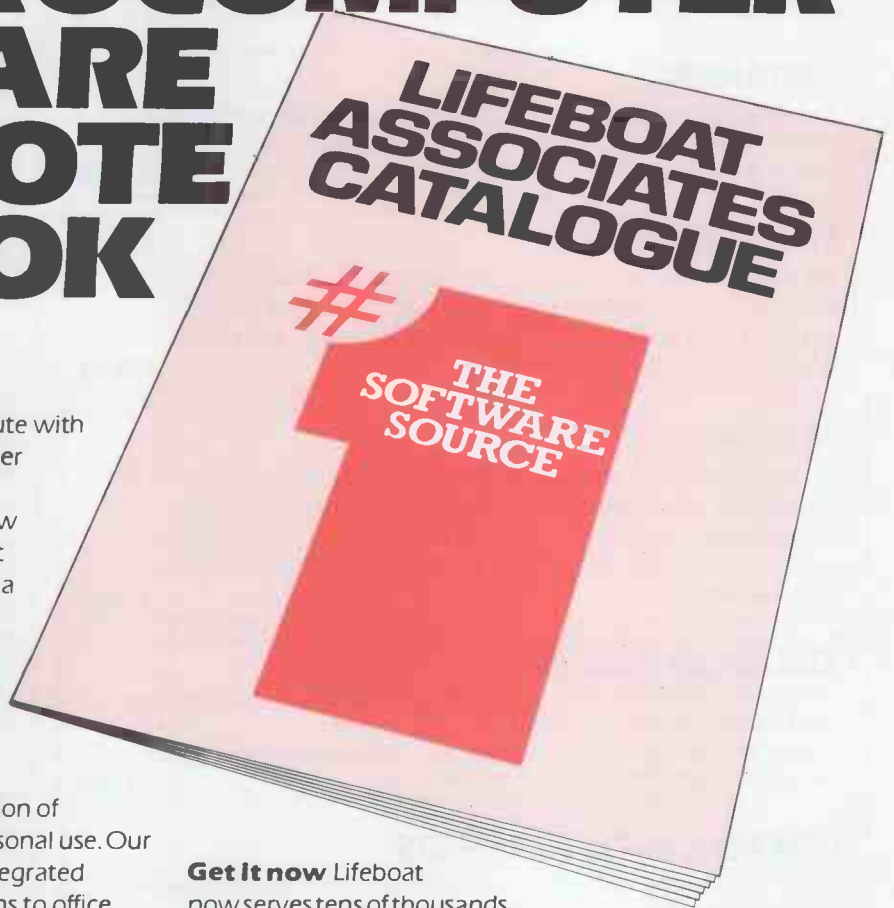
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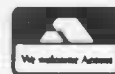
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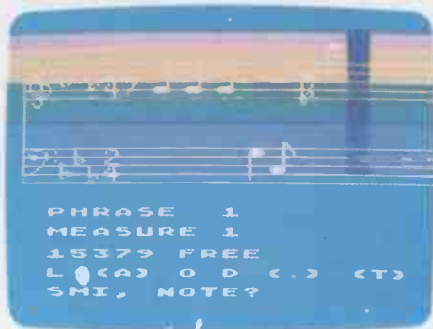
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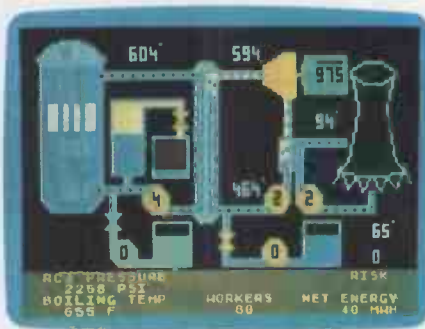
Please state machine type and memory size when ordering software.



Access Welcome



Music Composer



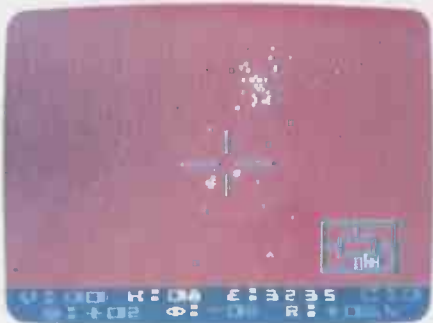
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Graph-it



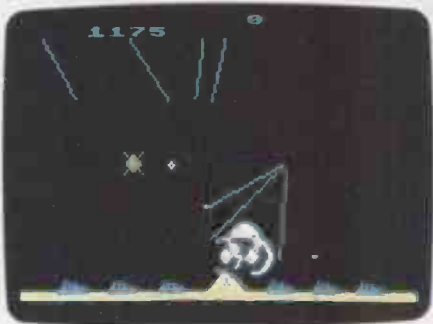
Intro to BASIC 1



Star Raiders



European Countries



Missile Command



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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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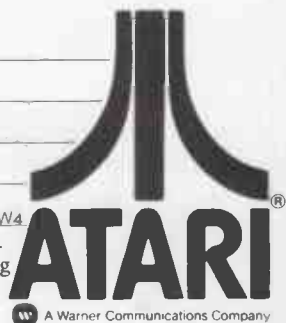


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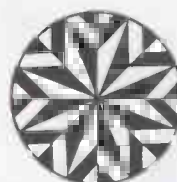
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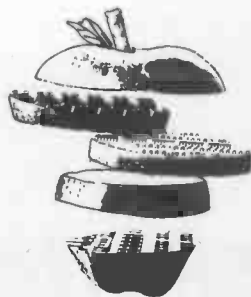
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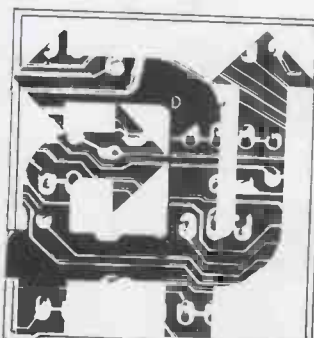
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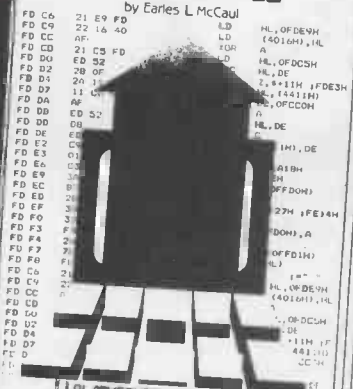
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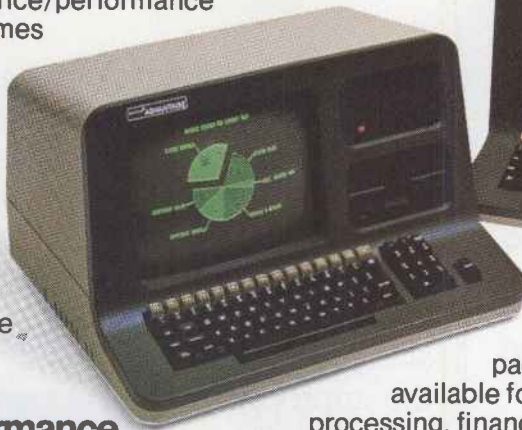
## The best value in microcomputing.

The North Star ADVANTAGE is the perfect low cost micro-computer for business or personal use. With 720Kb of floppy disk storage, or an optional 5Mb Winchester disk, the North Star ADVANTAGE offers the most memory in its price/performance class. And it comes with advanced business graphics software at no extra cost. You can look everywhere, but you won't find a better micro-computer for the money.

## High performance computing and high performance software.

The North Star ADVANTAGE system offers high speed computing based on the Zilog Z80A<sup>®</sup> microprocessor, the most accepted 8-bit microprocessor in the world, plus an Intel 8035 auxiliary processor. 64Kb of RAM main memory delivers fast program execution, with an additional 20Kb of RAM for the graphic display. North Star provides graphics software com-

patible with CP/M<sup>®</sup> and HDOS operating systems and application packages, and most standard languages. There are thousands of CP/M compatible software programs available throughout the world. Or you can choose any of the North Star application



packages available for word processing, financial analysis, accounting and data base management.

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The free North Star ADVANTAGE BUSIGRAPH<sup>™</sup> package makes it possible to generate line, bar, pie, and 3-dimensional charts, plus complex 3-dimensional forms. Reports can be transformed into impressive hard copy graphic displays in a matter of seconds.

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One North Star ADVANTAGE computer can be linked to other North Star ADVANTAGES by twisted pair cable using North Star's new network interface and software package. This allows you to have a low cost network of individual systems sharing the more expensive peripherals. This can be the first step toward fully automating an entire office or department.

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The North Star ADVANTAGE is a fully integrated micro-computer in an attractive, integrated enclosure. It provides high reliability and excellent operator comfort, plus straightforward servicing. For more information about the North Star ADVANTAGE, contact...

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# The new Dragon 32. So well designed, you'll even understand this ad.

If you're already a computer expert, may we refer you to the box of technical specifications displayed opposite.

If you're not, may we refer you to the new Dragon 32 Family Computer. A computer so easy to understand, you won't understand why all the others seem so difficult.

And the new Dragon 32 costs under £200.

## 32K RAM FOR UNDER £200?\*

When you're comparing computers, the first thing you need to know is the size of the memory. In plain English, the Dragon has approximately 32 thousand units of Random Access Memory. (32K RAM for those who prefer to be blinded by science.) This means that the Dragon's memory is at least twice as powerful as its competitors'.

With a memory this powerful, the amount of information the Dragon can store is literally vast. But the Dragon doesn't just make it easy to store information. It makes it easy to use, too.

## USER-FRIENDLY?

You may have heard of the term 'user-friendly.' Reverting to plain English once more, this means simply that the computer will go out of its way to understand you, rather than vice-versa.

The Dragon 32 is so user-friendly, it practically licks your hand.

You tap (literally) its vast resources through a beautifully-designed keyboard that's as easy to use as a typewriter.

On this keyboard, you type in a language which is surprisingly close to the English you talk every day. The Dragon 32 will receive your order. Understand it. Send it to the appropriate section of its massive brain. And then display the appropriate information on your screen. All before you can say 'gobbledygook.'



\*TV not included in price.

| SPECIFICATIONS  |
|---|
| 6809E MICROPROCESSOR. Pet, Apple, Atari 400, BBC Micro, and VIC 20 still have the less powerful 6502.   |
| 32K RAM (as standard). At least twice the power of similarly priced machines. Expandable to 64K RAM.  |
| EXTENDED MICROSOFT COLOUR BASIC (as standard).<br>Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using).<br>ADVANCED SOUND 5 octaves, 255 tones.<br>AUTOMATIC CASSETTE RECORDER CONTROL.<br>FULL EDITING with INSERT and DELETE. |
| 9 COLOUR, 5 RESOLUTION DISPLAY.   |
| USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor.  |
| PROFESSIONAL QUALITY KEYBOARD.<br>Typewriter feel. Guaranteed for 20 million depressions.   |
| PRINTER (Centronics parallel).  |
| JOYSTICK CONTROL PORTS.   |

### FIRE YOUR IMAGINATION.

Learning how to use the Dragon 32 won't cause you to experience any problems. Learning what you can use it for will cause you to experience something entirely different.

Delight. Surprise. Fascination. And challenge.

The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

As if by magic, a simple typed message will command the Dragon to create your own drawings. Then it will colour and paint them in 9 colours.

And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

### LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

| PRODUCT   | DRAGON 32 | SINGULAR SPECTRUM | ACORN ATOM | VIC 20 | TI 99/4A | BBC MICRO-V |
|---|-----------|-------------------|------------|--------|----------|-------------|
| FEATURE   |           |                   |            |        |          |             |
| PRICE   | £199      | £125              | £175       | £190   | £199     | £300        |
| STANDARD RAM SIZE                                   | 32K       | 16K               | 8K         | 5K     | 16K      | 16K         |
| STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS | 26K       | 9K                | N/A        | N/A    | 14K      | 3K          |
| EXTENDED MICROSOFT BASIC AS STANDARD                | YES       | NO                | NO         | NO     | NO       | NO          |
| PROFESSIONAL-TYPE KEYBOARD                          | YES       | NO                | YES        | YES    | YES      | YES         |

### BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

## **DRAGON 32** The first family computer.

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DATA SYSTEMS

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# The programme guide

Stock control, order processing, invoicing, statement production, payroll, general accounting... these are most of the jobs that a business will tackle every day. GRAFFCOM's Integrated Small-Business Software packages - ISBS are designed to get these jobs done better and faster. ISBS can improve your productivity and give you better management control over your business.

For the smaller business user with a twin floppy disk based system, ISBS-F is the ideal starting point. A truly integrated accounting approach, the system offers simplicity of use without trade-offs in facilities. In fact most of the ISBS-F features

can be found in mini and mainframe systems.

Companies with large data volumes and multiuser requirements should look at ISBS-W. The system supports multiple workstations and is designed to take full advantage of the latest hard disk storage based systems. As you would expect, ISBS-F users can easily convert to ISBS-W when the business expands through the System Migration Plan - SMP.

GRAFFCOM's software products have been designed for most CP/M, MP/M based microcomputer systems. All packages are supplied with comprehensive documentation and backed up with technical support, and maintenance to cover legislative changes. In

addition there are products such as accounting guides and graphics programs available to complement and complete our service to the commercial user.

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## ISBS-W

A totally integrated suite of software designed for microcomputers which use Hard disks or Winchester disks. The user can choose from any combination of modules and add others at a later stage if required.

### 1.0 Business Controller

The business control module acts as a task manager and supervisor for all users and mainfile updates. Operators will feel at ease with the menu prompting when selecting tasks such as order processing, invoicing, accounting modules and word processing. The controller is used to set the system parameters, typically the number of disk units and sizes, number of printers, passwords and authorization codes. You can develop your own application modules for those special jobs and have them incorporated in the business control menu.

### 2.0 Accounting

The system offers a comprehensive range of facilities to meet the most demanding accounting applications. The modules cover tasks such as sales and purchase ledger, payroll and nominal ledger. Management reports including the P/L and Balance sheet can be produced from the data captured by the system. Audit trails are produced for all transactions entered, with batch totals where applicable. In addition to the main accounting reports, pre-printed output includes statements, cheques and remittances, and also payslips and bank giro.

### 3.0 Stock & Order Processing

Stock levels can be checked quickly using the on-line enquiry module, and the operator can also allocate stock if required. Order processing allows orders to be entered and maintained until all items and quantities have been shipped. Invoices and order acknowledgements can be produced on line if required with automatic release of the stock and drawdown from the orders file. Pre-printed invoice stationery can be used and the layout can easily be modified using the built in formatter.



### 4.0 Word Processing

To complete the suite, the word processing module offers one of the most sophisticated systems found on today's microcomputers. It includes all the standard features that you would expect to find in a WP system, such as tabs, justification, margins, global search and replace, proportional spacing etc. In addition there is a merge document option to produce those personalised mailshots and labels, and also a built in spelling checker with a 10,000 word (expandable) dictionary.

## ISBS-F

ISBS-F is a comprehensive system designed for first time users of floppy disk systems. It can be fully integrated or each module can be used individually, adding others at a later date, which makes it an ideal choice for the first time user.

### 1.0 Stock Control

The programme allows fast interrogation of any stock line and produces 11 comprehensive reports to achieve optimum stockholding. Amongst the many features, including stock updates, release and goods inwards, the system has the option to define stock groups allowing for parts explosion.

### 2.0 Order Entry & Invoicing

Invoices can be produced quickly and easily, either by referring to an order already entered, or by entering data at the invoice stage. If necessary, part orders can be sent, as the system can keep track of each order until it is completed. Release of stock and posting of invoices to the Company Sales System is carried out automatically.

### 3.0 Company Sales System

Customers can be set up as open item or balance forward accounts, and statements can be produced easily at anytime. An online enquiry and comprehensive credit control reports allow you to monitor customer credit limits and help maintain a healthy cash flow. The system can handle part payments and unallocated cash, and produces a full audit trail of payments received.

### 4.0 Company Purchases System

Target payment dates can be assigned to each supplier invoice, to plan cash flow and to help speed payment procedure. There are reports to show ageing of invoices and the system also has the facility to print cheques on preprinted stationery or payment advices on Company letterheads.

### 5.0 General Accounting System

The main feature on this programme is the flexibility of the cost code system, which allows you to design final Company reports such as the Profit and Loss Account and Balance sheet. Comprehensive budget reports can be produced, showing any variances between budget and expenditure for your own chosen accounting period.

### 6.0 Payroll

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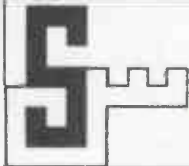
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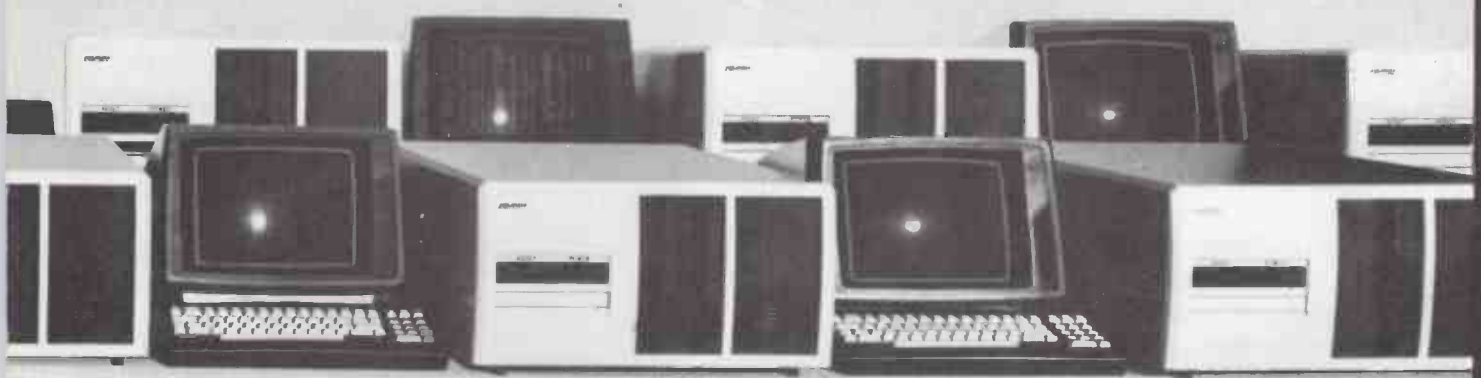
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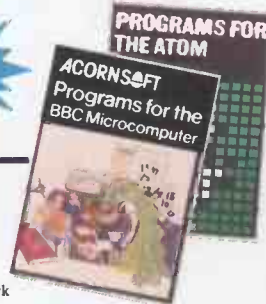
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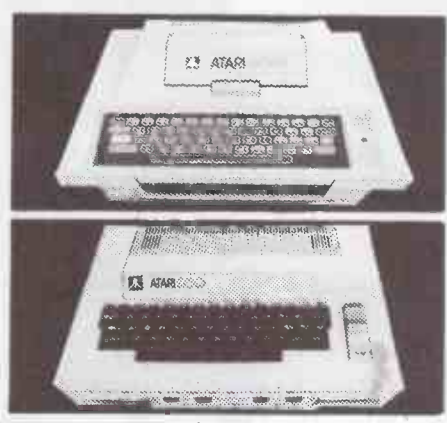


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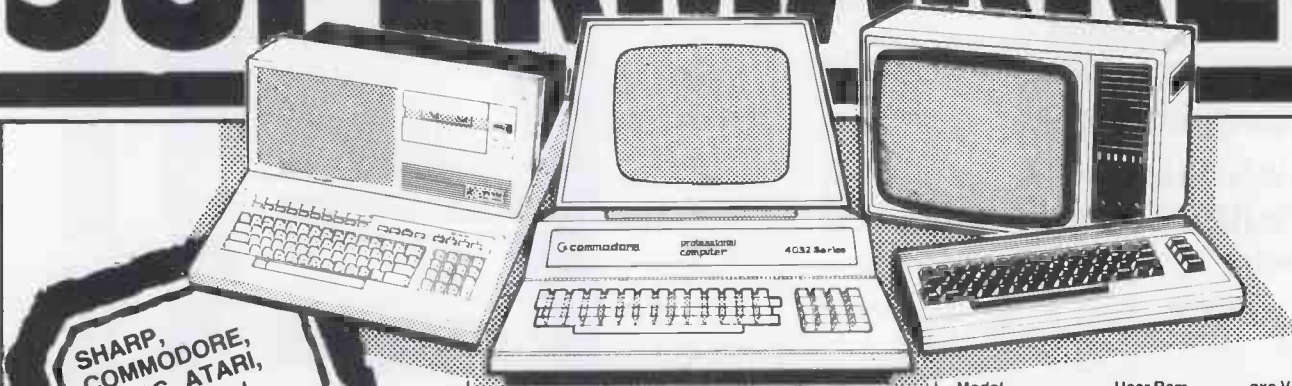


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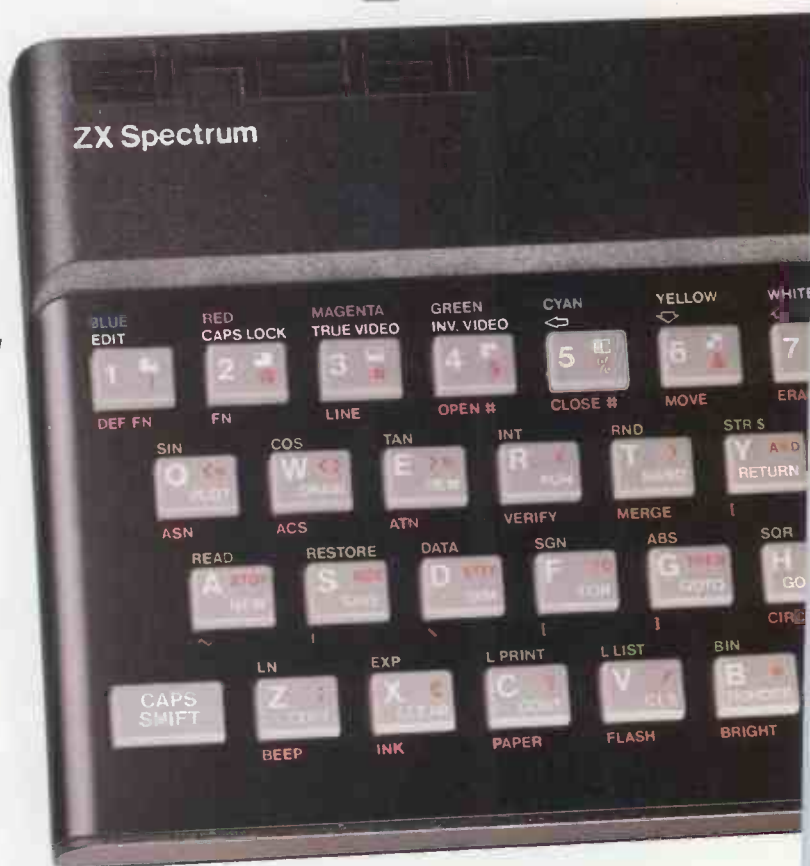
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| <b>DEPTH</b>        | <b>LINE</b>             | <b>OPEN #</b>                | <b>MOVE</b>                | <b>CLOSE #</b> | <b>ERASE</b>        | <b>POINT</b>         | <b>FORMAT</b>          |
| <b>SIN</b>          | <b>COS</b>              | <b>TAN</b>                   | <b>INT</b>                 | <b>RND</b>     | <b>STR\$</b>        | <b>CHR\$</b>         | <b>CODE</b>            |
| Q ←                 | W <>                    | E >=                         | R <                        | T >            | Y AND RETURN        | U OR                 | I AT INPUT             |
| <b>ASN</b>          | <b>ACS</b>              | <b>ATH</b>                   | <b>VERIFY</b>              | <b>MERGE</b>   | <b>SQR</b>          | <b>VAL</b>           | <b>LEN</b>             |
| <b>READ</b>         | <b>RESTORE</b>          | <b>DATA</b>                  | <b>SGN</b>                 | <b>ABS</b>     | <b>G THEN GOTO</b>  | <b>H ↑ GOSUB</b>     | <b>K + LIST</b>        |
| A STOP NEW          | S NOT SAVE              | D STEP DIM                   | F TO FOR                   | G              | G                   | J - LOAD             | L = LET                |
| <b>LN</b>           | <b>EXP</b>              | <b>LPRINT</b>                | <b>LLIST</b>               | <b>BIN</b>     | <b>CIRCLE VAL\$</b> | <b>SCREEN → ATTR</b> | <b>USR</b>             |
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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.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



## The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microflop.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



## RS232 / network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

# ZX Spectrum

Available only  
by mail order  
and only from

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Sinclair Research Ltd,  
Stanhope Road, Camberley,  
Surrey, GU15 3PS.  
Tel: Camberley (0276) 685311.

## How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard,

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|     | Sinclair ZX Spectrum – 16K RAM version | 100  | 125.00          |            |
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# ZX Spectrum software: how good and how soon?

The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

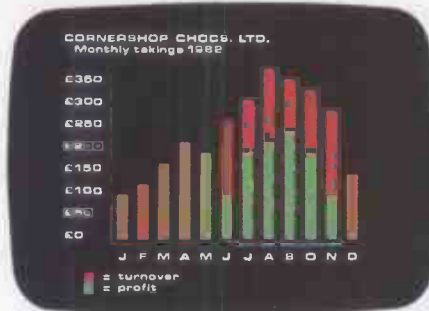
Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.



The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.



This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock-control and payroll) and general business management systems (eg matrix models).



This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough; advanced technology makes the ZX Spectrum a breakthrough in price and performance.

## Elegant, effective, unique—the ZX Spectrum design.

**'Less than half the price of its nearest competitor – and more powerful.'**

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant.

What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

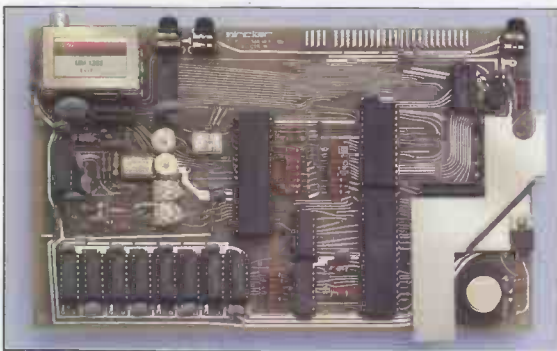
'It has data transfer rate 25% faster,

supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

'We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!'

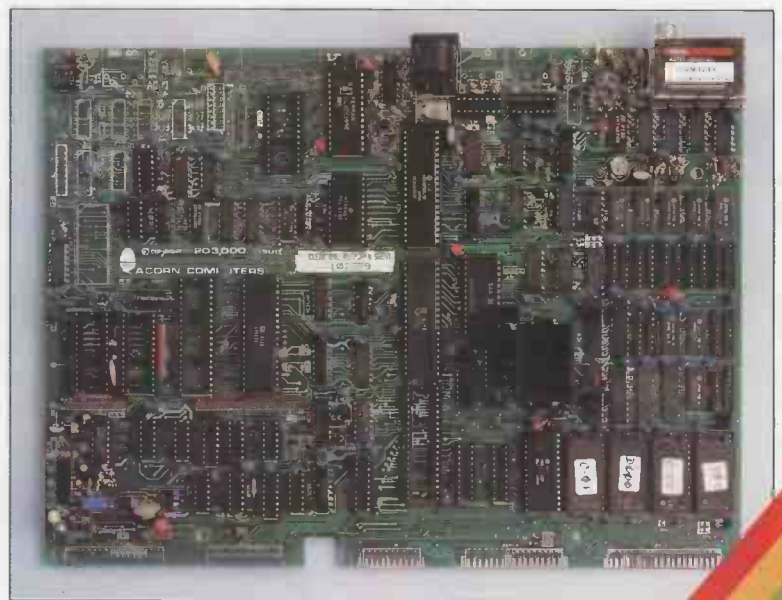
– Clive Sinclair.



Above left: internal layout of Sinclair ZX Spectrum.

Right: Internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.



# sinclair ZX Spectrum



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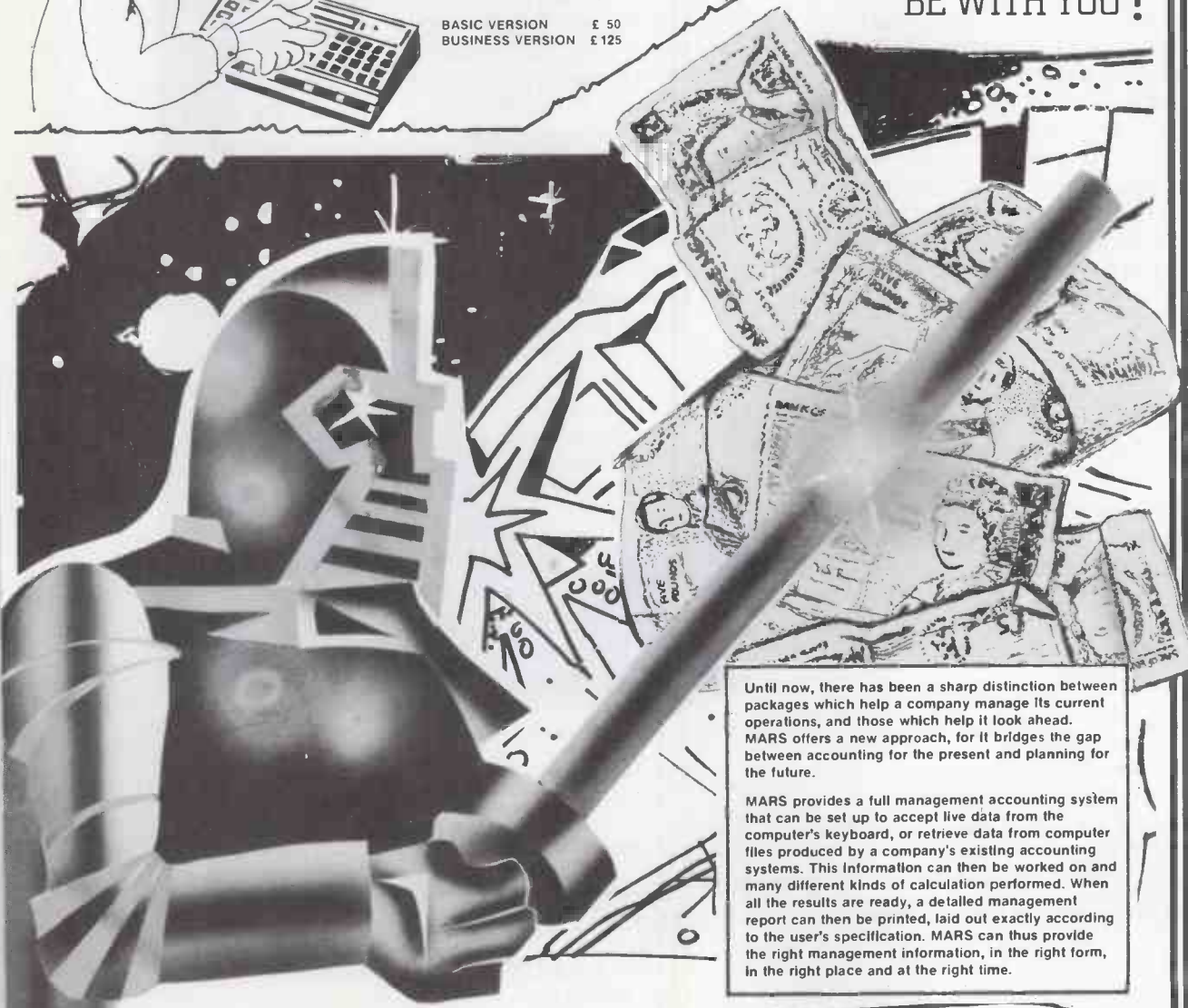
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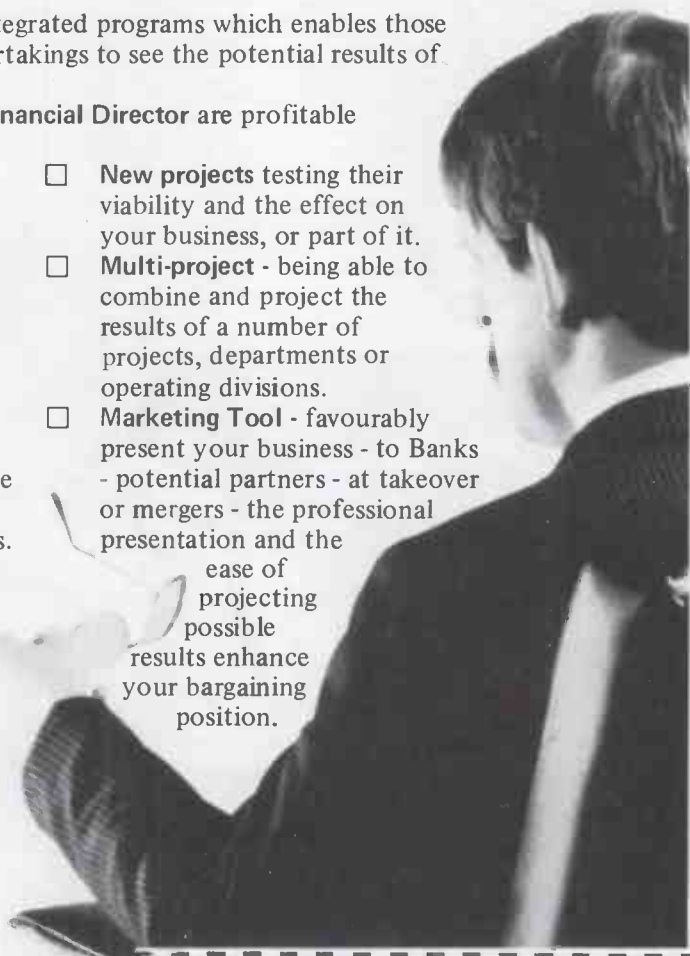
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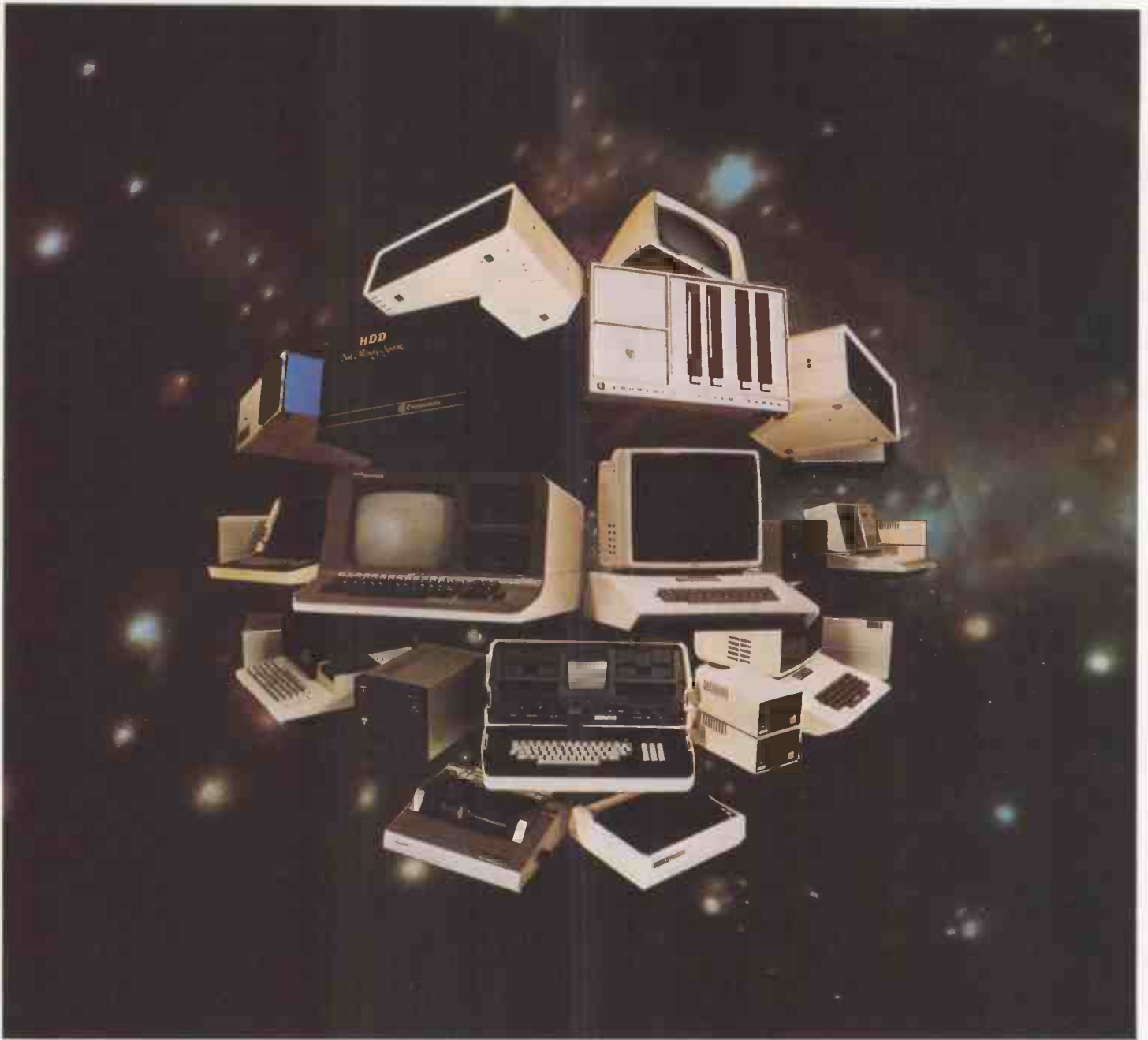
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**NO OTHER MICRO  
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So as a business machine it really comes into its own.

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.

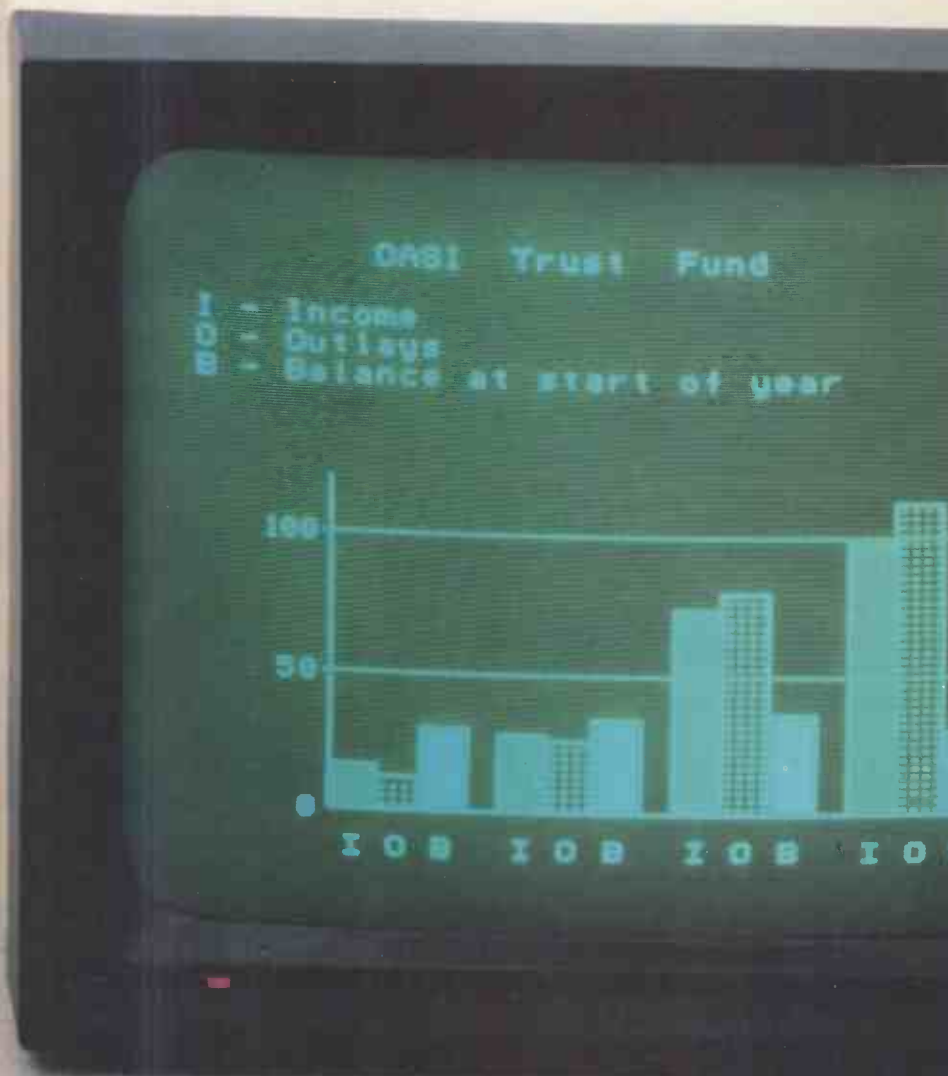
A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

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.



Dealer enquiries invited, please contact:-

NewBrain, Grundy Business Systems Ltd., Grundy House, Somerset Road, Teddington TW11 8TD.

Each NewBrain order will include a FREE comprehensive user manual, a catalogue of expansion modules and peripherals, and a detailed list of available software.

Please send me the following:-

| Quantity | Item   | Price per item<br>(Inc. VAT & p&p) | Total |
|----------|--|------------------------------------|-------|
|          | NewBrain A                                   | £233.00                            |       |
|          | NewBrain AD with onboard single line display | £267.50                            |       |
|          | Printer                                      | £466.00                            |       |
|          | Monitor 12"                                  | £142.50                            |       |
|          |  | Total £                            |       |

I enclose a cheque/Postal Order for £\_\_\_\_\_ payable to Grundy Business Systems Reader Account.  
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Please debit my Access Card No: \_\_\_\_\_ my Barclaycard No: \_\_\_\_\_

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

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# NEWBRAIN

**"If you can buy a business computer package of the same quality at a lower price, I'll buy it for you!"**

**Noel C. May, Managing Director  
Transtec Computers.**

**The Transtec Total Accounting Package costs just £2400 (ex. VAT) and includes . . .**

**The BC2 Computer**

- ★ 800K usable disk storage
- ★ 64K of memory
- ★ 80X25 hi-res. green screen
- ★ CPM 2.2 operating system as standard
- ★ Detachable keyboard with 17 function keys and numeric pad
- ★ In-built facility to expand capacity at any time.

**The Printer**

An Olivetti DM 5050C heavy duty 80 cols. 100 CPS dot matrix printer with capacity to handle single sheet or continuous sprocket fed paper.

**The Software**

Complete "Business Desk" set of programs by Paxton incorporating Invoicing, Stock, Sales, Purchase and Nominal Ledgers - a fully integrated accounting software package.

**Other financial modelling, word processing and data base packages available at low all-in costs.**

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Canton, Mass.

I'm interested, tell me more.

Name,

Address.

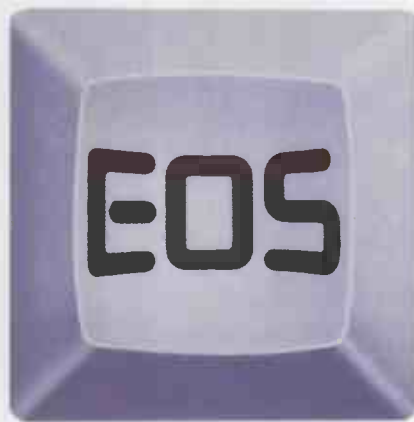
Company,



**SIMPLY BETTER COMPUTING**

Trade/USER Enquiry (delete as appropriate)





# INFORMATION TECHNOLOGY

# EOS on-line

"What ever is best, wherever it comes from, EOS will try to have it first for the UK." That's the philosophy of Russell Sparkes, Marketing Director of EOS - who turned theory into fact when EOS became the first Distributor to offer UK end users the IBM Personal in quantity.

"The business we are in moves at lightning speed. Every end user knows exactly what is available in various parts of the world... and he wants to get his hands on it today - not at some vague date in the future. My job is to make sure that end users in the UK are not left behind."

Two years ago, Russell Sparkes and his co-director Tony Maclaren moved from a routine office supply business into tomorrow's world of computers. As Dealers in the City of London, they saw how end-users were starved of the latest equipment. In February this year, they made their first buying visit to North America - and in June, signed a contract to bring enough IBM Personals into the UK to meet the immediate demand for this,

---

*"End users want tomorrow's technology in their offices today... EOS aims to get it there."*

---

the world's most up to date micro-computer available.

July 22nd saw the first EOS National Dealer Conference. It was held at The Barbican and attracted more than a hundred would be EOS Dealers and software suppliers.

Within two weeks, more than fifty Dealers nationwide had been accepted into the EOS Dealership Network.

"We look for Dealers with a proven track record and attitudes that show they thoroughly understand the needs of today's businessman. We provide our Dealers with tomorrow's equipment today. We select only the best

---

*"Excellent products... first class dealers... nationwide back-up... that's what EOS is all about."*

---

equipment - and only the most active Dealers."

Sparkes aims to expand his Dealership Network to approximately 100 within the next few months. "We must make sure that every end user in the country has at least an opportunity to test the IBM Personal or any of the other advanced systems we are carrying."



*Russell Sparkes, Marketing Director of EOS.*

In tandem with their Dealership strategy, EOS have chosen General Computer Systems to provide nationwide 24 hours a day servicing and maintenance cover. "In our opinion" says EOS Technical Director Tony Maclaren, GCS offer the best back-up facility available today. They are quick, reliable and up to the second with their knowledge of technology. Added to that, they understand the pressures of today's commerce... so they get the job done."

The EOS Portfolio of hard and software is impressive. Much of it - for example the EOS 7000 three-in-one printer and the newly contracted TIM 111 - is exclusive to EOS.

"All our equipment was on display at the PCW Show at the Barbican"

says Russell Sparkes, "but we wanted to give PCW readers who couldn't get along to the Barbican in early September an opportunity to see something of our product range. In the following pages we have illustrated some of the lines we are offering through our Dealership Network to end users throughout the length and breadth of the country. It is a carefully integrated package of personal computers, memory boards and software... an ever changing Portfolio. We are constantly striving to provide the best, the most reliable and the most up to date.

That's our Company policy. That's the way we intend to continue. Tomorrow's technology today - that's what EOS is really all about."

# Electrohome Colour Monitors



EOS has recently concluded negotiations with Electrohome Limited in Canada to supply their two models of colour monitors with RGB inputs specifically designed for use with personal computers. These are in fact data monitors and are ideal for using with either Apple III or the IBM Personal Computer. There are two models of monitor: the ECM 1302 provides resolution of 370 by 235

pixels and has a 13" screen. With a band width of 6 megahertz it can display 40 characters by 25 lines. The ECM 1302/2 displays 580 by 235 pixels, has a 13" screen and with a 10 megahertz band width can display 80 characters by 25 lines. These monitors provide a very sharp display with vivid colours and no screen distortion. Neatly styled, the new Electrohome colour monitor has an attractive

moulded cabinet and its buff colour ensures that it matches attractively with personal computers such as the IBM and the Apple III. Special leads are supplied to our customers to connect directly to the personal computer of your choice without the need to get involved with awkward wiring problems.

# The small business computer

By Tony Maclaren, Technical Director, EOS

IBM's entry into the personal computer field has been regarded by the industry as one of the most significant developments in the short history of micro computers. To witness the entry of the IBM into the micro computer market place is to witness history being made.

The IBM Personal Computers will have considerable business significance for a whole spectrum of existing and future users of small business computers. The IBM PC is a true 16 bit machine using an Intel 88 microprocessor, offering over twice the memory of traditional 8 bit machines.

I think today, as things are becoming increasingly more complicated in the world of small computers, a buyer will increasingly "buy a company" with all of its reputation, intent and practices. This tendency is part of the excitement about IBM's entry into the market. Buying an IBM in the past, at least for certain products, has been a good investment for many business people. The personal computer industry, like all growing industries, has suffered growing pains. It has come out of an historical hobbies market and one of its chief problems has been the tendency towards putting the low priority items to last, one of which has been documentation for the systems themselves. As the market is becoming more mature and shifting its emphasis towards the business sector, the demand for easy to read professional documentation is becoming increasingly more important.

## Attention to detail.

The fact that IBM's profit before taxes for 1980 was nearly 6 billion dollars - greater than the gross sales of many companies that are recognised as corporate giants - may be in a large measure the reason why IBM's system documentation and tremendous attention to detail is so good in everything connected with the IBM Personal Computer. To the business man the ability to be able to immediately put his new purchase to work for him is extremely important. Time wasted struggling through badly indexed photocopied manuals is simply unacceptable for the modern business professional.

One of the most unusual departures on the part of IBM has been that they have departed from their traditional posture of manufacturing their own components for computers themselves. In the case of the personal computer, IBM went to Tandon for the disk drives, Epson for the printer, Intel for the micro computer chip, Microsoft for the operating system, Information Unlimited Software for the word processing package and VisiCorp for the Visicalc package. This, I feel, to some extent shows how in-

creasingly important it is becoming for standardisation in such things as operating systems and fundamental small computer software packages such as Visicalc. Even the giant IBM has adopted the posture of standardisation which is going to be the key to the survival of all future companies in this highly competitive industry.

## Power

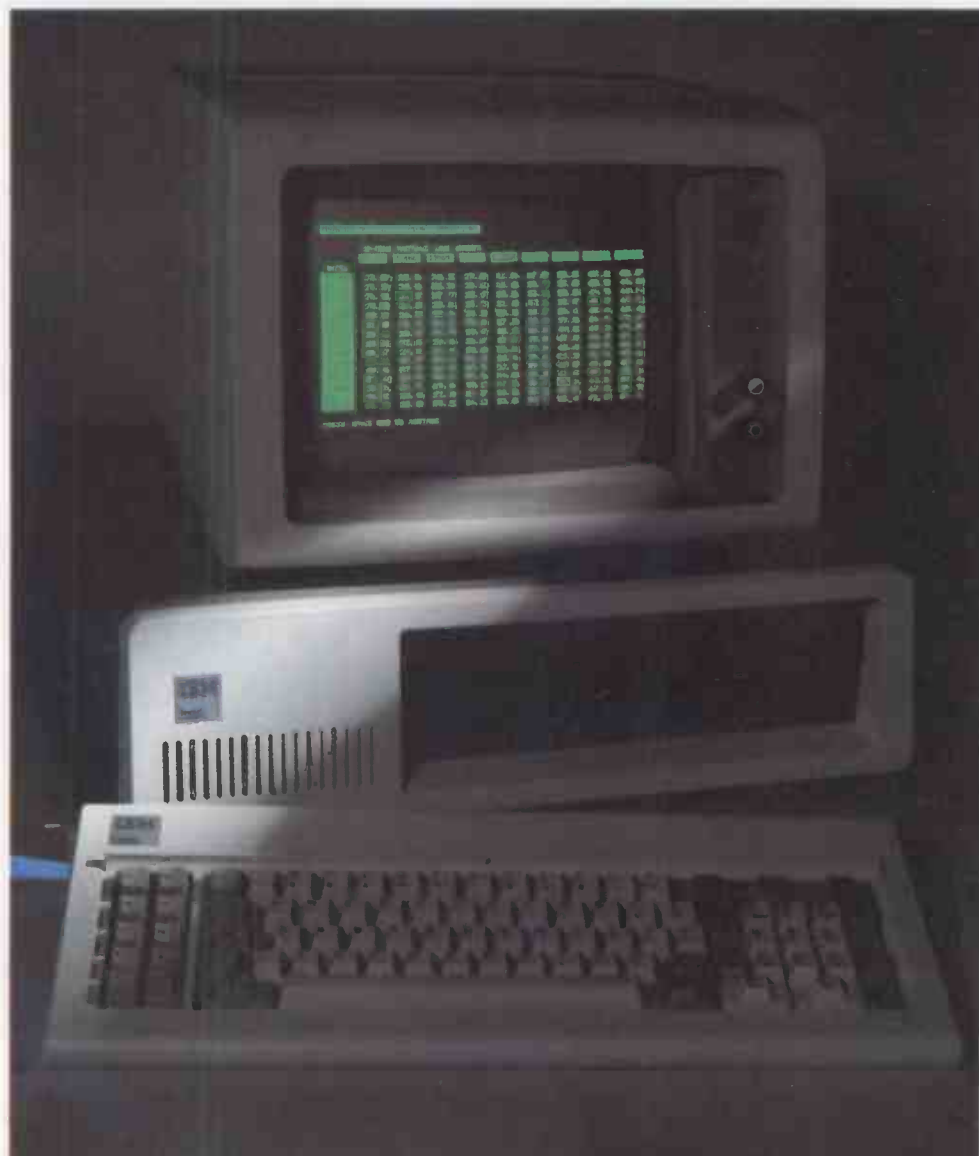
The IBM Personal Computer is now so powerful that in some extents it surpasses the capabilities of main frame computers only a decade ago. For example, the IBM 360 which dominated commercial computing from 1964 through the early 1970's. The 360/40 was used extensively in payroll accounting and stock control applications for companies with several thousand employees. The 360's were housed in huge environ-

mentally controlled rooms, cost \$180,000 for only the 32K model plus \$168 per month maintenance. These machines had a maximum memory of only 262K of RAM compared to 760K on the IBM Personal Computer. The cost of a 262K 360/40 was \$497,000 plus \$383 per month maintenance. The Personal Computer sells for £2,950.

## Speed

As for speed, the CPU of the 360 could access main storage in approximately 2.5 micro seconds compared to the Personal Computer's total storage access and retrieval time of only 600 nanno seconds.

Floppy disk drives for the Personal Computer are up to 200 times faster than the early card readers and punches used on the early 360's. For both pure speed and memory size, the Personal Computer can match one of



# by the biggest in the business

the most popular and most powerful main-frames of only ten years ago. This is not to say that the Personal Computer's total work capacity is as great as the 360. Actual output is dependent on the speed, number and capacity of peripheral devices such as line printers, hard disks etc. However, even this area has now been challenged by personal computing with the advent of low cost Winchester disk drive technology both increasing in power and decreasing in cost. It seems that no area is safe from the inroads of technology.

## Local work station

In large businesses where there are large amounts of experience with large main-frame computers, the IBM will be used as a local work station for everyday business use in addition to its use as a terminal to the main-frame computer. Even by comparison with very recent 8 bit micro computers, the IBM has made really significant break-throughs in the type of business tasks it can handle. When combined with electronic spread sheet packages such as Supercalc, models of up to 500K can be accommodated and using IBM's colour graphics adaptor and a high resolution RGB monitor such as the Electro-home, it is possible to construct extremely large financial models and get a very high degree of feedback from the system through the clever use of colour display.

Although there is now a small number of 16 bit personal computers coming into the market place, it seems that IBM have given considerable thought to where the next step will come in terms of speed and power requirements. Micro processors can perform thousands of mathematical instructions per second but micro

processors work with only one or two bytes at a time. This limitation restricts the speed at which they can add floating point numbers. Mini computers and main-frames also suffer from this problem. However, they invariably have what is called a floating point processor or a math processor to deal independently with calculating floating point arithmetic. IBM have left an auxiliary socket next to the main processor in their Personal Computer for an Intel 8087 floating point processor to be installed. This will represent a very significant technical advance over even current 16 bit micro computers in that as the tendency becomes more and more for these machines to be used for accounting and business applications, they will be in need for faster arithmetic. For a few hundred pounds an 8087 can be installed which will drastically increase the performance of electronic spread sheets, such as Supercalc, and give a vital performance improvement in many accounting packages, etc., written in high level languages such as BASIC and PASCAL.

## Colour Graphics

Winchester disk drives of the 5¼" size are now so small that they can be fitted inside the IBM PC and this, combined with compiled programs, will give a further increase in speed, performance and capacity. With the colour graphics adaptor IBM have taken an extremely flexible approach. The colour graphics adaptor board can be used not only with a high resolution colour monitor but also with a colour television receiver with a RF modulator and a standard monochrome monitor. The colour graphics adaptor has the same graphics characters as the display printer adaptor but offers two additional

capabilities: coloured characters and individually addressable dots on the video screen (graphics). This board is extremely flexible in that, when used with a colour monitor, it can be used in black and white character mode for packages such as word processing and electronic spread sheets. With the new Supercalc package it can also, of course, be used in colour.

16 colours are possible which are variations on the three primary colours (red, green and blue) and the actual intensity can also be varied. In colour graphics mode 320 dots horizontally by 200 dots vertically is possible. In the high resolution mode-640 by 200.

The IBM is supplied with three operating systems: PC DOS which by any other name is MS DOS by Microsoft, CPM 86 from Digital Research and UCSD/P system from the University of California and San Diego. The IBM is supplied with two basics, standard Microsoft basic and an advanced basic which takes in the special commands for use with IBM's colour graphics adaptor, some of which are extremely useful when creating attractive colour displays. Some of these unique statements are circle, draw, get, paint, put. Under the MS DOS operating system, there are several extremely useful compilers available from Microsoft. These are BASIC, FORTRAN, COBOL AND PASCAL, all of which are two pass compilers producing full machine code. In the short space of time that EOS have been dealing with the IBM Personal Computer, we have seen a really staggering amount of progress in the amount of software available for the machine. New software packages are received in our offices for evaluation at the rate of about two a week.

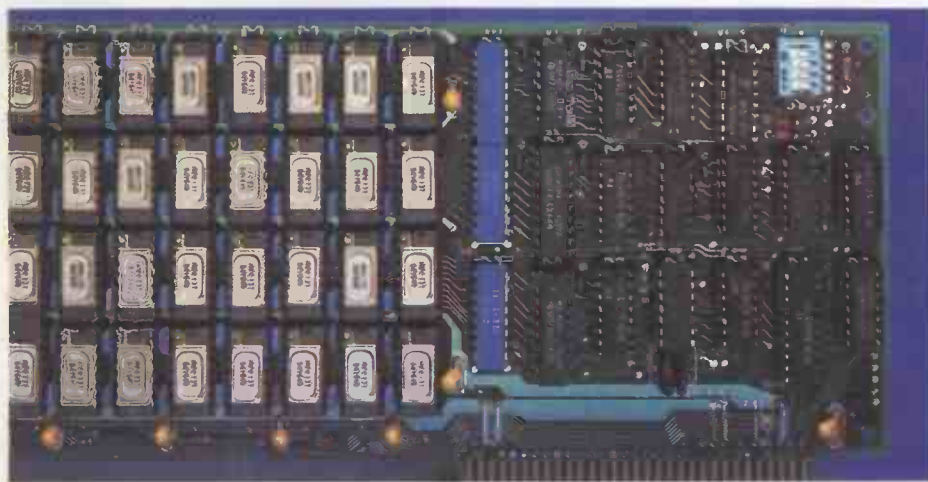
## Great memories run in our family

Now EOS offers you and your IBM powerful memory-expansion PCBs with up to 512Kb storage per board.

With these versatile add-ons, you can increase your computer's memory to the highest, practical level of current technology - and do it with minimal demands on space and power.

Because only the finest-quality materials and construction go into our multi-layer boards, you are assured of both the lowest signal distortion and the best RFI performance.

Mapping ROM makes set-up fast and easy, with a choice of flexible memory configurations. Our five PCB memories are available



now - in 64, 128, 192, 256 and 512Kb. Each can be obtained in an expandable version.

Whatever your needs may be, you'll find that our "product-family" approach to memory design and

manufacture backs you with total operating-system support - before and after sale.

For complete details on our family's great memories, don't forget to return our coupon.

# Sirius—Britain's best selling 16 bit

The Sirius I is the UK's best selling 16 bit personal computer. It is based on the Intel high speed 8088 microprocessor. The Sirius supports a large range of advanced 16 bit software to take advantage of its unique capabilities.

## Beautifully designed

...the screen tilts and swivels to suit the user and screen glare is eliminated through the use of a special coating. The quality of the display is superb with the ability to display 800 x 400 pixels. Contrast and brightness can be adjusted from the keyboard without the need to reach behind the monitor as was necessary on earlier micros. The best high resolution graphics in the business.

## Massive memory!

Because the Sirius can address directly up to 896K bytes of RAM, plenty of capacity is available for professional business software - the machine is an ideal "data base machine" - EOS offers complete data base solutions from a "user friendly electronic file cabinet" (TIM III) to a full fledged data base management system (MDBS III).

## Larger floppy disks.

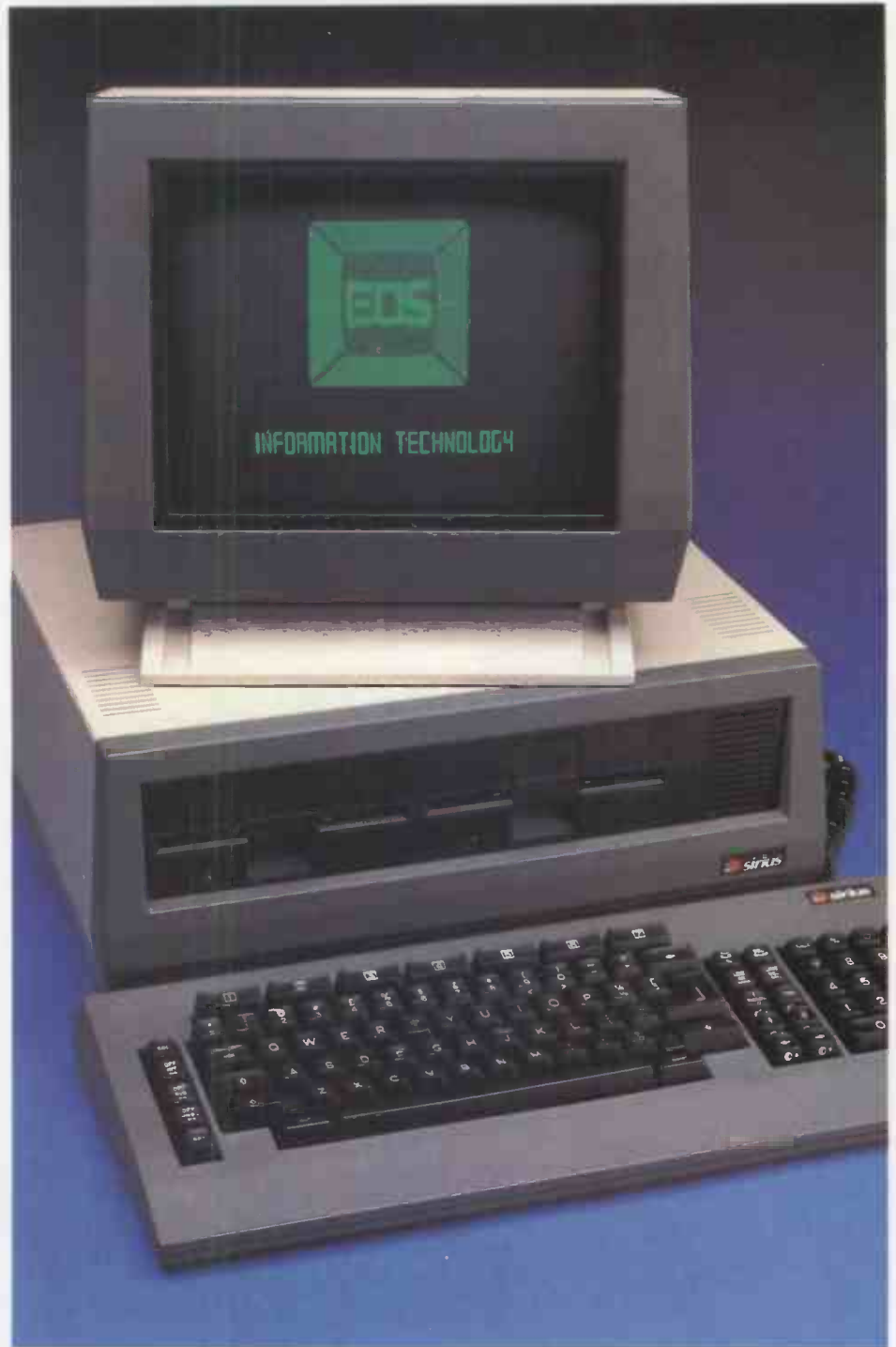
Sirius is available as standard with 2 600K disk drives or 2 x 1.2 megabyte drives are available as an option. More than any other comparable personal computer! 5 and 10 megabyte internal Winchester disk drives will be available shortly (probably at PCW). Local area networking is available now from outside suppliers, and ACT plan to announce their own system shortly - more than enough expansion potential as business needs change and develop in the future.

## Sirius speaks.

Sirius offers a revolutionary feature "voice synthesis" using a small microphone messages can be "dictated" to your Sirius, which then stores the message in RAM or on disk for subsequent incorporation into your programs or relayed to another Sirius in another office - or using RS232C coms - anywhere.

## Fabulous software.

Sirius provides a complete range of business software, ACT's PULSAR, TABS, SYSTEMATICS for accounting. Wordstar, Spellstar and Mailmerge for word processing. Supercalc, Multiplan and Micromodeller. There is also SELECT, the only word processor that teaches you how to use it in less than 90 minutes. More than 100 top software companies are



developing specialist software for every business and profession.

## More languages.

The Sirius supports all the new MICROSOFT compilers, BASIC, PASCAL, FORTRAN and COBOL. UCSD PASCAL has also recently been introduced. We have found that this wide variety of BUSINESS languages is why more and more application developers are choosing Sirius.

## Two operating systems as standard.

The Sirius is supplied with two 16 bit operating systems as standard - MS DOS and CP/M 86 with CONCURRENT CP/M 86, the multi-tasking

version, on the way.

## Communications.

Sirius two RS232C ports as standard - both are fully programmable up to 19200 baud. Facilities are also available to communicate with large mainframe computers.

## Peripherals.

EOS can connect the Sirius to almost anything - printers, plotters, digitisers, modems etc. Combined with the EOS 7000 it can dump all the screen graphics out onto the printer. With Supercalc the EOS 7000 can print 272 columns at near letter quality.



# Hello TIM, goodbye filing cabinets

With the exception of spread sheets and financial modelling packages, the area that will undergo the most extensive and rapid development on personal computers will be information management systems. These are also commonly referred to as "data base" packages.

The problem in the past has been that these packages were not "user friendly".

One of the most significant products to appear in this field is TIM III from INNOVATIVE SOFTWARE INC.

## The non-programming approach.

TIM III is a state of the art data base management program, it is written in compiled basic - so it is quick, and because it supports hard disks, it can handle large data bases. Most important of all, TIM III is extremely easy to use. TIM communicates with you on your own terms by using a fully menu driven approach. Just pick what you want from the lists of displayed options. *No programming required.* Help is always available throughout the program, and a clear, well indexed and easy to understand Users Manual is included.

These features combine to make TIM user productive almost immedi-

ately after using the program.

## Word processing interface.

TIM interfaces with Wordstar and Select in both directions, ie TIM files can be put into Wordstar and Wordstar files can be put into TIM.

## A proven system.

Over 3,000 TIM III programs have

been sold on the IBM Personal. TIM is currently available under MS DOS for the Sirius and IBM Personal Computers and all CP/M 2.2 machines.

*Electronic Office Services is the sole distributor for TIM III in the UK.*



Exclusive to EOS, the 7000 3-in-1 Printer is capable of operating in three different modes - fast mode at 180 cps, letter quality at 90 cps and high defini-

tion graphics at 120 dots per inch. The EOS 7000 is available now at the new low price of £1,995.



# CAUSE AND EFFECT

Every day, a new—and frequently unexpected—factor will affect your business...oil, the dollar, the value of sterling, the price of sugar—or copper...whatever your business, something (or someone) will create a situation that calls for a complete recast of targets, budgets and cash flow. Until now, that has meant a lengthy, often labour intensive rethink.

The new version of Supercalc for the IBM Personal Computer represents the latest state of the art of technology in electronic spread sheets, offering up to 512K main memory capability. The largest financial models can be accommodated. The superb colour capability brings a new dimension to electronic spread sheets. Being in the 'red' really does take on a new meaning... if a new figure entered into a cash flow produces a negative cash balance, all these figures appear in red.

One of the new features is the

ability to protect fields so that items which are important are not accidentally erased. Using protective fields enables the author of the spread sheet in question to lay out a mask into which an operator who has no detailed knowledge of the model may input figures for later manipulation.

One of the most useful facilities is the ability to define variable column widths. This enables one to have, for example, a wide column A for inserting titles for the rows, a number of columns for the months of a cash flow at, let us say, 9 characters and a total

column of say 13 characters, allowing complete flexibility. Where the package scores over more well-known products such as Visicalc is the excellent context specific help messages provided.

If the user is unsure when prompted by a selection of mnemonics by the system, he simply types a question mark and immediately receives a more detailed description of the options indicated by the mnemonics. It is also possible to load all or part of a particular work sheet and to output the spread sheet to a disk file which can later be incorporated into a word processing package.

Editing is simplicity itself and it is possible to simply call up a particular entry and insert, delete or modify your entry with a few simple key strokes. Another excellent feature is the ability to insert dotted lines or indeed repeating characters of any type right across the page without the need to replicate cells as was necessary with earlier spread sheet programs.

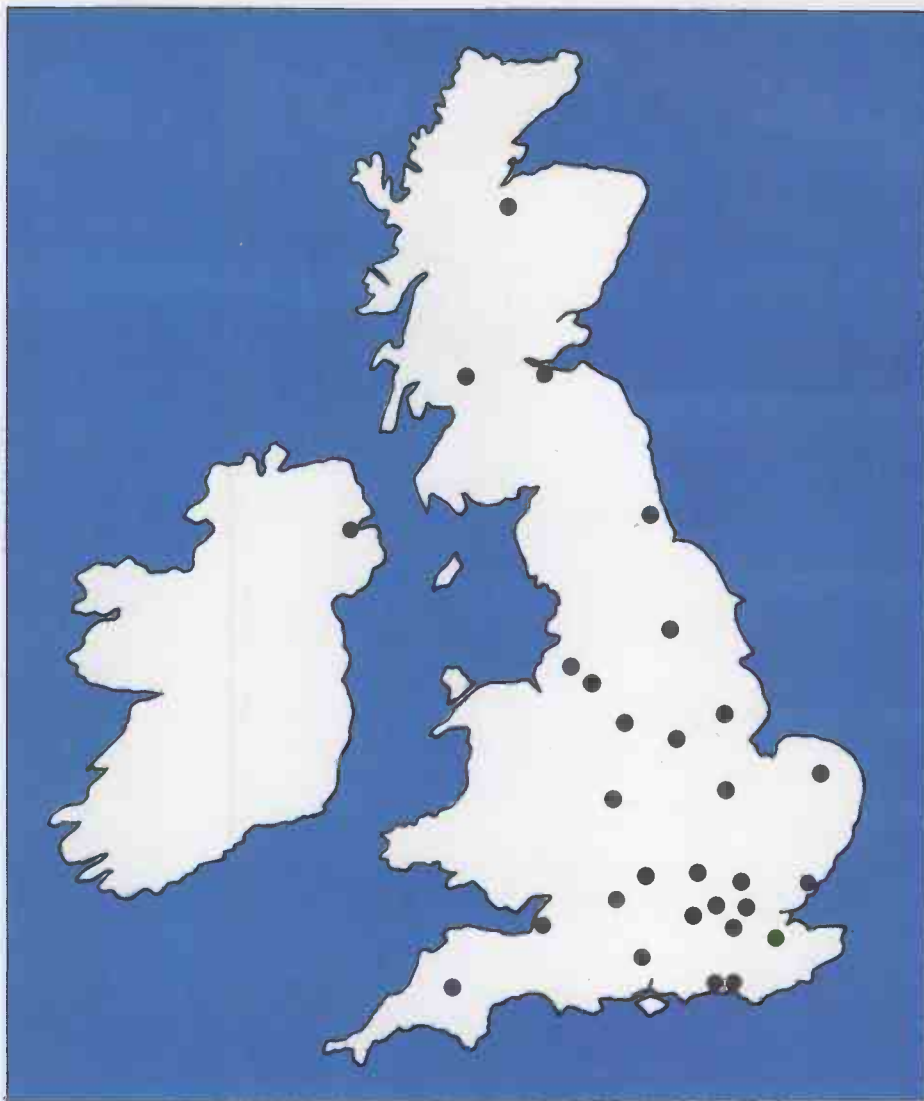
Tell Supercalc today's price of copper, or how the dollar shifted overnight. It will do the rest for you and keep you totally up to date at the touch of a key.



# WANTED: Top class dealers to join the EOS network

An EOS Dealer has access to tomorrow's technology today. He will be offering his clients the most comprehensive, modern and reliable range of hard and software, much of it exclusive to him through EOS. He can guarantee service and maintenance of the highest order and be assured of full support in terms of advertising and publicity, brochures, posters and mailings. He will also have his own clearly defined geographical territory.

If you wish to be considered for an EOS Dealership, contact:  
Russell Sparkes,  
Marketing Director,  
EOS House,  
29-31 Fleet Lane,  
London EC4M 4YA.  
Telephone: 01-248 6971.



On the previous pages, we have been able to show some of the products from the EOS portfolio of hard and software for today's business applications.

If you would like further information about any of the products shown, please tick the appropriate box(es), and post the coupon to:

EOS, PCW Enquiry, EOS House, 29-31 Fleet Lane, London EC4M 4YA.

Your enquiry will be forwarded to your nearest EOS Dealer.

- Electrohome Colour Monitors  IBM Personal  EOS 7000  
 EOS Memory Boards  ACT Sirius 1  TIM III  Supercalc

NAME \_\_\_\_\_

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ADDRESS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TELEPHONE \_\_\_\_\_

At £299 it's very little. At 64K it's very large.



## The 64 from Commodore.

This is the new Commodore 64 Personal Computer.

It costs £299. Not bad for a brilliant piece of technology with a 64K memory.

But then, it's a Commodore.

And as one of the world's leading high-performance micro-computer companies, we're not exactly unknown when it comes to outstanding achievements.

The Commodore 64's nearest rival – if that's the word – costs over half as much again.

Here is the specification, a comparison with the Apple II, and a coupon.

The rest is up to you.

1. A total memory capacity of 64K, 38K directly available to BASIC. When not using BASIC a full 54K is available for machine code programs.

2. Interface adaptors will allow the use of a

complete range of hardware peripherals including disk units, plotter, dot matrix and daisy wheel printers, Prestel communications, networking and much, much more.

3. A complete range of business software including word processing, information handling, financial modelling, accounting and many more specific application packages will be available.

4. Other computer languages such as LOGO, UCSD PASCAL, COMAL and ASSEMBLER are being developed. Existing VIC and 40 column PET BASIC programs can be easily converted.

5. The powerful sound chip gives 3 totally independent voices each with a range of 9 octaves. User control over music envelope, pitch and pulse shapes provides the ability to make your Commodore 64 sound like a variety of musical instruments, solo or in harmony.

6. 62 predefined graphic characters plus



business, educational, home and leisure software.

11. A second processor option using the Z80 gives the Commodore 64 the ability to support CP/M®.

### HOW COMMODORE PIPS APPLE.

| FEATURES                                   | COMMODORE          | APPLE II+     |
|--|--------------------|---------------|
| Base Price                                 | £299*              | £499*         |
| <b>ADVANCED FEATURES</b>                   |                    |               |
| Built-in user memory                       | 64K                | 48K           |
| Programmable                               | YES                | YES           |
| Real typewriter keyboard                   | YES (66 keys)      | YES (52 keys) |
| Graphics characters (from keyboard)        | YES                | NO            |
| Upper & lower case letters                 | YES                | NO**          |
| Function keys                              | YES                | NO            |
| Maximum 5¼" floppy disk capacity per drive | 170 K.B. to 1 M.B. | 143 K.B.      |
| <b>AUDIO FEATURES</b>                      |                    |               |
| Sound Generator                            | YES                | YES           |
| Music Synthesizer                          | YES                | NO            |
| Hi-Fi Output                               | YES                | NO            |
| <b>VIDEO OUTPUT</b>                        |                    |               |
| Monitor Output                             | YES                | YES           |
| T.V. Output                                | YES                | EXTRA         |
| <b>INPUT/OUTPUT FEATURES</b>               |                    |               |
| Cassette Port                              | YES                | YES           |
| Intelligent Peripherals                    | YES                | YES           |
| Serial Peripheral Bus                      | YES                | NO            |
| <b>ADDITIONAL SOFTWARE FEATURES</b>        |                    |               |
| CP/M® Option (over 1000 packages)          | YES                | YES           |
| External ROM cartridge slot                | YES                | NO            |

\*EXC. VAT - DETAILS CORRECT AT TIME OF GOING TO PRESS  
 \*\*UPPER ONLY  
 CP/M® IS A REGISTERED TRADEMARK OF DIGITAL RESEARCH, INC.

full alpha numerics with upper and lower case letters, all available directly from the keyboard and displayable in normal or reverse video in any of 16 colours.

7. 40 column by 25 lines colour display. In high resolution graphics mode, a bit mapped screen gives 320 x 200 individually addressable pixels.

8. The dedicated video chip allows the use of high resolution multi-coloured "Sprites" (moveable object blocks). Sprites can be moved pixel by pixel, independently of anything else on the screen.

9. Sprites can also be set up in 8 "layers" giving full 3 dimensional effects with, if required, automatic collision detection between sprites and any other screen object.

10. Machine bus port will accept ROM cartridges for many applications, including



For more information on the powerful new Commodore 64, and the address of your nearest Commodore dealer, telephone or write to us at:

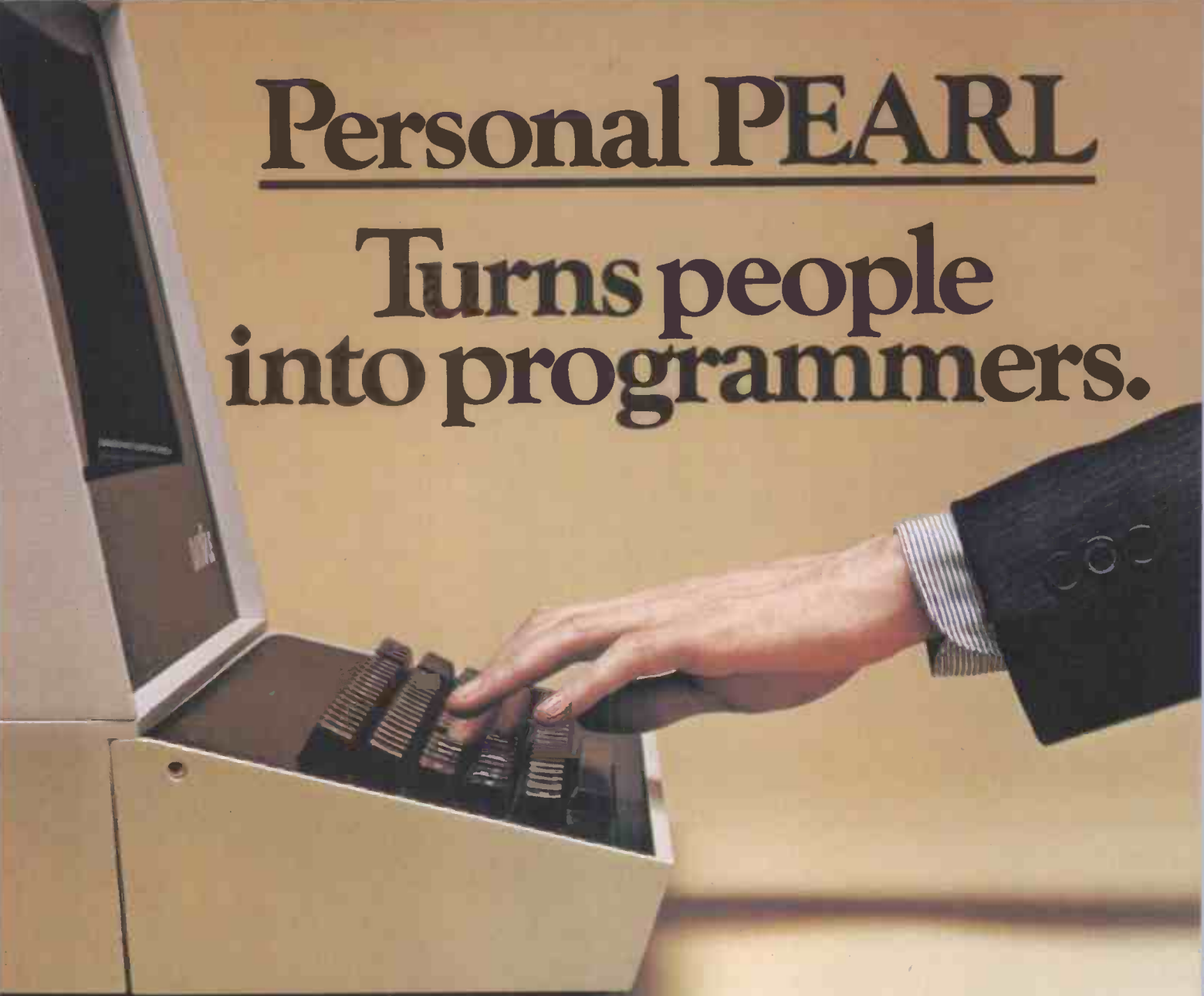
The Commodore Information Centre,  
 675 Ajax Avenue, Slough, Berkshire SL1 4BG.  
 Telephone: Slough (0753) 79292.

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If you could program a computer by simply telling it the result you wanted, without using complex codes or languages, then anyone could become a programming professional. Sounds fantastic?

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Computer Make: \_\_\_\_\_

Disk Size: \_\_\_\_\_ VDU Make: \_\_\_\_\_

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Tel: Parkstone (0202) 741275

**Pearl Software International (UK) Limited,**  
PO Box 34, Poole, Dorset, BH14 8AR.  
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# PERSONAL PEARL

## PURPOSE

To provide a natural, easy way for people to create custom application programs through an English language interaction with a personal computer.

## DESCRIPTION

Personal Pearl is the natural, human way to create new computer solutions. Computers are designed to solve general problems at incredible speeds. Application programs are required to operate the computer in order to quickly solve specific human problems. Personal Pearl unlocks the power of the computer so you can resolve your unique business problems.

Personal Pearl asks you for examples of the results you require from the computer. Personal Pearl then produces the application program. Personal Pearl is for the individual who requires custom computer solutions without the cost and time delay of hiring a programmer.

With Personal Pearl, you can create a library of personal programs, each tailored to your individual requirements. Accounting, mailing lists, data files, data management, calculations and reporting. Personal Pearl builds the program library of your choice, for one price.

Why buy several programs designed for the average computer use? Buy Personal Pearl to create an entire library of the highest quality programs designed by you, for your Personal Pearl leads you through the program design. Your answers are used by Personal Pearl to create the new program.

## HIGHLIGHTS

- Interactive English program development. Menu-oriented application description speeds development via formatted screens, input error checking.
- Built in HELP facility.
- Display handling is defined by using Personal Pearl's convenient full-screen facilities to simply type in the display screens exactly the way they are to appear in the new program.
- Report handling is defined in the same way; by simply formatting the display screen to show the layout of the reports required by the new program.
- The application program display screens or reports may be modified at any time, or new displays or reports may be added.
- Calculation edit: arithmetic operations, editing, translation, table look up, and data validation are included.
- Data routine: display-to-display, display-to-printer, and display-to-file facilities are provided.
- Files may be quickly and easily sorted, printed, searched for selected records, reorganised or analysed.
- Display screens, files or reports may be modified to reflect changing program requirements.
- Display screens may be custom designed in any form.
- Reports may be custom designed in any form. Several report formats may be stored for later use.
- Data may be sent to SuperCalc\* or Multiplan\* for forecasting.
- No limitation on number of application programs.
- Maximum file sizes determined only by the maximum capacity of the disk storage medium on the computer.
- Records may be up to several thousand characters long, if needed.
- The number of records that may be stored in a file is determined by the total file size. Records are variable length with record packing, eliminating the wasted space incurred by fixed length schemes.
- Data base support is provided by an independent data base manager.
- File support is provided through indexing and sequential data access.
- Security and Integrity of Data:
  - Data input can be validated against previously defined edit criteria before changes are made to data files.
  - Edit criteria can be modified dynamically.
- Automatic Screen Entry Message:
  - Users of Personal Pearl can establish messages to the program operator in order to direct correct data entry.
- Data File Independence:
  - The descriptions of data files are maintained in an independent description file - the dictionary.
- Multiple Program Integration
  - Several generic programs such as word processing and spread sheet analysis may be integrated through Personal Pearl.

PEARL  
software

**PREREQUISITE PRODUCTS**  
CP/M Operating System  
48K RAM Microcomputer

Manufacture, OEM and dealer enquiries welcome.  
Suggested retail price: under £200\* \*excluding VAT

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Please send me details of Personal Pearl

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Address.....

..... Postcode.....

Type of equipment..... Disc size and format.....

Type of VDU .....



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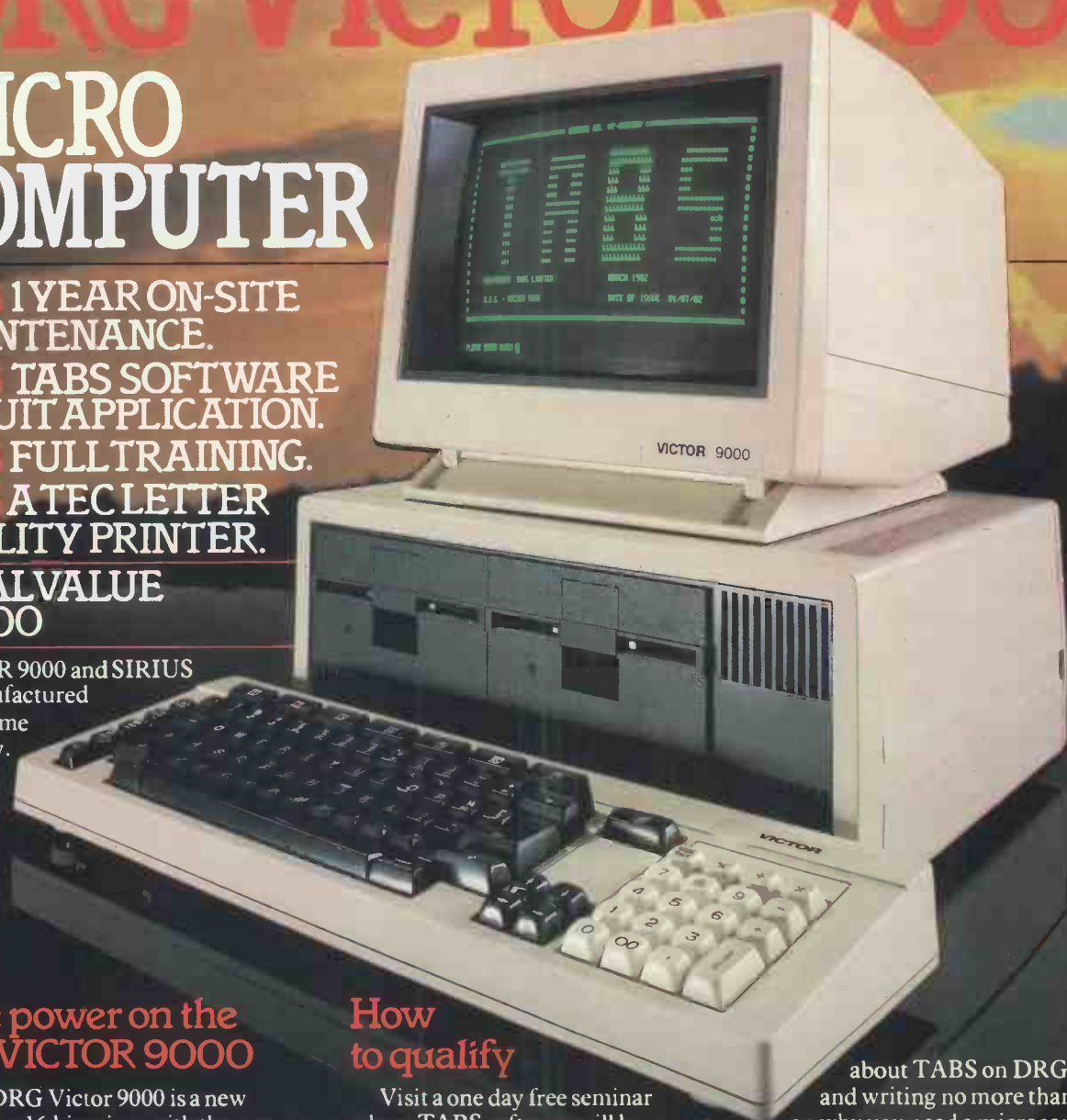
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Closing date for entries is December 31st. The winner will be announced in the Daily Telegraph by February 1st.

**TABS FREE SEMINARS:** LONDON Great Eastern Hotel 19 Oct. 20 Oct. 16 Nov. NOTTINGHAM George Hotel 6 Oct. 2 Nov. 30 Nov. MANCHESTER Grand Hotel 4 Oct. 4 Nov. BIRMINGHAM Crest Hotel 12 Oct. 9 Nov. EDINBURGH Caledonian Hotel 29 Sept. 27 Oct. 25 Nov. NEWCASTLE Holiday Inn 27 Sept. 26 Oct. 23 Nov. CARDIFF Park Hotel 14 Oct. 11 Nov. BRISTOL Unicorn Hotel 22 Sept. 18 Oct. EXETER Royal Clarence Hotel 8 Nov.

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For more information about TABS on the DRG Victor 9000 please phone Andover (0264) 58933 or write to TABS Ltd, Sopers House, Chantry Way, Andover, Hants SP10 1PE. or DRG Business Machines, 13/14 Lynx Crescent, Winterstoke Rd., Weston-super-Mare, Avon BS24 9DN.

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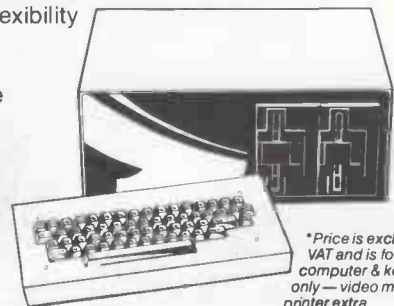
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OEM enquiries welcome.

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# £1,350\*

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120 TEXT  
130 PUT 12  
140 CALL "RESOLUTION", 0, 2  
150 I=5  
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170 CALL "COLOUR", 0, 0, 0, 0  
180 CALL "COLOUR", 1, 5, 0, 0  
190 CALL "COLOUR", 2, 230

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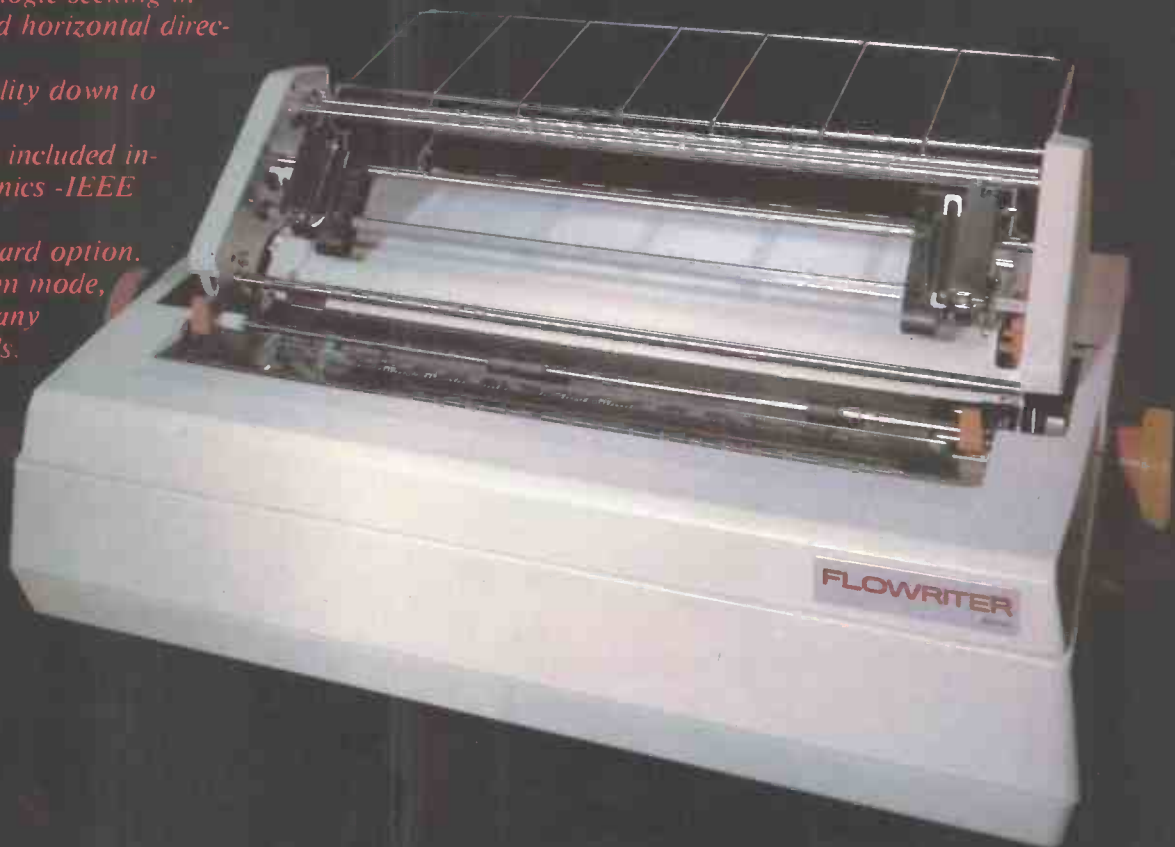


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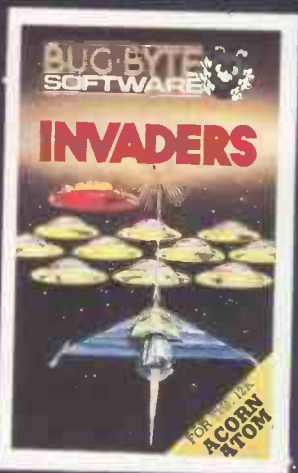
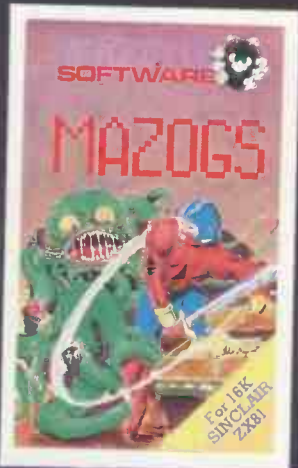
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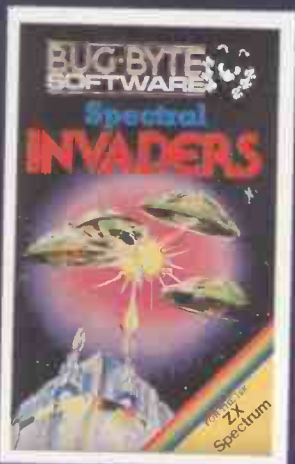
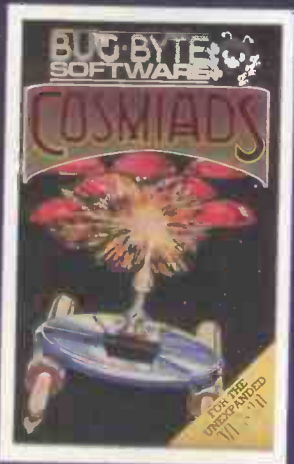
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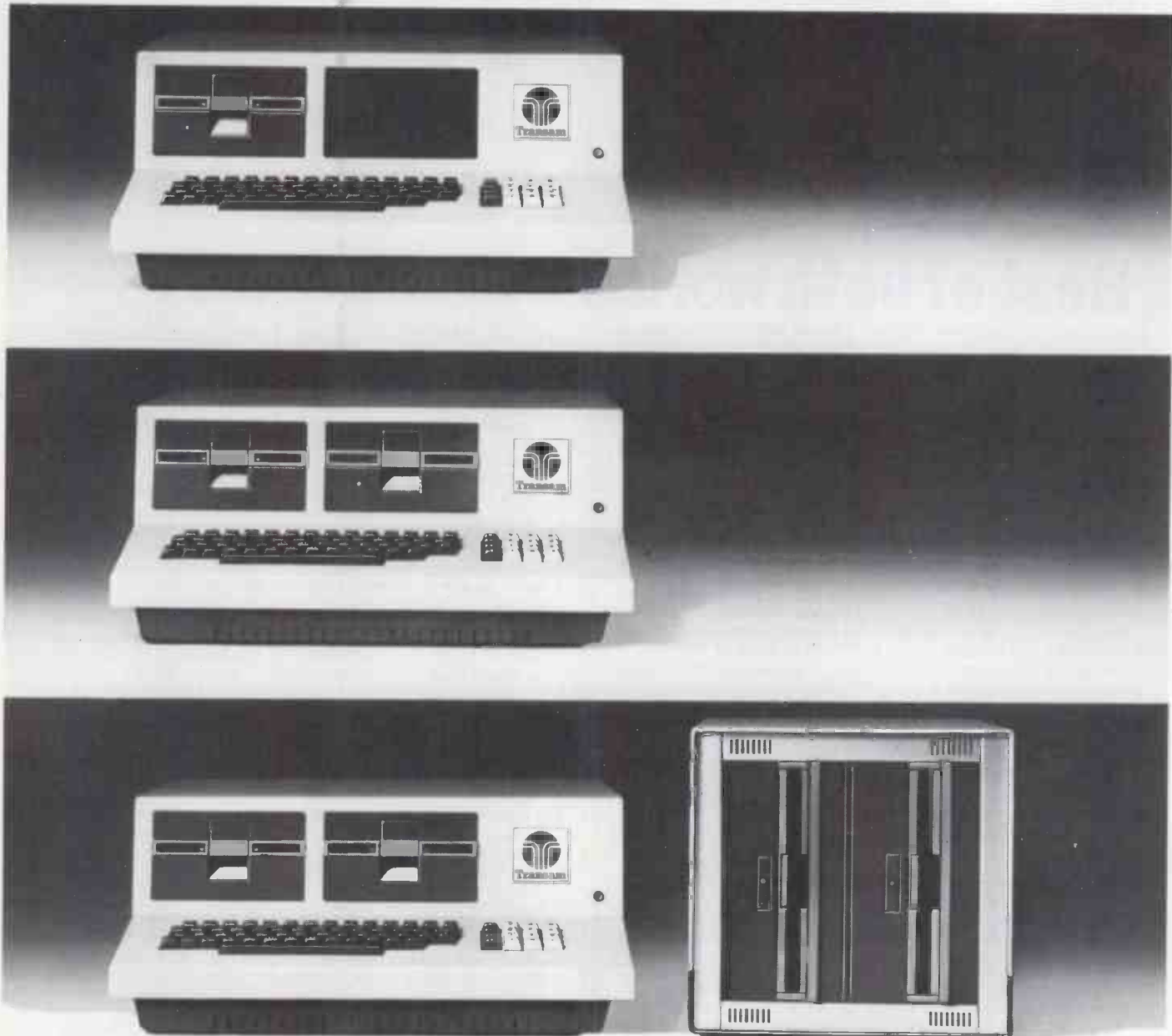
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## Best of both worlds

Way back in May, one of the most significant things to hit the micro industry next year started poking its first shoots tentatively through the soil, when the world's second biggest computer company and biggest minicomputer company, DEC, announced its micro family.

Then, somehow, one of the less significant things of the year happened, and the news of this cataclysm failed to get into PCW. I swear it wasn't my fault.

Nonetheless, Digital Equipment Corporation has obviously got it right, by launching a machine that is both old and new. It is an eight-bit CP/M machine with an ordinary eight-bit Zilog Z80 processor, and it is also a 16-bit machine with a bright new Intel 8088 processor, as used by IBM and Sirius.

On top of that, Digital has backed its own design of minicomputer by launching a micro version of it — something which all minicomputer makers do in order to flatter their own egos. In this case, however, Digital's pride in its mini range is justified by the simple fact that it is the world's best selling mini, and that lots and lots of people really do want to use the wealth of available software that has been generated for it — in marked contrast to those who wish that somebody really would sit down and write a wealth of software for things like the . . . well, the rest of the minis.

The two machines are called Rainbow and Professional, with the Rainbow being the really interesting one that runs CP/M and CP/M-86. It is the only machine in this market which will do this bar some minority interest machines which sell at considerably more than DEC's £2,300 odd.

To everybody else, the choice between established, eight-bit micros (which have lots and lots of software ready to run under CP/M) and exciting, powerful 16-bit micros which will one day have even better software, has been agony. Not to Digital: it has calmly put both eight and sixteen bit processors in the same box.

More: it has ensured that you needn't bother about which micro runs which program.

IBM has been (sort of)

baled out of this problem, by the arrival of a firm called Xedex Corporation, which launched a Zilog Z80 processor, on a board, ready to plug into the IBM Personal Computer and run ordinary CP/M. But you don't have the mindless ease of just shoving in a diskette and pressing the start button, which DEC will give you — because Baby Blue's operating system is either one, or the other.

DEC's operating system is both. It examines the program diskette, and decides which processor is meant to run it. End of hassle.

So far, the only thing known against the DEC micro is the fact that nobody has seen one. It was originally planned to appear in October. This is now to be delayed, and internally executives predict that it will be available in December, but 'better say January to be safe', they say.

Any other computer company would have launched the Rainbow (if at all) with a minimum of fuss, and would have given pride of place in all publicity to a range called the Professional.

The Professional, after all, is the one which gives us all a chance to become PDP-11 users — PDP-11 being the name of DEC's enormously successful range of minicomputers.

The Professional Operating System (P/OS) is derived from base-level RSC, which is Digital's real-time operating system (real-time is what nearly all micros have) of the PDP-11 family.

Digital is as proud of its PDP-11 family, and the design mannerisms which went into it, as its old rival, Data General is of its Nova families. DEC, however, has not restricted itself to offering the Professional the way Data General has restricted itself to Nova lookalikes. Indeed, where DG has, reluctantly and haughtily, condescended at last to offer a non-DG operating system as an option, DEC has put the Rainbow in front of the Professional in its publicity handouts.

And where DG has, inexplicably, refused to allow CP/M to cross its threshold (and has gone for the Business Operating System originally developed by CAP Microproducts, which it describes as a mainline operating

system as though there were tens of thousands of users in the UK alone) DEC has produced not only CP/M, but the new CP/M-86 which IBM has backed.

Strangely, one might have expected things to go the other way. If either company is entitled to a belief that it is right, and the world should follow in its footsteps, it should be DEC, not DG.

There can be no question that a great deal of DEC software is 'superior' — in the sense of being more powerful, avoiding compromises, and being easier to use — than CP/M or MBasic — but you can get both on the Rainbow.

Having praised the company so much, it must then be added that DEC learned its lesson the hard way. It launched a microcomputer two years ago. What! (you say). A DEC Micro, and I never heard of it?

Well, long ago and far away, DEC started out with the PDP-1, and after a while evolved through -2 and -3 until it arrived at the PDP-8. This was a wild success, and the foundation of the company fortunes. It still sells, just because there are things written for the PDP-8 which will run on nothing else — the way people bought Apples when Visicalc would run on nothing else.

A company called Intersil was so impressed that it produced a microcomputer

chip called the 6120, which would do anything a PDP-8 would do.

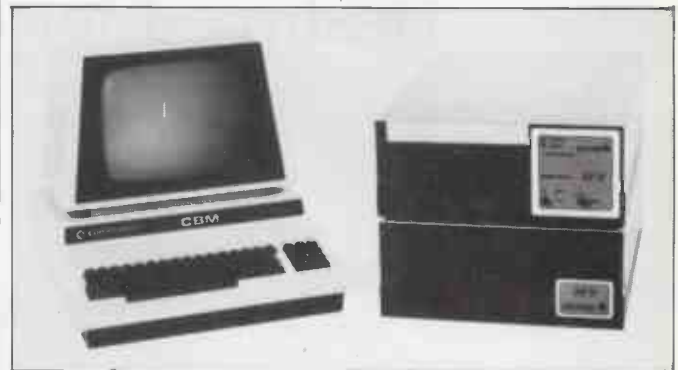
This failed to become a wild success for esoteric reasons to do with the non-volatility of magnetic core memory and the non-alterable nature of ROM. Digital, suitably flattered, installed this chip in its DECmate micro.

It still failed to become a wild success.

The company has not abandoned DECmate: it has produced DECmate II, which might have sold rather better than it will in the shadow of the Rainbow and Professional. But remember, many another company would have suppressed the Rainbow and Professional on that account — go and have a chat with Texas Instruments, if you don't believe me.

Interesting subsidiary features of the DEC range: they are all equipped to send data direct to ordinary DEC minis and maxis (the Vax is a maxi, because DEC says it isn't a mainframe and I refuse to call anything that big a mini). And they all accept plug-in hard disks without alteration of the operating software. Oh, you thought any micro did? Boy, are you in for a surprise!

Don't bother ringing Digital in Reading on (0734) 868711, because they have already started signing up dealers, and if they aren't talking to you already, you



A German-supplied hard disk for Commodore machines, the Adcomp drive, has the unusual feature of being connectable to 16 PETs at once. The system apparently 'understands the CBM 8050 Basic Instruction', a German-language derived phrase which I take to mean that it emulates the 8050 floppy drive and will obey operating system commands normally used for the 8050.

Users can normally have their computers as far as 20 metres away from the disk, and they can even be as much as a kilometre away, providing they use the special long-distance cable driver. The only thing I can't tell you about the system is the price, because I couldn't get through to Mr J Genius (yes, really!) on 089 19 40 19, which is a Munich telephone number. The firm is Adcomp Satensysteme GmbH at Horemansstr 8, D-8000 Munchen 19.





See 'Phone Foul-up'

don't count. And if you just want to buy one, they haven't got any yet.

## Name game

Not to anyone's surprise, I hope, Future Technology Systems has decided that Future Technology Limited is a company name that will not do, and has invoked the Registrar of Companies as authority to stop its rival. Watch this space for further news.

## Turbo PET

It doesn't really matter all that much, usually, how fast your computer is at finding information on a disk. However it starts to matter a lot when 12 computers are using the same disk and you have to wait 12 times as long. Stack, a company which sells a simple method of attaching any PET computer with Basic 4.0 to an 8050 disk shared with several other PETs, also sells a go-faster program to cut the queues for the data. It's called Turbo ROM and it can be installed as an exchange for one of the normal PET chips. Details on 051-933 5511.

## Phone foul-up

Recently, Lion House Micros and I collaborated in an experiment to transmit a 12k byte program down the phone line in hex dump format via a central computer store.

It took well over 80 minutes to transmit — when it worked. The whole first day was wasted because of noise on the line which completely garbled the characters — and the phone kept on ringing up the charges.

It took only around 20 minutes to load, because error checking wasn't available. A pity, because after three separate loadings, it wouldn't run reliably, and obviously had about five characters out of the 12,000 garbled.

These experiences have

deepened my character and I can't blithely accept that the Owltel downloader, which retrieves programs from Prestel for running on the Apple, is really effective on programs much over two or three kbytes in length.

Owl Micro-communications recommends using the package for the 'wide range of educational, games, and utility software now becoming available on Prestel', I recommend sticking to the short ones.

Full details on Bishops Stortford (0279) 723848.

## Virtual virtues

An awful lot of people (for example, those who use the Wordstar word processing program) know that it is possible to run a program that is too big to fit into your computer by 'overlying' bits of it as required — and they are normally very puzzled when firms like Zilog announce 'virtual memory processor units which eliminate the constraints placed on application programs due to main memory size'.

The essential difference between overlay and virtual memory management is that you have to work out the overlaying yourself, but the computer does it for you if it has virtual memory. Neither of these is 'virtual machine' operation, which goes one step further, and overlays the operating system and job control instructions too.

A virtual memory computer programmer sits down and writes code. He (theoretically) doesn't worry how long it is, but hands it over to the compiler, which generates a nice sequence of machine instructions, which it in turn passes to a loader, which feeds it into the computer memory and tells the processor to start at the beginning.

At some stage, the virtual memory management unit notices that the computer is about to access a memory location which doesn't exist. It only goes up to (say) 65535 memory bytes, and is now sending out a request for

the data in byte 78009. Hastily, the virtual manager interrupts, fetches 78009 onwards from the disk, and re-labels it so that it actually starts at number one again.

The drawback is that all too often 78009 contains a quick test which turns out to call for location 25008, which is now location 46999. Processing stops while the new section of program is stored on disk again, and the old lot fetched back out. This can go on and on; it's called 'thrashing' and, in reality, programmers have to watch out that they manage their plans so as to avoid it.

Nonetheless, you don't get omelettes without breaking eggs, and the omelette is a genuine increase in the ability to write programs in languages like Fortran, without worrying how much memory the user will have to have. In other words, to write programs for nearly any machine that can run the compiler.

The chips which Zilog has announced are the Z8003 and Z8004 processors, which will run all software already produced for their predecessors, but will also organise longer programs into segments. The difference is that the Z8003 generates 23-bit addresses organised into 128 segments of up to 64 kbytes each, while the Z8004 generates 16-bit addresses.

The chips will actually start being available around the end of this year. Details on (0628) 39200.

## Advance warning

The exciting thing about the ZX Users' Fair to be held in Pudsey in October is not the fact that it will be in the Pudsey Civic Centre, Stanningley from 10am to 5pm on Saturday 2nd, nor the fact that there will be a free draw and a £50 voucher

to be won. No, it is the simple fact that Northern Premier Exhibitions have told me about it in time to get it in the issue before the Fair happens. You may even have time to book a stand of your own if you've invented something clever for Sinclair computers. Details on (0532) 552854.

## War of the words

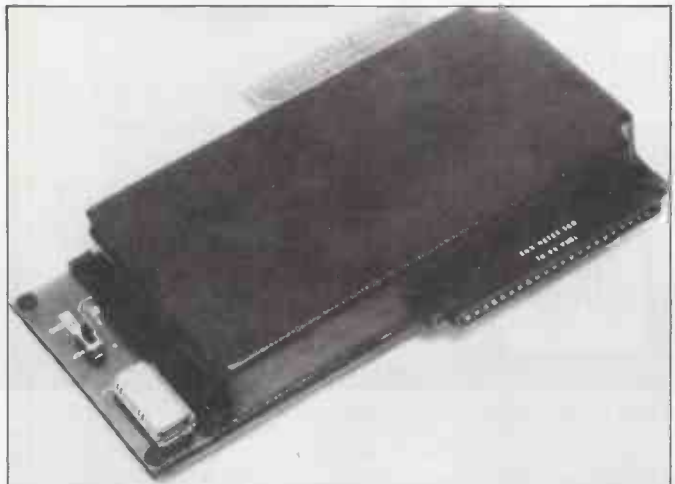
The gentle hint of a future war between word processing machines and microcomputers is revealed in a £35 market report from Key Note Publications on the business of processing text.

The report spends much of its time analysing the different types of word processing equipment, all the way from memory typewriters to micros but notes that while micros are starting to sell into the office typing market, there is now some signs of a trend the other way. That is, word processors are starting to handle some computing.

'Many hardware suppliers are now offering additional software to convert their word processors into management information systems, especially accounts, payroll, and financial modelling,' the report notes. 'Some are even offering standard Microsoft Basic so that their word processors can be used as microcomputer emulators.'

However, though word processing machinery is cheaper than it once was, it still isn't down to general purpose micro levels. Some word processor machinery costs 'as little as' £4000, notes the report.

'To become really competitive with general purpose microcomputers, word processors with extended capabilities would have to come down in price by some 50 per cent,' Key Note says. 'At the moment, they only



Stack originally released an add-on memory board for the VIC users that gave 3 kbytes for £49 — and promised that one day it would offer more. This is the more. It still costs £49 and now has 8 kbytes plus the ability to expand and room for permanent programs in ROMs.

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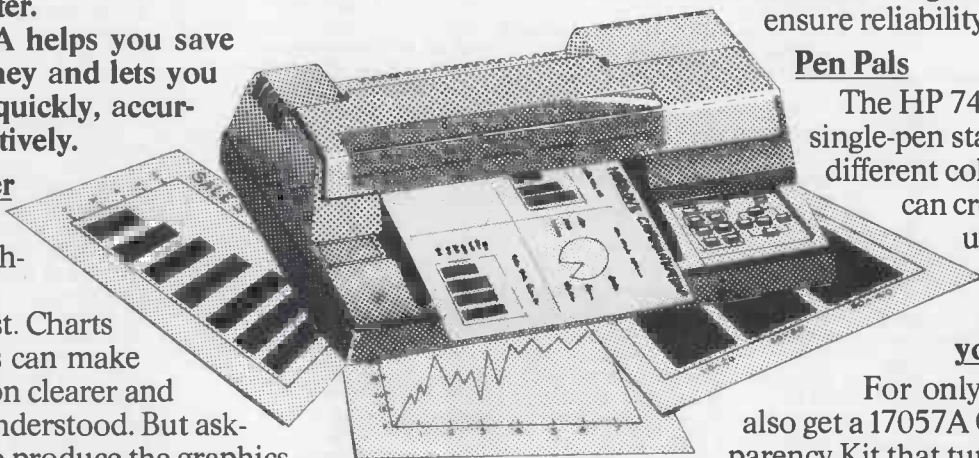
For only £74.19 you can also get a 17057A Overhead Transparency Kit that turns your plots into transparencies for overhead projectors. For "I need it tomorrow at 9.00am!" meetings, it's a necessity.

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really attract large organisations seeking standardisation and/or compatibility with existing systems.' What I call people with more money than sense . . . anyway, the report is available from 28-42 Banner Street, London EC1Y 8QU.

## Bubble blowing

Two chip-making companies, Motorola and Intel, are not normally very cooperative so the announcement of an agreement between these two to cooperate on developing Intel's range of bubble memories either proves that the project is very complex and needs heavyweight effort, or that neither side is really too much bothered.

Bubble memory is semiconductor memory that doesn't evaporate when the power is disconnected but it is slow and it hasn't turned out to be as cheap as was first hoped. It was seen as a possible rival to disks when disks were expensive, and nowadays is more realistically viewed as a sophisticated way of producing a disk system that can't get clogged up with dust or that can be bounced around.

The two companies agree that we won't see any of these new bubbles arising from their joint splash until middle of next year at the earliest, from which you can deduce that products with these bubbles in will have to wait even longer. So don't sell your disk company shares just yet.

## Sparky's magic

'The most exciting and novel development in the piano world today,' (says the Cambridge Pianola Company — yes, really), 'is the bringing together of a piano and a home computer.'

The purpose of this exciting and novel development is 'so that they can communicate with each other'.

The idea is enough to make strong fans of Stockhausen quail but I think I have grasped the essentials, and what it means is this: you remember, don't you, the sort of game you play on microcomputers where they have programmable BEEP functions? You randomise the value for the BEEP and do a FOR . . . NEXT loop, and listen to a tiny loud-speaker doing a random walk through the audible spectrum.

Well, now you can do it with a piano instead of the tiny loudspeaker.

'A home computer can invent music,' remarks Cambridge Pianola with breathtaking understatement and oversimplification. 'The piano can play directly from a computer program in Basic, producing an infinite number of variations. It can also be programmed by a musical dunce, to play any score from

Scott Joplin to Mozart.'

If you like this sort of thing, then this is the sort of thing that you will like. Consider: 'piano music can be composed and played without regard for the limitations imposed by the pianist having only human fingers'.

The complete kit will cost £1600 plus VAT. It includes the normal pianola device called a pianocorder, which presses piano keys down, and a Sinclair ZX81 which tells it which keys to press. You can have music without regard for the limitations imposed by humans only having human ears.

For details, contact Thomas Poole on Cambridge (0223) 861348. Better yet, get a time machine and return three years into the past, and blast Uncle Clive before he invents the damn thing.

## Osborne upgrade

The good news from Osborne is that it will supply Pascal/P-System (some say free, but that hasn't been confirmed in the UK) with the upgrade of the Model 1 to a dual-density disk system.

The bad news is that Osborne isn't happy with the dual density controller circuitry, and has postponed its release until January. Apparently too many systems were crashing with CP/M error messages, and there is no better way to infuriate a user than to display a CP/M error message in the middle of his most complex account billing run — because a CP/M error message means 'go back to where you were when you switched on this morning, and start again, because I've just wiped the lot out'.

Details through dealers.

## Here comes Hitachi

Japanese giant Hitachi is all set to launch its 16-bit business micro in the UK early next year. Although billed by some US mags as an 'IBM lookalike', the Hitachi Personal Computer actually has a higher spec than the basic 'baby blue'. Try this for size: 8088 processor, 128k RAM, 192k video RAM (that's 64k each for red, green and blue), 640 x 400 graphics resolution in 16 colours (you can have eight on screen at any one time), 80 x 25 text display, 655k twin minifloppies, MS-DOS, Microsoft Basic and an internal expansion bus which will be compatible with that of the IBM Personal Computer.

Fortran, Pascal, Cobol and Basic compilers will be available, together with an assembler, Multiplan and a

'standard' word processing package. Add-ons and options include 5 and 10 Mbyte winchesters and — probably — Hitachi's 500k 3in micro-floppy disk drives. A large number of applications packages, aimed especially at the business user, are also planned.

As well as setting up a dealer network, Hitachi plans to establish a chain of support centres across the country, where both dealers and end users can be trained and where small businessmen can receive introductory teach-ins.

Peter Rodwell

## IBM clones

While we are all waiting for IBM to find somebody with enough nerve to struggle up the cargo loading bay with its Personal Computer and launch the damn thing in the UK, all is not yet sweetness and light in America.

Two minor niggles have provoked outside manufacturers into trying to compete with (or improve on) IBM's design — one is the keyboard, the other the display.

It is known that IBM's monochrome display is slightly unusual in that it has 'high persistence' — that is, the glowing characters on the video screen fade slowly. If the screen scrolls it is almost impossible to see what is going on because the screen shows the mixed-up overlays of three or four lines together.

Those who have experimented with a short-persistence display, however, report that it may not be an accident that IBM selected the high-persistence phosphor. There is, they say, a decided flicker which seems to be caused by a hardware or software fault in the display.

Other people, less technically experimental, have been known to reject the IBM Personal Computer be-

cause they can have colour or monochrome — but not both.

The display problems are minor niggles, but they have provoked a Michigan company to make the startling announcement that it has 'improved' on the IBM PC by launching the 'Portable IBM Color PC'.

The keyboard is an even smaller niggle but matters more. Simply, the keyboard is nearly unusable by ordinary typists, because the SHIFT and RETURN keys are not where touch-typing fingers expect to find them.

The result is that the very well known keyboard design company Key Tronic in Washington is planning to sell IBM a redesigned keyboard of a more orthodox or up-to-date style.

The really entertaining side of the whole business is that while Key Tronic's venture has attracted much interest, the Michigan Color PC has attracted nothing but derision.

The company, Applied Systems Corporation (ASC), seems to believe that the Intel 8088 chip used in the IBM PC is in fact an IBM 8088 chip. It has also announced that it will put the IBM logo on the front of the box.

That's a suggestion to which IBM has yet to respond, but the company has in the past been known to prosecute people (like British computer company ICL) merely for mentioning the letters IBM in their own advertisements, even when saying merely that something was 'IBM compatible'.

The other rather strange thing that ASC says is that it will use IBM's own keyboard.

It is, perhaps, possible that when IBM switches to the Key Tronics keyboard (if it does), it may have a huge keyboard factory somewhere filled with Mexican workers who want desperately to continue to work, and that in compassion for their plight IBM will sell the useless old-



Ian Dunkley was last year's boss of the Computer Retailers Association. This year, he's gone off with an Osborne 1 to Bombay, where our photographer found him sitting in the market outside Victoria Station, apparently claiming to be negotiating a £150,000 contract for precast moulds by Datron Interform, a company which owns Datron Microcentres, of which Dunkley is the boss. It all sounds very strange to me.

model keyboards to ASC — but it will be the first time IBM has ever done any such thing if it happens.

A healthy scepticism about ASC is therefore probably justified.

Meanwhile, those who like the IBM PC but want a bigger and faster version can look to the announcement of a machine called the Gazelle, just emerging from an American firm called Seattle Computer.

Seattle Computer has a distinct edge over most hardware producers who hope to imitate the IBM computer: it was the company that Microsoft commissioned to write the IBM PC operating system, MS-DOS.

The Gazelle, unlike the IBM PC, uses the full 16-bit implementation of the central processor chip. That is, it uses the Intel 8086, not the sawn-off 8088 version, which makes it bigger and faster but allows it to run exactly the same software. This was always the plan, of course, but perhaps few people expected a direct challenge quite so soon.

In this country, of course, the Gazelle will be old hat — Future Technology Systems has been making a very similar machine, with 8in drives and the 8086, for nearly two years.

Price of the Gazelle in America, including MS-DOS, plus Basic (Microsoft) and a word processor program called Perfect Writer, is \$6000 but that doesn't include a display or keyboard. So it's not likely to sell in its hundreds for quite a while.

## Mock turtle

Yet another version of the Logo language (that's the one that draws pictures by directing an imaginary turtle around the screen with his tail dripping ink) has been launched from New York by Krell Software.

Priced at \$99, this one (like most Logo packages) runs on Apple II and is described as a 'no-frills' version. You get three disks, two containing a 'full authorised MIT copy-righted version of Logo' and the third with 'invaluable MIT applications, including Dynatrack, Rocket, Animals, The Sound Editor, The Shape and the Logo Assembler,' says Krell.

Details from 1320 Stony Brook, NY 11790; tel (516) 751 5139.

## Zilog flood

Around a year ago, we all noticed (didn't we?) a lot of announcements of micro-computers based on the Motorola 6809, plus the beginnings of software support for those machines. Now the fuss has all faded into the background and we will continue to live in the real world of PETAppleTandy and

CP/M as before.

This year we must all try to convince ourselves that the flood of announcements of machines based on the Zilog Z8000, a powerful 16-bit micro, is not a similar silly season hiccup, and that in July next year we will start seeing a small flood of Nat Semi products as a slight intermission to the real world of IBM and Sirius.

Certainly there are some very nice machines based on the chip which won Adam Osborne's White Elephant Award in San Francisco last year (the award was not derogatory but a genuine triumph of tradition over metaphor). Olivetti, Onyx and others are selling, and others will appear.

The good news has been reinforced by Zilog drawing our attention to the fact that its silicon partner AMD has not, after all, backed out of its agreement to make Z8000 devices.

'The unfounded speculation,' said a triumphant Phil Pittman, Zilog UK boss (and ex-Sinclair designer) 'that has been rife concerning a possible rift between Zilog and AMD has now been very firmly squashed.'

He was referring to a new cross-licensing agreement for the whole range of Z8000 processors and support chips.

My own feeling, which isn't much more than opinion, true, nonetheless remains lacking in staunchness of faith, and I still expect the future to be a battle between Intel and Motorola, with Intel eventually winning in 16-bit designs simply by beating everybody over the head with IBM.

One other, small, point which I know Phil Pittman will be grateful for my remarking on: the 'speculation' was not 'unfounded' but 'wrong'. It was founded quite firmly on the news that AMD had signed a deal with Intel, based on the 8086 family of chips — and nobody is pretending that *that* agreement has been ended.

## One-chip modem

There is a big demand for telephone directories and it wouldn't exist without lots and lots of telephones. Similarly, when there are lots and lots of computer-phones (by which I mean modems that connect computers to the phone lines) there will be a big demand for things like Prestel and bulletin boards and useful stuff like that.

One step towards lots of modems is still missing: a cheap modem. Cheap, in this business, means using only a few chips. And I am therefore delighted to observe that Texas Instruments in France is putting together a one-chip modem for computers and Prestel sets.

The chip will not receive ordinary slow (300 bits per second) communications — which is a real shame, because there are quite a few people around who transmit that standard. However, it may not matter. It will receive at either 600 or 1200 bits per second, and it will transmit at 75, or 150, or 600, or 1200 bits.

Frankly, anybody who has ever used a 300 baud communications line will be delighted at the thought that this might become obsolete, because it is painfully slow. If you have a screen of data coming laboriously onto the display at 30 characters per second you can virtually read it as it is printed — and normally we want to read the bottom line first.

What makes the chip really interesting, however, is the fact that it will, according to TI, work with both European and North American standards — which means that modem builders who use this chip can expect a much bigger market than before — which in turn means cheaper modems.

By this time next year, we may see the first early production systems using it, I hope.

## Cash conference

Each year the European Information Providers Association (Euripa) runs a conference, which they call a symposium, and next year they plan to do it again.

This time the subject will

be rather more hardline than the previous rather woolly 'Role of the private and public sector in the information industry', and will concentrate on money.

'How to make money out of Information', then, will run from 17-18 March 1983, and details are available from 79 Great Titchfield Street, London W1P 7FN.

## Movie magic

Someone was asking recently what the point was of all this enormous drive to bigger and better machines.

Is it a plot, he asked, a scheme by the industry to get us to make our nice 8-bit word processing and spreadsheet machines obsolete just so we can chase after new 16-bit and 32-bit stuff? Who needs all the 'extra power' anyway? We can't type fast enough to keep up with the slowest micro today... and so on.

If any designers are reading, then here is a small inspirational idea along those lines. The first order for the world's most powerful computer available for sale is not from the weather forecasters, nor from the big banks, but from an animation outfit. It makes animated films.

No, it doesn't make cartoons. It uses the new super-Cray processor to plot the individual 'grains' of colour film and simulate photographic action. Working flat out, this outfit (Digital Productions Inc) used to be able



This Spectrum is disguised as a Red Indian brave because it wants to understand the IN and OUT commands. The two commands are on the keyboard but they don't make any sense to people who can't find the right pins on the connector at the back to watch them pulse. This Kempston product provides three 8-bit ports, for input and output. 'It's available fully built and tested together with a set of detailed instructions and control applications,' remarks the manager, Mr Pandaal. It costs £16.50.

A £17 motherboard is available, too. Details from Kempston Micro Electronics at 50 Adamson Court, Kempston, Bedford MK42 8QZ.

to churn out one whole frame in a quarter of an hour on its old Cray. On the new one, it will go a lot faster.

Apparently one frame per quarter-hour is around four minutes of film per month, and the new machine can give nearer half an hour's worth of action in that time.

Your average micro can't do this, nor anything like this. The fastest micro likely to be on the market in the next 12 months or so, based on a chip like National Semiconductor's 16032 (a quasi-32-bit design) would be pushed to plot two minutes' worth of movie viewing per year.

The thought, however, is this: drawing pictures is in many ways easier than recognising them. But the power needed to produce two minutes of movie that could be mistaken for camera film could be harnessed to the sort of burglar alarm that could tell the difference between a dog and a human, even if it didn't stand a chance of telling the difference between me and my aunt Maud.

And when Cray machines are priced at the level Sirius machines are today, an awful lot of dreams will suddenly become easy, normal and useful.

Think of the possibilities.

## Wedded bliss?

The word 'marriage' has been used by software writing company MSA to describe the integration of programs for giant mainframes and for individual micros.

What John Imlay, head of MSA, really means by this is complex, but the essence of the idea is that files of data produced by micros should be intelligible to the central computer in any organisation, and, similarly, that data produced by the central computer should be able to be processed by software running on any micros that the group might use.

As Imlay says, his company is 'in a unique position' to offer a range of software that fits this bill. MSA is, whatever rivals may say, probably the biggest specialist software-producing company in the world and it has bought Peachtree, one of the leading micro application producers.

This is not to say that all MSA software and all Peachtree software is automatically interchangeable. It means that one day, with luck, a lot of the newer stuff will be.

Some examples of the applications to be released over the next few months, according to the company's official statement, will include the following.

First, customisation of financial statements produced by MSA's general ledger, to add late changes, footnotes, etc, using Peachtree's word processing system PeachText.

Next, selection of information from big mainframe databases for use on MSA's Visicalc-type program, Peachcalc, 'for budgeting, planning and management analysis'.

Also, integration of the Peachtree Software order entry system will be possible on MSA's accounts receivable mainframe system, so that local orders can be processed centrally all together.

Possibly the most interesting application, however, is that financial and statistical data produced by each of MSA's systems will be transferrable to micros, and turned into full-colour graphics displays with Peachtree's new Business Graphics system.

What I like about the direction this is going is the fact that the micro side of the partnership is intended to enhance, rather than rival, the central DP department's work. It could lead to more co-operation between established and 'pirate' computer users inside corporations and, from that, the new business computing market will be able to draw rich nourishment in ideas, market opportunities and shared resources.

## Genie hi-res

High resolution graphics are now added to the Tandy look-alike Video Genie, for an extra £86.

The new device is the LE18 unit, which uses a separate 16 kbytes of memory to provide a dot matrix of 384 by 192 points, which is some 73,000 points — almost exactly 73 times as many as the Tandy normally has.

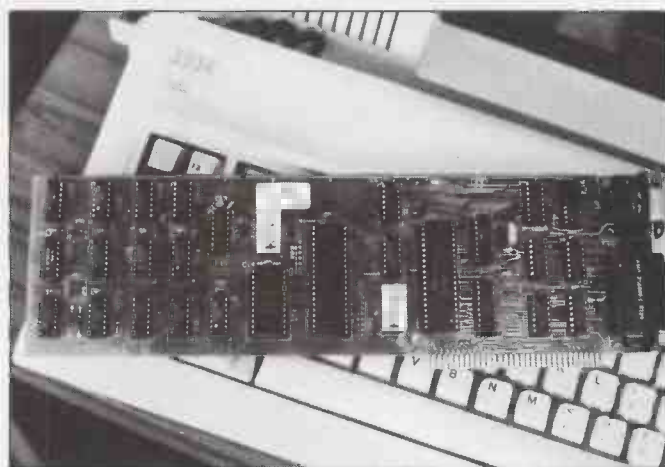
New commands in TRS-80 Basic (needed to control this video memory) include PLOT, VECT, FILL, REV, CLR, DISP, HOLD and VIEW. 'In addition, a scratch pad memory allows animation and the use of programmable graphics characters, and the unit can also produce reverse video displays,' says Lowe Electronics.

Lowe is the UK distributor of Video Genie, having sold some 10,000 machines here, but this product is its own design. Details on (0629) 2430.

## 'Allright,' says the Squire

What I like most about a certain part-time director of ACT and general micro entrepreneur (Julian Allason is his name) is his irrepressible optimism. It currently covers the new IBM operating system, MS-DOS.

Allason has released a fervent dose of enthusiasm in conjunction with his associate Christopher Preston on a brand new 'Research Brief' which appears to be the first of a series. It is quite cheering to be told, for instance,



that 'Microsoft claims MS-DOS is almost 100 per cent compatible with CP/M' or that Allason Associates' tests show the new system to be up to three times as fast at reading disks as CP/M-86.

I hope that in future research briefs we will be offered rather more on the differences than on the similarities. CP/M itself differs from CP/M-86 more than MS-DOS appears to here, and I feel there must be more to it, somehow. But it is all very cheerful reading. Contact Allason at PO Box 2, Goring, Reading RG8 9LN for his future plans.

## Tango time

Tango is a dance: it is also the colour, believe it or not, of the paint on ICL computers (hence the fact that people often refer to ICL computers as orange boxes).

A Tango-Lynk, then, is the device which links something to an ICL mainframe. The something is an IBM Personal Computer, and thereby hangs a long tale, mainly about Network Designers and a firm called Telecomputing.

Telecomputing was a software firm which wrote and sold excellent software to allow ICL users to drive their computers from remote terminals. The Telecomputing software was generally agreed to be better than ICL's own software for teleprocessing, and ICL junior operators promptly arranged to do everything in their power to harass the company for showing them up. It ended up with Telecomputing getting close to a million pounds in an out-of-court settlement.

Network Designers is a company with a lot of names at the bottom of the letterhead, which are the same names as used to appear at the bottom of Telecomputing's paper.

What happened was that the company found that they were making a lot of money out of selling their software — but a lot more out of selling an over-engineered, over-priced, and (it turned out) unreliable design of micro made in Australia.

## See 'Tango time'

Having disentangled themselves from that group (not without strife) the directors selected a better micro, and have gone back into selling software which helps you to drive your ICL mainframe through a micro.

The only difference is that this time they have picked the IBM personal micro as the box which you sit at. You plug in the board (illustrated) and run Network's Tango-Lynk software.

Anybody who wants to use a different micro to drive their orange box, contact Network Designers on Oxford (0865) 776888. They will probably prove sympathetic.

## No scrumping

In this country, Bill Unsworth reminds American readers, the verb 'to scrump' means to steal apples. So to unscrump is to prevent them being stolen, hence the name U-NSCRUMP for his software protection device for the Apple II.

Unsworth notes that hardware protection of software is 'more attractive' than disk protection because it allows backup copies to be made of program disks, and also allows the user to run the program on hard disks or on 8in floppies.

U-Microcomputers plugs the device into the expansion bus, not into the games port, which allows the user to have the games port working but clutters up the bus.

The device is now available for evaluation at £28, and at that price, notes Unsworth, 'will be used with the more expensive business, scientific, and professional packages'.

I don't want to spoil his market, but beside the simple fact that I hate these protectives, I really query their value.

Whatever theory you may produce to explain 'lost' revenue due to pirates, you will still be the first person to manage the trick, if you can produce any evidence that software houses which use protectives make any more money than those which don't.

Visicalc has made a mint and is theoretically 'protected'

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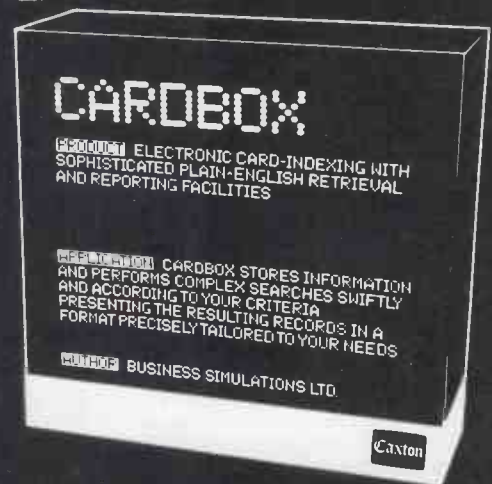
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and all I can say to that is that it has also made a mint for the bright sparks who sold programs to unprotect it. Wordstar has made a mint, and isn't protected at all from the user.

Anyway, Unsworth is on (0925) 54117/8 in Warrington.

## Not as bad as it sounds

A good indication of the strength of a new product is the list of things that the proud inventor compares it with. The inventor of the Nippon-Univac micro compares it with the IBM Personal Computer (not launched in the UK), with Burroughs' new micro (can't recall hearing about it, can you?) and the enormously successful Apple III, of which so many have said 'when is Apple going to launch the Super II?'

In other words, it's slower than a speeding bullet, can leap over the Empire State Gutter in a single bound, and so on — you deduce. Well, no, it's a bit better than that.

It actually looks to be a reasonable middle-of-the-road sort of beast, capable of selling a thousand or so systems if only it had been launched a couple of years ago. For just under £2000 you get an 8085-based system with CP/M 2.2 and two medium-capacity small disks. That compares reasonably well with the ICL Personal Computer which 'stands out from the crowd' as Martin Banks so caustically observed last month.

Distribution is (sensibly, I would say, in the circumstances) not going to be done on the scale that ACT is pushing the Sirius 1, but will be 'a small distributor network in the UK', according to Peripheral Hardware Ltd, the importing outfit, which can be contacted on 021-745 3033.

## Psychobabble seminars

Computertown USA may have inspired David Tebbutt to start pushing the idea of ComputerTown UK — but the two projects are as unlike as cricket and baseball.

The American version started off as a club in the Menlo Park (in the middle of Silicon Valley) library, for children. It has now become a 'microcomputer literacy project funded by the National Science Foundation' and has announced the selection of its 'official Western US Test Site', in Wenatchee Valley College (in Washington State).

The idea of a Test Site, it seems, is to develop a 'package' which provides 'suggestions for creating

hands-on, public access events, conducting workshops, giving classes, establishing outreach activities, and locating and procuring funding and support,' remarks my handout incomprehensibly.

I wonder if the Americans know what 'quango' means.

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## Cheap but outmoded

Texas Instruments in the US is singularly stubborn about admitting to problems on the basic design of its 99/4A 'home computer' which has received new price cuts here in the UK.

The company says that this year is the beginning of the 'long-awaited' boom in home computers, according to American journal *Electronics*, and is accordingly diverting production resources from the 'soft' terminals market into the 99/4A. The company has already got production economies to the point where it can be sold for \$199 in the US.

Even so, I'll be surprised if that makes it the success of the decade. It's nice that it can talk — but what else can it do that isn't way out of date? Can it play Pac-Man?

Come on Texas, give us a really new design. You can do it, you know you can.

Not surprisingly, the price cuts in the US have been reflected by a drop here, too — to £200.

The company has also announced expansion facilities. You can now buy the illustrated box to plug expansion cards into, plus a floppy disk drive.

## Mega-memory

Two megabytes of disk on a Nascom computer would be something to nod solemnly about, say 'nice' and forget. Two megabytes of silicon chip memory, however, is something else.

The trick has been done by MAP 80 Systems, which has produced a memory board with 64 kbytes of memory chips on it, for £150. That includes all necessary decode circuitry for the expansion of up to eight such cards, which can take a total of 256 kbytes each.

The method that MAP 80 has used is to treat the memory as if it were a very fast floppy disk, which means

that you can abandon your silly dream of writing a single program two megabytes long. And of course you will have to adapt your software to the system to take full advantage of it.

But the trick is now quite widely done, and it is nice to see it performed on the Nascom family, which includes the Gemini and new Galaxy range of machines as well.

Details from 333 Garratt Lane, London SW18; phone 01-785 9721.

## Neat hi-res

A quick trip to the Notting Dale Technology Centre recently revealed, in the middle of a mass of micro bric-a-brac, a rather neat little graphics add-on for the ZX81.

'81 owners who, for varying reasons, would rather keep their old faithful than sell it and fork out for a Spectrum can upgrade the graphics powers of the ZX81 to a higher-than-Spectrum resolution for just £27.50.

The graphics board will allow you to define your own characters using POKE in a rather similar way to the Spectrum's use of BIN and to fill in shapes in varying shades and textures. It adds considerable power to the individual ZX81 graphics commands to enable the use of this extra capability without your having to learn a whole lot of new reserved words.

The only serious limitations it has are that it cannot be used with some of the 64k RAM packs, as these use areas needed by the board.

The board needs at least 8k of RAM but cannot be used with some 64k RAM packs as these use areas of memory required by the board. Also, the G007 (to give it its proper name) makes the ZX81 behave in a rather odd way, compared to its normal habits and this is a little hard to get used to at

first. However, the board comes with full and clear documentation which explains what you can expect to see.

The board was designed by Gary Keall, originally as a hobby project and is now about to go into production at Information Technology Centres throughout the country. It will be on sale from 1 October. For more details contact the Notting Dale Technology Centre on 01-969 0819.

Maggie Burton

## Top of the pops

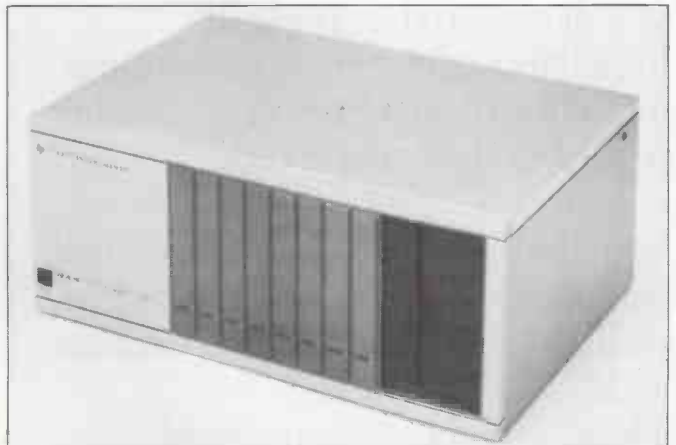
There are some cynics who feel that the micro business is rapidly becoming a branch of show business, complete with smash hits, cover versions and superstars. What is needed to support this jaundiced view is a hit-parade; a micro Top Ten.

BIS-Pedder have for nine years published an annual Census of Information Systems and in a recent press release they summarise some of the findings of this year's survey. The whole thing makes fascinating reading as it documents the spectacular plunge in mini-computer sales. But the really fun part is a pair of tables which rank the numbers of units shipped in 1981 for general purpose computer systems under £15,000. These have in effect become a hit parade for personal computers as the mini-manufacturers slip out of the top ten.

One difference between records and computers of course is that there isn't a standard price, so you have two top tens; one by units shipped and one by value shipped.

Here then are the top of the pops in 1981:

| % of units shipped |                    |
|--------------------|--------------------|
| 43.3               | Sinclair           |
| 8.8                | Commodore          |
| 6.7                | Acorn              |
| 6.6                | Lucas/Nascom       |
| 5.7                | Apple              |
| 3.6                | Lowe (Video Genie) |
| 4.4                | Sharp              |
| 2.6                | Tangerine          |
| 2.4                | Tandy              |



See 'Cheap but outmoded'.

# "Something tells me Sydney's Apple III has solved his accountancy problems."



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business functions like sales forecasting, modelling and analysis. So they soon become a lot more ordinary to you than they sound at the moment.

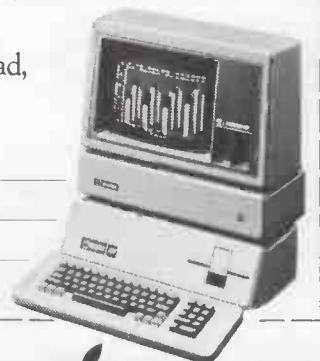
Suddenly you'll see charts and graphics that make complicated business equations simple and easy to consider.

And when key functions like those become easy, small businessmen suddenly have the time and confidence to think about getting bigger, and more profitable.

\*For details of the comprehensive range of Apple III software, write to the Sales Desk, Apple Computer UK Limited, Eastman Way, Hemel Hempstead, Hertfordshire, HP2 4YE. FREEPOST

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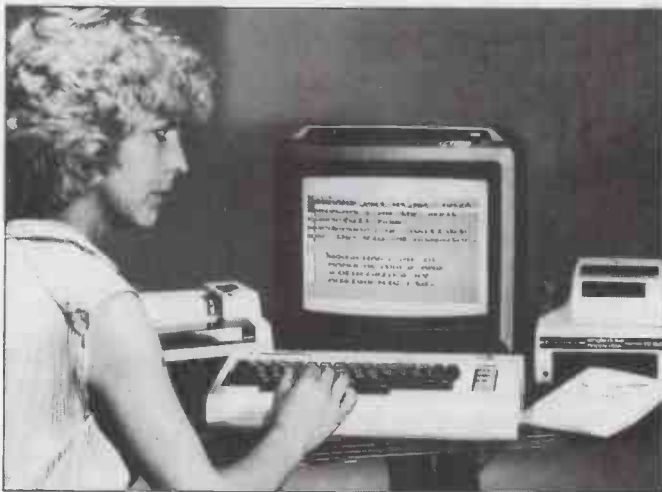
Address \_\_\_\_\_



The personal computer.







## Bludners extra

There were a couple of bugs in the DIY Logo program printed last month (page 156). Here are the corrections needed.

The QUIT statement mentioned in the article is not in fact implemented in the listing. To make it work add this line:  
 4084 IF SYSS="QUIT"  
 THEN I=0 : GOSUB 9010 :  
 GOSUB 28000 : GOTO 4200

Set K8 in line 10050 to 35 and add this line:  
 10170 R\$(34)="QUIT":  
 R\$(35)="AND"

This also corrects a bug which would have allowed

you to define a procedure called AND despite the fact it is a reserved word.

Finally the RIGHT statement as written in fact moves left on the screen! To alter this change AN-C(S) to AN+C(S) in line 23500.

Some readers have queried the ON...GOTO in line 20130 which has three apparently unresolved line references. These values should never be selected unless there is a typing error somewhere else in the program. If it disturbs you it would be best to write error traps for the three lines involved, 23600, 23700 and 23800.

See 'Not so silly'.

|                       |      |
|-----------------------|------|
| Intertec (Superbrain) | 1.5  |
| % of value shipped    |      |
| Apple                 | 14.2 |
| Commodore             | 9.2  |
| (Olivetti)            | 4.4  |
| (CAI)                 |      |
| Tandy                 | 4.1  |
| Data General          | 3.4  |
| Intertec              | 3.2  |
| Sinclair              | 2.9  |
| ITT                   | 2.3  |
| BCL                   | 2.2  |

These are only figures for new business in 1981 and don't reflect the size of the installed base. If you need more comprehensive information on the state of the micro marketplace get in touch with BIS-Pedder on 01-633 0866 (Philip Hammond or Derek Pedder).

## Not so silly

You have to give Audiogenic some points for candour, in launching the well-known Commodore PET-based word processing package on the 20-characters-per-line VIC. Not everybody in the world would actually display a photo of what the text looks like if it looks like this, would they?

For those who don't have a VIC, however, it is worth saying: it looks sillier than it is. Remember, those who actually do have one will probably want to write notes with it some time, and now they can. The rest of us have been warned.

You buy the software as a plug-in cartridge for £125, including an extra 8 kbytes of memory. Details from Audiogenic at PO Box 88, Reading, Berks; tel 0734 595647.

## A fit of the vapours

We PCW types love good esoteric jargon; we have crazes which last for weeks on particularly barbarous jargon words. Sometimes we go as far as to deliberately introduce them into articles as a sort of private joke or dare, but usually we restrain ourselves and keep them for



office circulation only. A favourite for many months was 'orthogonal' used in such contexts as 'this coffee isn't very orthogonal' or 'that's a rather orthogonal shirt you're wearing'.

'Functionality' enjoyed a considerable vogue, especially when combined into such hybrid horrors as 'just nip out and probe the periphery of the functionality envelope of the coffee machine please'.

We were therefore tickled pink when Chris Buckham of ACT brought us back a real live specimen from the West Coast, namely 'vapourware'. This fascinating concept refers to software which has been announced but doesn't exist yet; there is a lot of it about (or not about, depending on the philosophical school to which one belongs). We don't imagine that Chris heard the word used in connection with any Sirus products of course.

The principle established in an excellent one and we hope to add to the list of 'wares'; for instance 'fogware' could be undocumented software. We leave the definitions of 'rubberware', 'noware', 'someware' and 'edgeware' to the readers.

This picture is a good example of the limitations of providing information on paper, printed in black ink. If PCW was an entirely electronic magazine (and who knows, maybe it will be in 10 years' time), you would be able to appreciate to the full this picture of Rair's latest terminal, the ColorScan 10.

As its name implies, it's a colour terminal and can display up to 256 'unique symbols' per character set, which, says Rair, is 'especially useful in business applications requiring display of forms or bar charts'.

In case you're one of the few people left who seriously think colour computers as strictly for games, let me remind you that colour actually provides an extra information channel - and for that reason we'll be seeing a lot more business computers with colour as standard, soon.

One thing which Rair (phone 01-836 6921) doesn't say about the ColorScan 10 is its price, so you can be sure it ain't cheap!



*'I'm sorry, Mr Harris, but being able to get by in Pidgin-Fortran isn't quite good enough.'*

# NAMER OF THE NAMELESS

*Dick Pountain writes on a little-known mathematical calculus which could have some importance for computing.*

無名天地之始

In 1969 I was a newly graduated biochemist with a keen intellectual interest in maths and philosophy and a keen practical interest in pharmacology. I shared a flat in Notting Hill with several others of like inclination and this flat was filled with many esoteric books of great obscurity. One day I perused a book called *Laws of Form* by G Spencer-Brown. I was unable to understand it on that first reading and decided that it was probably cranky, like most of that mountain of books. It left an impression, though, and I never forgot it; I had a vague feeling that it might in fact have been profound, and felt a certain guilt at not having persevered.

Some eight years later I was flicking through my *New Scientist* when I came across a news piece: the Four Colour Map Theorem had been proved. This famous theorem of topology had resisted proof for more than a century and was a kind of Everest for topologists. It had been proved by one G Spencer-Brown using a fairly short and elegant proof. Around the same time a group of Americans reported a proof by a brute force method using some hundreds of hours on a fast mainframe computer. My mind was forcefully sent back to *Laws of Form* (which had long since disappeared along with several of the people). I scoured Foyles, Dillons and such only to find that it had been out of print since that first edition. Eventually I found a mathematician friend who had a copy which he grudgingly parted with for two weeks. In those two weeks I read it again three times making some progress but still being very far from understanding it.

About this time my involvement with PCW began and I raved somewhat intemperately about the book to David Tebbutt, the new editor, one day. Some weeks later he returned from his first visit to the West Coast Faire and presented me with a brand new copy of *Laws of Form*. It is alive and well and published in paperback by Dutton of New York. According to David it has a certain following among the Artificial Intelligence community in Stanford.

I'm telling you all this to persuade some of you to seek it out and read it because of my faith in the personal computing idea; with so many people out there now possessed of computing power it is just possible that one of you might use the concepts contained in *Laws of Form* to stand computing on its head. I doubt that it will be me, unfortunately.

*Laws of Form* is about logic — sort of. In fact it is about something below or behind logic. Anyone who knows Basic knows something of the algebra

invented by George Boole, though probably not in any rigorous or formal way. Boolean algebra is a notation which allows logical propositions to be expressed as algebraic equations, these being solved by a set of transformation rules to establish the truth value of the original proposition. In Basic it shows up as your AND, OR and NOT and those flag variables which only have the value TRUE (1) or FALSE (0).

Now algebras are abstracted from arithmetics ( $a+b=c$  expresses the form of all such arithmetic sums as  $2+3=5$ ,  $4+5=9$ ). But Boole's algebra was born fully grown as an abstract system to solve problems in logic. The lack of an arithmetic of which Boolean algebra is an abstraction went without notice for 120 years until G Spencer-Brown (aided by his late brother D J) produced this arithmetic. This is the subject of *Laws of Form*.

This arithmetic is non-numeric and is very simple indeed; so simple that it is extremely difficult to understand. That is not just a cheap paradox. Spencer-Brown (GSB from now on, begging his pardon) devotes a preface to warning of the difficulties in store for the reader; these are not due to any mathematical jargon, for the book is written in plain and nicely turned English and doesn't require formal maths training to read. The difficulty will be just as great for mathematicians as non-mathematicians because he is describing concepts which are almost too simple to be expressible in language. The notion of number and counting is formed very early in human beings (some people believe it's innate) and it is an obstacle to understanding concepts which are more primitive than itself. GSB's Primary Arithmetic is easier for amoebae than humans.

The argument starts from the idea of distinction. A distinction 'severs or cleaves' the space in which it is drawn, like the circumference of a circle in a plane. The space is now in distinct parts and one part can only be reached from the other by crossing the boundary drawn by the distinction. This act of crossing is given a symbol  $\sqcap$  which is in fact the only symbol in the arithmetic. It represents the 'marked' state (a distinguished state). The unmarked state is represented by a blank space. I should hasten to point out that GSB develops this rigorously. I'm cutting corners for reasons of space and pace.

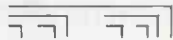
Two laws, the law of calling and the law of crossing are taken as axioms and lead to a pair of primitive equations: 2

and  $\sqcap \sqcap = \sqcap$   
and  $\sqcap =$

and the calculus based on direct deri-

# BRAIN DUMP

vations from these equations is the Primary Arithmetic. Expressions made up of any number of these 'crosses' to any depth of nesting can be produced and simplified to give a value which is either  $\top$  or  $\perp$ . An example is



which has the value  $\top$ .

Small wonder that the opening page of *Laws of Form* contains a quotation in Chinese from the Tao Te Ching which goes 'The nameless is the beginning of heaven and earth. The named is the mother of ten thousand things.'

At this point you are probably wondering whether anything concrete can emerge from such a notation. Patience please.

Having proved a number of theorems in the arithmetic, GSB introduces variables or unknowns and so creates the Primary Algebra, which is by no means similar to Boolean algebra though it can be interpreted to give Boolean algebra and more by identifying cross with truth and blank with falsehood.

An expression in the algebra looks like  $\neg a$  where the value of  $a$  is unknown. By deriving a series of nine consequences to which he gives significant names like 'reflexion', 'generation', 'iteration' it is possible to simplify such expressions though they do not always reduce to a known value.

The fireworks now begin. Boolean algebra is based on a set of postulates (ie, unproven assumptions), the exact nature of which set has been the source of much investigation. GSB proceeds to take one such set (Scheffer's Postulates) and prove them all in one page using the algebra. He goes on to demonstrate the interpretation of the algebra for logic. Massively complex syllogisms can be reduced to conclusions with astounding ease when compared to the laborious application of Boolean algebra and de Morgans theorems. At one point it is shown that all of pages 98 to 126 of Whitehead and Russell's 'Principia Mathematica' can be reduced to a single  $\top$ .

But the application to logic is a minor incident on the way. The Calculus of Indications, to give the system its full title, is of much greater generality than any logic.

In a breathtaking final chapter GSB introduces the idea of imaginary values by allowing the creation of re-entrant or recursive expressions. From this in a few short pages he produces expressions which demonstrate oscillating values, and can emit 'waves' which propagate through the space containing the expression. In other words, starting from two simple axioms and a simple notation he has produced expressions which can model the behaviour of the physical world of quantum mechanics.

In fact the calculus provides a general theory of forms which does not merely describe different forms but shows how they all emerge from the original form of distinction. Numbers and counting are derivable as interpretations at quite a low level.

At this point, having indicated just how far one could go with the calculus, he stops with what is perhaps my favourite sentence of all: 'This book is not endless, so we have to break it off somewhere. We do so here with the words

and so on.'

This last chapter contains the key to the solution of Boolean equations of the second and higher degree, which is the method the Spencer-Browns used to prove the Four Colour Theorem and which they put to practical use in designing complex switching networks for British Rail. I cannot pretend that I understand it well enough to either explain it here or to use it myself.

That then is a brief and clumsy account of the importance of *Laws of Form*. Why should PCW readers be interested? For a whole stack of reasons, the first and best of which is that it is a challenging and exciting book, written with an elegance and wit which is almost extinct in modern

science. If you like mental exercise this will stretch you even more than 'Godel, Escher, Bach' and with more immediately usable results.

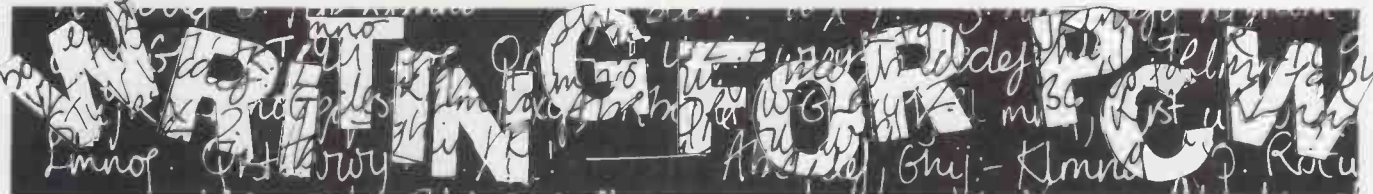
The first project I thought of connected with microcomputing was the obvious one of writing a parser and evaluator to simplify expressions in the calculus. This is not at all an easy task because the calculus relies so heavily on the cross notation, which is simple and beautiful but highly unsuited to character-oriented micro displays. The trouble I had typing those examples above using Wordstar testifies to that. It's probable that you would have to reduce this notation to something rather like the nested brackets in Lisp to make it work; in fact all kinds of half-formed analogies with Lisp enter my head whenever I read the book.

But the really exciting idea which I can't shake off is that of a language which uses the Calculus of Indications in the place of Boolean algebra. Or, to go the whole hog, a processor with this logic implemented in silicon. I'm in way over my head with this sort of talk but everyone nowadays seems to be talking about non-von Neuman architectures as the next generation of machines; is it possible that higher order Boolean logics may have a role to play too?

At any rate I hope I can stimulate a few readers to find the book (it may well be in print here again by now), read it, assimilate it (which will take about eight readings unless you're a lot smarter than me) and just maybe go on to do something amazing as a consequence. It is not as well known as it ought to be and it's nice to have a platform like this to boost it from.

PS. Professor G Spencer-Brown is alive and as far as I know well and living in Cambridge. Should he by any remote chance read PCW I'd like to apologise here and now for the roughshod way I've trampled among his ideas.

(*Laws of Form* by G Spencer Brown — E.P. Dutton Paperback, New York 1978.)



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you

should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

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 will give us a sound basis for discussion. Please give us a daytime phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications —

experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading PCW will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — PCW does pay for all published work.

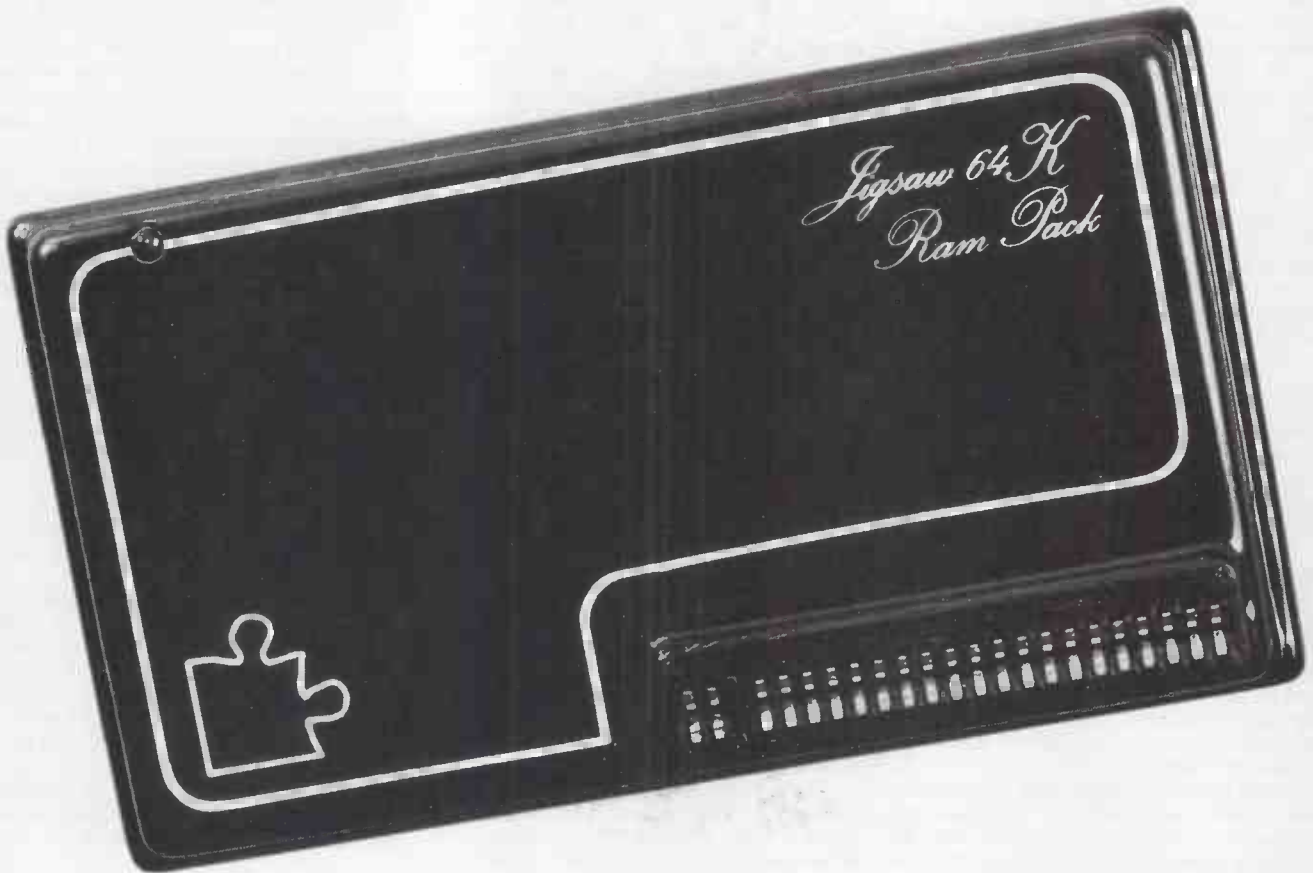
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# CTUK!NEWS

by David Tebbutt



You can always tell when summer comes — the number of ComputerTowns starting up drops to zero. Still, we are getting letters from people willing to have a go in the autumn.

Mr Ravinder Bahra writes from Blackheath to say he'd like to be involved in starting a local 'Town. If you live nearby and would like to help, why not write to him at 218 Shooters Hill Road, SE3?

Nottingham looks as if it might be getting its second local ComputerTown — this time in Eastwood. If you're interested in joining in, give Ted Ryan a call on Langley Mill 65011 or write to him at 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

John Davies writes from the Pinner and District Community Association to say that the ComputerTown project looks like a good idea. John can be contacted at 14 Kingsfield Avenue, N Harrow, Middlesex, H42 6AH.

Not far away, in the London Borough of Brent, John Clarke has located four libraries which would like to start their own 'Towns. Staff from the libraries have been in touch with their Harrow and Rayners Lane counterparts and, Presumably, liked what they saw.

If you're with the people at BFPO58, you will find that Cpl DP Morgan would like to hear from you. He's with 3 Squadron, 9 Signal Regiment and, hav-

ing recently started a computer club, he's now thinking of a ComputerTown too.

Now for news from existing 'Towns. First, Alan Waring has sent the names of the secretaries of the three ComputerTowns he helped found. If the PCW system worked this month, they should now be listed under ComputerTown Contacts at the back of the magazine.

By the time you read this, a very brave man called Frank Fadipe will have organised and run a ComputerTown Week(!) with the help and support of the Ruislip library staff. He has managed to persuade all sorts of people to participate, including several local computer firms. Next month I hope to bring you a blow-by-blow account of how things went.

Do you live in Staffordshire? Do you have any influence over decisions of the Library Committee? If the answers are yesses and you think that ComputerTown should be given free space for its meetings could you please whisper in the appropriate ears. At the moment, of course, each meeting costs the organisers money. Since everything about ComputerTowns is voluntary and free, this seems to go against the spirit of the thing.

We're on Prestel! Thanks to the efforts of Vernon Quaintance, Greater London ComputerTowns are being put

on at the moment. If all goes well, Vernon hopes to have the space and information to set up all the ComputerTowns. If you'd like to have a look, the pages start at \*35748111 # for the moment.

Soon, you will be seeing another name associated with this column. Maggie Burton will be sharing ComputerTown work with me on the grounds that I'm not always available when I should be. Maggie has been working on PCW for the last year and is particularly interested in seeing the ComputerTown Project go well. So, if you have anything to say, you can say it to me or Maggie at one of the addresses in the box below.

We both look forward to hearing from you.

For further details of CTUK! write to: CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU, remembering to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone PCW for information because this project is entirely a spare-time activity.

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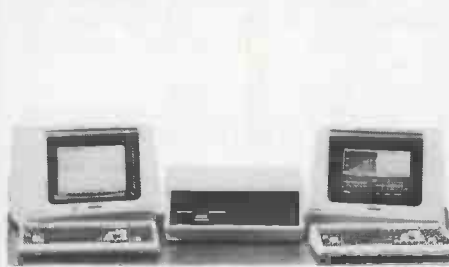
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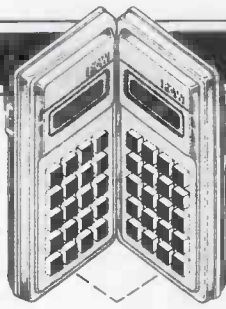
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# SHARP TIPS

Some useful programming tips for the Sharp PC1211 or Tandy Pocket Computer

After the hectic Quirkology of the last few months I'm taking a bit of a rest this issue and handing the column over to Simon Maycock of Oldham. Simon has sent in some programming hints for the Sharp PC1211 — or, to be more exact, for the Tandy Pocket Computer, which is what he owns.

Seeing his piece reminded me that I have somewhat neglected this machine in the last year; the introduction of the PC1500 in no way diminishes its interest as there must be an awful lot of units out there in either the Sharp or Tandy guise. The tricks presented here allow proper multi-record data files to be handled and also provide an insight into the way that PC1211 Basic is tokenised in memory.

Dick Pountain

The PC1211 has the useful facility of being able to GOTO a label, eg,  
10 GOTO "L1"

```
20 .....
30 "L1" : .....
```

This may be used advantageously in several situations.

The first arises in the context of performing different actions depending on the value of a string, eg,

```
10 INPUT " INSERT(I),DELETE(D),
   END(E) ?" ; Q$ : GOTO Q$
nn "I" : ..... GOTO x
mm "D" : ..... GOTO y
pp "E" : ..... GOTO z
```

In fact this is similar to the Pascal CASE construct:

```
10 READ (CH) ;
20 CASE CH OF
30 "I" : ..... ;
40 "D" : ..... ;
50 "E" : ..... ;
60 END; (* OF CASE*)
```

providing x, y, z are the same. Note a syntax error will occur if Q\$ is given a value which is not used as a label name.

The second use is similar, ie, to access data embedded in the program body using a named selector. For example, to act as a portable phone or address book.

```
nn "I" : INPUT "NAME?"; N$
   GOTO N$ (alternatively GOSUB N$)
mm "POLICE" : PRINT "999" :
   PRINT " LOCAL = 3278" :
   GOTO "I" (or RETURN)
pp "DOCTOR" : PRINT "456789" :
   GOTO "I"
qq "....."
```

A syntax error will again occur if the name is not catered for; however, with such a limited memory a properly structured program, liberally annotated with comments is only normally attainable at the expense of variable space.

## File handling

The cassette interface allows the computer to CSAVE and CLOAD named pro-

grams, also INPUT# and PRINT# are provided, allowing the memory variables A(1) or A\$(1) up to A(n) to be saved and loaded from tape. n depends on the program size and is typically 130.

An optional part of these instructions is from what memory to start the output, input — eg,  
INPUT# "DATA1" ; A(30)  
will load the internal memory from A(30) upto A(n) with the data file "DATA1" on the tape.

An obvious consequence of the '... up to A(n)...' is that if only a few variables are to be saved then it is not sensible to put them in the low numbered memories, as the rest of the memories will be dumped onto tape as well.

One way round this is to maintain a pointer in the program which is initialised to the top of the variable memory space and as successive variables/data are created the pointer is decreased, then when the memory is dumped onto tape the value of the pointer is specified so that only the required memories are saved.

For example, details of a bank account could be saved in blocks of five memories

```
A(x) = cheque number
A(x+1) = value
A(x+2) = date (dd.mm so that days and
month can be separated using INT)
A$(x+3) = comment1
A$(x+4) = comment2
```

In the following procedures T denotes the top of the memory; its value (a multiple of five) can be determined when the program has been written. P is the pointer, it is initialised to T, and as successive records are created it is decremented by five. All the variables A to Z are preserved.

```
10 T=.....:P=T
20 REM INPUT RECORD
30 "Y" : IF P = 30 PAUSE "NO MORE
   SPACE" : GOTO "DUMP"
40 P=P-5
50 INPUT "CHEQUENUM" ; A(P)
60 INPUT "VALUE" ; A(P+1)
70 INPUT "DATE(DD.MM)" ;
   A(P+2)
80 INPUT "COMM1" ; A$(P+3)
90 INPUT "COM2" ; A$(P+4)
100 INPUT "CONTINUE (Y,N)" ;
   Q$ : GOTO Q$
110 "N" : REM LAST VALUE
   INPUT
120 "DUMP" : PRINT "TAPE ON
   REC"
130 PRINT# "DATA" : A(P)
```

The above 'Dump' routine does not record the value of P; this can be remedied by preceding 'Data' by a definition record, which contains the values of P (and can be extended to contain the date the file was created etc).

```
120 "DUMP" : PRINT "TAPE ON REC"
130 A(T)=P
140 PRINT# "DEFN" ; A(T)
```

150 PRINT# "DATA" ; A(P)

This duplicates A(T) but providing there is no more space after T the "DEFN" will be a very short file.

An appropriate read program could be:-  
10 "READ" : PRINT "DATA TAPE ON  
PLAY"

```
20 INPUT# "DEFN" ; A(T)
30 P=A(T)
40 INPUT# "DATA" ; A(P)
```

Note that these two routines effectively reverse the order of the records in the memory — if the order is important this can be overcome by using the Basic equivalent of a Downto loop in the processing program:  
FOR I=P TO T-5 STEP 5; REM  
PROCESS IN REVERSE ORDER  
FOR I=T-5 TO P STEP -5; REM  
PROCESS IN ORIGINAL ORDER

The above ideas have been successfully used in a series of programs to produce and maintain a record of a current bank account, and calculate balances and trends.

Another interesting point is that when programs are written the memory space for use as variables is gradually reduced. However, if program lines are deleted then these memories become available again. Looking at the contents of these memories reveals that they are full of apparent junk and non-numeric symbols. However, by typing characters into lines of programs, then deleting, and then finding the highest memory available ((A(n)) it can be seen that this 'junk' contains an itemised copy of the line. (Reading from right to left). The character set seems to be in some form of hex, since the following sequence commonly occurs:-

```
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., E, %, ¥, $, ,,
the alphabet is itemised as follows:-
A=51, B=52..... I=59, J=5., K=5E,
L=5%
M=5¥ (this symbol produced when shift
Y is entered), N=5$,
O=5π, P=60..... Z=6.
```

All the other symbols have a representation, and Basic commands also have a code — eg:  
PAUSE = ¥.  
PRINT = %1  
GOTO = ¥7

As an example: if NEW is entered, then CLEAR (in PRO mode) A(204) is the highest memory, so if 10:PAUSE A is entered, then 10 is entered (to clear line 10), examining A(204) gives 0.00015.¥01

Since the code for A=51, PAUSE=¥., we can split the line up:  
0.000 15 ¥ 01  
shows these itemised (in reverse order) with the line number at the 'front'.

This is the only explanation I can conceive for this 'junk' and I would appreciate anybody enlightening me further.

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# A GROSS OF FRESH SALES STAFF, PLEASE...

*Brushing off the sales talk, Martin muses on micro marketing. . .*

'Hello.' He was tall, angular, and his mohair suit had obviously just come from its third visit to the smoothers.

'Hello.' He repeated his greeting as I sat at my desk wondering what other stunning utterance would spring forth to shatter my concentration. It would come in time; it always did.

'My name is Smith, and I was wondering if you might be interested in some office supplies. You know the type of thing. I have a lovely line in carbon paper, glossy one side, matt finish the other. I have 47 different sizes of typewriter ribbons — they're assorted makes as well, so the customer gets the maximum choice, I have little spray cans of Klenelugs, that's the stuff for cleaning telephone handsets. I have a nice line in personal business computers. Then again there is. . .

'Hold on there, son,' said I. 'I could be interested in a computer. What type is it?'

'Well it's a . . . let me look at the brochure. . . ah, it's a Widget.'

'Is it the 48k version running on CP/M or the original 16k that used that wally operating system that no one ever produced any software for?'

Well, it seemed a fair question for me to ask. After all, I'd read a bit in the magazines about how Widget Computers had completely redesigned its product range so that it could sell some.

He looked perplexed. You can always tell when a sales person is perplexed — his eyes meet in the middle. 'What's software?' he asked. I just asked what the discount was for cash.

Thus ends Scene I, Act I of a play that will almost certainly be performed up and down the country more and more in the future. It is also a precursor to this month's piece and is, for reasons of propriety if nothing else, totally *unconnected* with what follows. What follows is a company's stated intentions. What has already passed is pure fantasy, right?

A few months ago now, Osborne Computers in the UK, the subsidiary of the company that is scaring the financial pants off some others by refusing to roll over and die, held a press conference. At this affair, its management made a significant announcement. It was significant because of the basic idea involved and also because of the numbers being bandied around to flesh the idea out.

Perhaps not surprisingly, there is some tenuous connection between the subject of the press conference and the foregoing scene. Yes, the press conference was called to talk about sales and marketing, and the way that Osborne Computers intended to set about it in this country.

To put this in perspective, there is need for just a little history. The

company, the offspring of Adam Osborne, is less than a year old as a legal entity, with a product that many have defined as 'rubbish' and other 'ong words of a deprecatory nature. The product, the Osborne 1, took run-of-the-mill technology and run-of-the-mill software, put them together in a portable box that had an apparently unusable screen, and sold it at a silly price. The company seems set to exceed \$100 million sales in its first year, which is good going for rubbish.

Unlike earlier successful, and unsuccessful, machines, the Osborne

was tailored for a specific market. With its built-in facilities, its attendant software and its portability, it was a natural for the professional and business market.

Having now dispensed with the history, we move back to the point of the press conference. How will Osborne in the UK move to meet the potential sales demand it expects to find — nay, not only expects but has sales projections to justify the expectation?

The company's objective, as stated at the press conference, is simple. It plans to have about 60 retail outlets around



Illustration by Will Hill



the country by the end of the year(ish). For the type of product the Osborne 1 is — a directly business-oriented machine despite its low cost — the general consensus of opinion suggests that this is a good number of outlets with which to sensibly cover the country.

To this will be added a number of OEM-oriented outfits, the type of company that buys the machine as an engine for its own 'unique' software products..

On top of this there will be a number of freelance sales staff, recruited to hit the major sales accounts. By this the company means the now well-understood market for multiple sales of machines into large companies. OK, so the company is looking for half a dozen such hot sales persons, maybe 10 at the most, certainly to begin with.

Well, no. It plans (or planned, for it will now be in the past tense according to the announcement) to appoint up to 200 by September (and that is the September that has just gone, not the one next year).

It was a great shame that the company felt impelled to put figures to the basic idea, for it made the idea nonsense when in fact it is completely sound. It made it nonsense because one set of figures could be compared with others, as will be seen later.

First of all, the idea. In theory it is just right. A machine like the Osborne 1 is geared specifically for the type of market filled with the managements and executives of the large companies of this world. Such large companies often have central buying policies so that the best prices can be obtained. They are also

normally tough sales nuts to crack. It is an ideal area for professional sales persons that know their way round both the product and the marketplace.

But it is a market that does not need too many of them. Indeed, it is arguable that there are not that many of them to start with. It requires a special blend of skills in — sales, marketing, and the technology of hardware and software to sell micros to such people. It is also a marketplace where sales take time. Months, even years, can go by before the 'big order' comes over the hill.

Now, Osborne want to have appointed 200 by the time you read this. Yet at the same time it is saying it is predicting a UK sales volume of 1,000 units per month by the end of the year. With our calculators at the ready we can see that, on average each person will sell five units a month, which means that with around 30 percent discount, they could expect to gross around £1800-£2000 a month. This is just about enough to run a single person small business with such overheads as a car and money-in-front stock purchasing. It would barely cover the cost of in-depth customer support however.

Ah, yes. Support. Now where would support come from? This according to Osborne, would come from the dealer network.

Oh dear, we had forgotten the dealers, hadn't we, and there will be around 60 of them. That means that each 'outlet' will sell under four units a month, on average, which is hardly enough to make a living. But there is a

grey area here, for why should the dealers provide support for apparent rivals? The answer, according to Osborne, is that the sales people will be selling for the dealers under arrangements that they strike between them.

In essence, what this would surely mean is that the salespersons' operating margin would be less than 30 percent — probably considerably less. Each would have to sell much more to stay in business, even though Osborne's predictions for the market don't indicate it.

The net result of the idea is right — in theory. There is a big market in the large companies, and it is a market that the microcomputer industry is trying to come to terms with. Sales people out on the road is a definite starter as a solution, even if it would have been anathema as an idea just a couple of years ago.

The figures as published by Osborne at its press conference, however, do not seem to indicate the best way to go about it. The purchasers, certainly in the short term, will probably love it. It is a recipe for virtually every form of cut-throat sales tactic that the sales trade has ever invented (for cut-throat the potential purchaser can normally read cut-price) for the sales people will be out to grind each other into the ground to maintain some level of business.

Either that or the 'sales people' will be as outlined in Act I, Scene I. Computers will just be something else they have on the van, along with the carbon paper, used cars, and a night on the tiles with Auntie Vera.

END



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## GRAPHIT

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There are a number of programs which will portray graphs on a Microcomputer. Indeed, we stock two already, Graph Plotter and Plotter. Graphit, however, is the ultimate of such programs. It has been written solely for displaying graphs. It is compatible with Visicalc DIF files. Hence such a file constructed with Visicalc can be fed into Graphit and a graph display obtained. Users may also, however, insert data directly from the keyboard into Graphit. This data may then be fed into Visicalc for further processing.

Every function that we can think of that would be of use to a person requiring a graph has been included in Graphit. Labels may of course be used and these may be transposed from the side to the bottom or vice versa at any time. A great deal of work has been put into manipulation of the display in the sense of magnification, or changing the scale. The program will itself first of all calculate an appropriate scale but thereafter this may be altered in almost any way. Thus a small section of the graph may be made to occupy the whole of the screen. Alternatively a large proportion, or all, of the data may be displayed at once. In other words, the program has complete flexibility of display of the graph.

Scrolling is supported in either a latitudinal or longitudinal direction and by one column or by a complete page. If, for instance, the months for one year are set up along the bottom of the screen with sales figures up the side, the user can move along in either direction from month to month or jump six months at a time and show the whole page — the display facilities are almost endless. And display, when you come to think of it, is what a graph is all about.

The graph as shown on the screen may be printed out to a line printer or the raw data on its own can be printed out. The axis can be changed at any time so that if, as in the example mentioned above, we have the months along the bottom of the screen, by one simple keystroke they can be made to go up the side, and the sales figures along the bottom, with the graph changing accordingly of course.

At any time the zig-zag display can be changed for the step and of course vice versa.

Perhaps the most important feature, has been left until last. Graphit was specifically commissioned and the specification called for ease of use, as the prime requirement. Not only, therefore, is a comprehensive manual supplied, but also at almost any time while using the program the H key can be pressed for help, whereupon all of the available commands are displayed. Graph programs in the past have rather suffered from being included in other software. This one concentrates entirely on drawing graphs and gains a lot thereby. Available on disk only, compatible with the Genie I and II and the original Genie, together with the Tandy Models I and III.

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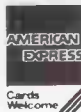
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# QUICKPRO PLUS

Quickpro Plus is a Basic program generator. That is to say you tell it the type of program you want and it writes it for you. The most widely publicised of such program generators is The Last One and it is, therefore, inevitable that Quickpro Plus will be compared with it.

There are two approaches that one can take in writing software like this. Either one can set out with a very broad brush and try and make the generator capable of producing a wide variety of data handling software or one can restrict it to some extent, to simply producing file handling programs. The Last One seeks to go the first route, Quickpro Plus goes the second. There is a great paradox in this software if one thinks about it. Obviously, if a person is at least a semi-skilled programmer then he does not need a program generator. They are really for people who are not skilled in programming and want that chore taken off their hands. The paradox is that programs like The Last One, by being all things to all men are also complex in use and one therefore gets the position of a program aimed at a beginner, but actually requiring some skill to use it.

It was because of this apparent paradox that Quickpro Plus came into being. It is written for somebody with little or no knowledge. You will find no mention of flow-charts and little mention of fields, records and other technicalities. It was written so that a person could sit down in front of his computer, answer a few questions and have a program produced for him, and this is exactly what Quickpro Plus does. The other side of the coin is that it concentrates entirely on producing file handling programs. Within that context the program which you have generated will run on the computer like any other Basic program. You will be able to add file records, in other words items of information in your file. You will be able to search for and locate records, and retrieve these records, as and when you wish; you will be able to up-date and change the records, indeed you can delete them altogether. In the program generation process you will be able to design your own screen layout. Co-ordinates appear on the screen and you simply say where you want questions and statements to be inserted. You will, of course, be able to define whatever part of the record you will wish to use as a search key. These fields may be restricted if you wish to just numeric data and, of course, you may name the data file and indeed the program as you desire.

An added feature is that you may carry out various calculations on any of the numeric fields and if you want to you can change this numeric data. Up to fifty separate computations can be carried out on these fields. The program will report the calculations to you in various arrangements using any of the normal mathematical functions.

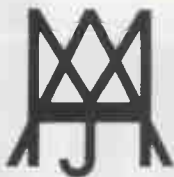
Quickpro Plus supports a full print report facility. Indeed within minutes you can design a new report with any column names that you choose, with any calculations that you might want and for many selections of records in your total file. A report will be produced within seconds. This can have been built into the program or you can re-arrange matters so that you get a one time reporting. The same file is thereby manipulated in many different ways. Computations are done and results printed all from the same file which your program has produced.

Quickpro Plus is available for the Model I, Model II and Model III Tandy machines, together with the original Video Genie, the Genie I and Genie II. A version for the Genie III will be available towards the end of 1982. Quickpro Plus is, of course, disk orientated and has no application for cassette users. It is supplied on a protected disk, but Molimerx have masters from which they can repair any damaged disks and hence retain their reputation for support.

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# HEWLETT PACKARD HP86

**BENCHTEST**  
PERSONAL COMPUTER



Photography by John Mason

## AFFORDABLE HP!

*Dick Pountain checks out the HP-86, a lower cost addition to HP's 80 series of personal computers.*

There is much excitement in the hi-tech halls of Hewlett Packard about a new product, the HP-86. Not because it represents any great departure in hardware terms from the established 80 series, but because for the first time HP has a personal computer which is priced to

compete in the mainstream of the market place. HP has always been associated with high-priced high-quality products which have been bought largely by the scientific, engineering and other professional communities on reputation rather than cost considerations. The

launch of the HP-125 business/management micro in 1981 broke new ground in using a non-HP produced processor (the Z80) and a non-HP operating system (CP/M) as an acknowledgement that these represent the realities of the current business micro market, but

it is still priced well above the industry average and must sell on reputation and its advanced ergonomic features.

The HP-86 takes a further step toward the deep end. It is nominally part of the 80 series of laboratory and professional microcomputers but it can be expanded with a Z80 module to run CP/M. Most significantly, though, it is priced at a level which competes directly with Apple III and various other machines in the middle range at around £3000 for a 64k, twin disk system with printer. This is still somewhat above the £2000 typical of the keenest CP/M systems, but the 86 does offer graphics facilities which are either unobtainable or extremely costly on such machines. It demonstrates a new commitment by HP to compete in the hurly-burly of the volume micro-market, and to achieve this by up-to-date production engineering techniques. The design features of the 86 are closely based on the HP-87 introduced earlier this year, and the two machines are fully software compatible; the 86 is at least £1000 cheaper for a comparable system due to cost cutting exercises.

## Hardware

The 86 is a 'separates' system, comprising keyboard/processor console, which is a departure from the 80 series philosophy of small integral VDUs.

The computer unit is cased in the traditional HP textured grey ABS plastic. At the rear of this case are three multi-pin connectors for two disk drives and a Centronics parallel printer. Notice I didn't say HP-IB connectors because they're not: the disk ports are dedicated interfaces for special HP peripherals, and HP-IB if required is an optional expansion. Moving across, we come to four edge-connector slots which can house a ROM drawer for certain firmware expansions, extension RAM modules, interface boards (such as HP-IB/IEEE, HP-IL, RS232, BCD or GP-IO) and the Z80 CP/M module. Finally there is a phono-type video socket for a black and white monitor and the power socket, fuse and switch.

Removing the case top reveals the source of cost-cutting: the computer inhabits a single board about 8in square which contains 80k of RAM (in 64k and 16k chips) and 48k of ROM as well as the processor, HP's own 8-bit unit which can address up to 640k via a paging system.

This main board is completely covered by a perforated metal plate to shield R/F emissions, and the interior of the case is metallised for the same reason. There is much evidence of cost-conscious engineering with foil-tape cables and connectors; HP sources say that the board is constructed on a new automatic component insertion line. The keyboard occupies a second PCB and the power supply has a third small

one. The key switches are robust sealed units, but it is slightly worrying that there is no sort of backing plate: you can see the underlying PCB through the gaps between keys and therefore also drop paperclips or coffee right into the works (the PCB is heavily lacquered which is some comfort).

The keyboard has four main areas: a qwerty alphanumeric section, a numeric keypad, a screen control pad and seven programmable function keys with their associated KEY LABEL key. The main keyboard area contains some special keys like RUN, LIST, TRACE/NORMAL, CONT, PAUSE and STEP which are used during editing and will be discussed more under software. The numeric keypad, to my delight, has ALL the arithmetic functions duplicated on it as well as the unshifted ) and ( symbols which makes it into a self-contained, one-handed calculator. It also has a RSLT key which recalls the result of the last performed calculation to the display. Keys are provided to clear the screen, clear to the end or to the beginning of the line, insert and delete characters (BACKSPACE is a destructive backspace while -CHAR removes the character under the cursor; it is good to have both). All keys repeat after a short depression at a brisk rate. There is no TAB key — one or more of the function keys being used for this function if required.

The enter key is called END LINE which I'll grant is a better name than RETURN or CR as this function is not merely carriage return but carriage return/line feed; it's a pity though that everyone can't agree to call it NEW-LINE since between Clive Sinclair and the ANSI standard this seems likely to triumph eventually.

RESET performs a hardware reset without clearing programs in RAM. The CTRL key does not use the normal representation for control characters instead the first 32 ASCII codes appear on the screen as Greek, Scandinavian and assorted graphics characters including the £ sign.

The ROLL key reveals an interesting facility: the 86's screen memory normally holds 54 lines of text by 80 columns, of which either 24 or 16 lines are displayed (selected by the PAGESIZE command). ROLL and its shift allow you to scroll this window up or down through the text eventually returning to the starting point as if the text were written on a cylinder. This means you can, for instance, scroll upwards through a program listing. In fact the screen memory is shared between text and hires graphics. The default condition is 54 lines of text and 400x240 graphics and you can switch manually between text and graphics screens with the A/G key or in a program by the ALPHA and GRAPH statements. If, however, you declare ALPHALL then the whole of

screen memory is given over to text (204 lines); similarly GRAPHALL gives 544x240 pixels of graphics. In GRAPHALL mode though it is not possible to enter any text at all to the screen; you can re-route it to the printer or a disk file if you wish.

I was deeply impressed by the ergonomics and the terminal facilities of this keyboard which are the best of any machine I have used; program entry and editing on it are a pleasure.

The monitor supplied was a 12in green phosphor unit made in Japan for HP. It displays only average sharpness and steadiness, though it is by no means bad; it does not have a green filter over the screen and as a result contrast in well-lit rooms is not as good as it could be. Interestingly it has video and audio inputs and outputs on its backplate, though the 86 makes use only of the video input, having its bleeper in the console section. Many other monitors would be suitable for use with the 86.

The HP 9130A disk drive is specially designed for the 86. It is much smaller than previous HP 5in drives in a neatly styled plastic case rather reminiscent of the Apple III drive. Like the latter it takes its power from the computer so that, thankfully, no extra power cord is needed. The firmware to drive two of these is contained in ROM in the 86 as standard (as is the printer driver for a dot-matrix printer). Each drive holds 270k formatted and (under Basic) has the user selectable skew-factor feature introduced by the HP-125. The disk format is compatible with the HP-87 (as are most features of the 86).

## Software

The HP-86 comes with an extended graphics Basic in ROM. On power up the machine goes through self-test routines and then deposits you in Basic, without any sort of sign on message, merely the square non-flashing cursor. Of the 80k, 16k is used as video memory and a little is pinched by the operating system leaving 61k for the user on switching on — which is twice as much as most disk-based Basics leave you; it is in fact more than you will get on a 128k Sirius or Apple III with Basic loaded. In this state the machine is in calculator mode which is rather more than the usual Basic command mode. Calculations of any complexity can be carried out directly without the need to use PRINT. Variables may be assigned values which are available to programs by using CONT instead of RUN as well as to direct calculations. Because of the rather special way the keyboard works (see later) it is possible to stop a program, perform manual calculations and pass the results to the restarted program.

Arithmetic is to 12 digits with the exceptional dynamic range of 10E±499,

# HEWLETT PACKARD HP86

which should please physicists. The time to run Benchmark 8 is slower than average but bear in mind the above-average precision.

All entries to the computer are via an excellent full-screen editor which allows direct calculations as well as program lines to be edited; using ROLL you can edit and re-enter entries made 50 lines ago. A fine feature is that there is no READY prompt, just the cursor, so you don't get that infuriating syntax error if you CR through the prompt which most full screen editors give. AUTO, RENUM and DELeTe are all provided, plus a fine selection of debugging aids, most of which have their own keys. PAUSE stops execution until CONT is pressed. STEP single steps through a program. TR/NORMAL toggles trace mode, which can display not only line numbers but also selected or all variable values. LIST lists the whole program and displays the number of free bytes at the end. The remarkable thing is that most of the keyboard is active while a program is running; there is no need to hit PAUSE in most cases. You can for instance go straight into TRACE during a program run. Most keys when hit will pause execution; some, like KEY LABEL which displays the function key assignments, leave the program running and just do their thing.

Full syntax checking is performed as a Basic line is entered. Error messages are descriptive, not just numbers, and the cursor is positioned over the error. Programs should normally be initialised with the INIT key before running; this performs semantic checking (eg, FOR without NEXT, GOTO nonexistent line) as well as erasing calculator variables and allocating space for program variables. The latter is valuable if you're in any danger of running out of space and is not performed by RUN.

The editor keeps all spaces inserted between the line number and the first statement so that indentation can be used for readability; it also turns all reserved words into uppercase, however entered.

All considered this editor/terminal combination comes closer to the ideal I outlined in August's Braindump than any I have seen to date, and the speed with which you can write code is significantly improved.

The Basic itself is not Microsoft based but close to the extended ANSI standard. For instance, string manipulation is by substring notation — eg, STRING\$ [n,m] rather than MID\$, LEFT\$ and RIGHT\$ functions. Strings must be dimensioned if longer than the

default length of 18. 31 character variable names, all significant, are recognised and lower and uppercase are distinguished. REAL (12 digit, 12 byte), SHORT (5 digit, 8 byte) and INTEGER (5 digit, 7 byte) can be declared defaulting to REAL.

The set of functions provided is more extensive than most Basics, including MIN, MAX, FLOOR and CEIL, INFINITY and EPSILON (the largest and smallest machine numbers) in addition to the usual trig and logs.

A powerful aid to program readability is the provision of GOTO and GOSUB < label > instead of a line number; the labels follow the rules for variable names so you can say GOSUB Compute-Area or GOTO INPUTROUTINE. Remarks are prefixed with ! and may be added to the end of line; the editor preserves spaces between the last statement and ! so you can line them up nicely. A single line IF... THEN... ELSE and single or multi-line user defined functions are the only offerings made towards structured programs. Nevertheless, the proper use of all these features plus indentation makes for much more readable than average programs.

A powerful PRINT USING (and DISPLAY USING) statement is provided which uses IMAGE strings to control the output format of numbers. Long programs can be segmented and loaded from disk using CHAIN. Any variables which need to be passed between segments are declared as COMMON; the variable names need not be the same, only their order in the declaration list being significant.

Three types of interrupt can be handled by Basic. ON TIMER# allows one of three internal timers to cause program branching. ON KEY# causes programs to branch by pressing one of the function keys; it is also used in command mode to assign strings to these keys. When the computer is switched on they are assigned 14 Basic keywords (seven shifted), and these are not affected by any assignments made by a program, so there are effectively 28 functions. Finally ON ERROR /OFF ERROR permits error recovery. While on this subject, certain maths errors can be trapped by Basic itself — eg, underflow, overflow or division by zero. A default value (eg, INF or 999999999999E+499) is taken, a warning is issued and execution is not halted. This condition can be overridden if required by DEFAULT OFF, in which case a normal error occurs.

The HP-86 graphics deserve a benchmark to themselves. They are lifted straight out of the 9800 series of bench-top 'microminis' and include the most powerful graph-plotting facilities to be found on a personal computer.

Anything which is displayed on the screen can be just as easily sent to a multipen plotter such as the 7049 by declaring PLOTTER IS and its device address.

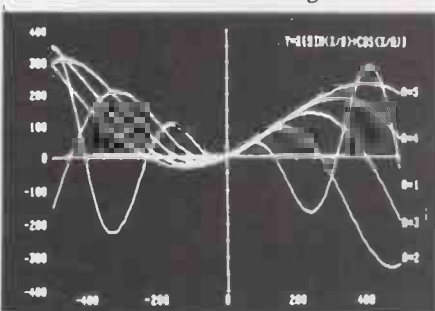
Characters can be freely mixed with graphics on the high-res screen by incorporating the text into LABEL statements. Such characters can be printed in any size via the CSIZE

statement which can also italicise and condense the letters. Labels can also be printed in any orientation using LDIR < angle >.

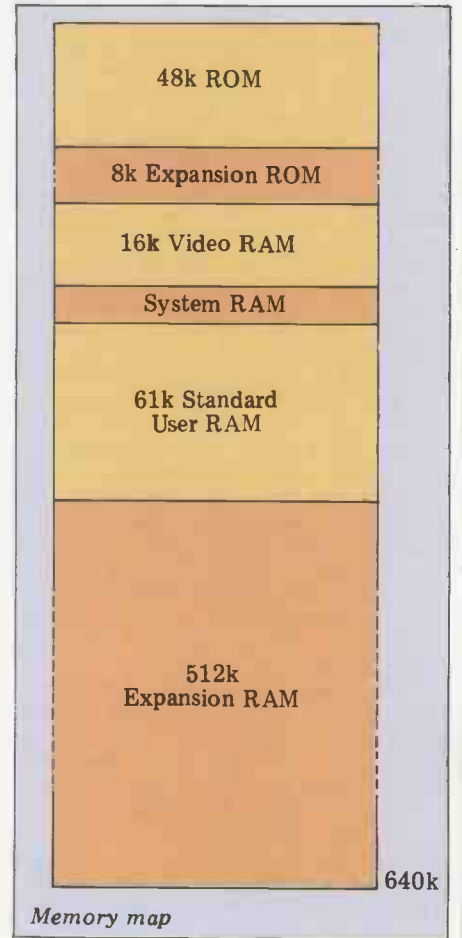
Any portion of the physical screen or plotter can be selected for plotting by LIMIT; within this area the LOCATE statement sets up a plotting area and scales it in Graphic Units so that there are always 100 GUs along the horizontal axis. These units can be overridden by User Units using the SCALE statement: eg, if you want to plot x from -200 to 200 and y from 50 to 300 then SCALE - 200, 200, 50, 300 does the trick, automatically converting to graphic units. MSCALE sets up a scale in millimetres for drawing office applications. Axes or grids can be drawn by the machine, marked with appropriate ticks using AXES or GRID. They can even be automatically labelled to the required number of decimal places by LAXES. A selected part of a graph can be cut out using CLIP and then blown up by changing the LOCATE parameters. Making certain LOCATE parameters negative will invert or reflect a plot while leaving the labels right way up.

These plotting commands are much harder to describe than they are to use. Suffice it to say that it is extremely easy to produce a graph with nicely labelled axes (with major and minor ticks) labelled with lettering following the slope of the graph and all automatically scaled so that no crashes occur due to plotting out of limits; and all this with about six lines of code.

Actual plotting of points is performed by PLOT in absolute screen coordinates, by IPLOT relative to the last point plotted or by RPLOT relative to a local origin which is moved by any pen moving command except RPLOT itself. All of these can take an optional para-



Axes are done automatically





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meter which controls the raising or lifting of the pen. Lines are produced by DRAW (a relatively weak version which can only take two points as arguments; you can't draw a polygon with one statement) and MOVE, which moves the pen without drawing. WHERE X, Y stores the pen position and status in variables X and Y. If a plotter ROM and plotter are present you can use the plotter in reverse to digitise drawings by the DIGITIZE statement.

User defined graphic shapes can be created with BPLOT, which takes a string as argument and bit maps the shape from the decimal ASCII representation of each byte. The speed of plotting is sufficient for convincing animation to be done by MOVEing the pen between BPLOTS.

It is hardly surprising that the 86 contains 48k of ROM when you consider the amount of matrix arithmetic and such which must be contained in this remarkable graphics package.

If graphics are the strongest point of the 86 then the disk operating system is definitely its weakest. The publicity material describes 'easy I/O' facilities as an advantage; for some applications this may be true but for any data-intensive work it is frankly too simple. Random and sequential files are implemented in a straightforward way using CREATE to allocate disk space (the number and size of

records is specified), ASSIGN# to allocate a file buffer and open the file. Data is transferred by PRINT# and READ#. Data of different types can be mixed in a file and the TYP function will return the type of the next record to be read. The allowed file types are DATA, PROGRAM, BPGM (binary program), and GRAF which contains stored graphics screens. Certain application ROMs can create other file types. When files are deleted using the PURGE command they remain in the directory as file type NULL and periodically you PACK the disk which sweeps away all these NULL files.

The first problem comes when you want to find out how much space is left on a disk. There is no utility equivalent to CP/M's STAT and the information is not given in the directory heading, which merely gives the volume name. To be sure, the directory gives the number of records and bytes per record for each file but I defy anyone to multiply and total these for a disk with 100-odd files. Fortunately DISK FULL is not a fatal error so the procedure is to keep going until you get this message and then change disks; you can format a new disk without affecting the contents of memory thanks to the ROM based operating system (it takes a reasonable two minutes).

This works but it is hardly elegant; so much better to have put the bytes free

in the directory heading.

The next problem is that the command to copy files or whole disks only works with two drives. With only one supplied I couldn't backup any disks as the COPY command doesn't allow you to change disk; it searches for the destination volume and gives an error when it only finds the source. Again it would have been quite easy to have COPY prompt for number of drives and pause if necessary to allow a change. This is a real pity as the drives are not cheap and a single drive system would be very suitable for a lot of lab and workshop applications.

COPY doesn't allow wildcard filenames either; you can only copy single files or whole disks. In the latter case, the files are added to any on the destination disk rather than overwriting them.

The final irritant is that the operating system gives no prompt to signal successful completion of a program LOAD or STORE: the red light on the drive is the only sign that anything has happened; the cursor merely sits blandly on the screen doing nothing.

The operating system works perfectly well and will do most things you require, but in a fairly spartan and unfriendly way which contrasts strongly with the excellent ergonomics and utilities of the other subsystems.

As a final note on software, the 86 like the 87 contains a built-in translator which allows programs written on the 83 and 85 models to be converted and run. Anyone with either



The perforated plate is a Faraday cage to trap RF emissions

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### HARDWARE

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| 80 column card                                       | £ 119  |
| Z80 card   | £ 95   |
| Microline 83A 120 cps matrix printer (15 inch paper) | £ 479* |
| Printer interface                                    | £ 70   |
|  | £2687  |

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of these models can thus upgrade without losing the use of their program library. It will not run 85 ROM software however.

## Expansion and potential use

The HP-86 is capable of addressing a prodigious amount of RAM. Expansion modules can be had in 32,64 and 128k sizes and may be combined to a total of 576k user memory.

Similarly the ROM may be expanded by fitting a ROM drawer into one of the rear sockets which can hold six ROMs. The most likely first candidate is the Plotter ROM followed closely by the I/O ROM which adds routines to the Basic to handle instrument and control applications. An assembler is also available in ROM and an EPROM programmer.

A module containing a Z80 can be fitted to allow the 86 to run CP/M. This module totally disconnects the 86 processor and ROM, effectively turning it into a new computer; most of the advanced editing/debugging aids are disabled as are the function keys and the calculator mode. File formats are incompatible so there can be no transfer of data between HP Basic and CP/M. The attraction of CP/M is nevertheless strong for two reasons: Wordstar and Visicalc-PLUS, both of which are offered. One would treat the 86 as two different computers and use CP/M purely for word processing and spreadsheet work. The Visicalc is a greatly enhanced version with extra maths and graphics capability, and with the full RAM expansion it can handle an enormous worksheet.

HP intends to implement the UCSD p-system in the near future and to offer the Pascal and Fortran, though I have no details of how it will be done (ie, will it be under CP/M?)

On the hardware side, an HP-IB module can be had which opens the 86 up to all HP's plotters, printers and instruments as well as to their other disk drives, 5in,8in and winchester. A very large number of these can be accommodated on HP-IB (40 5in drives or five winchesters!) if you can afford them.

The new HP-IL loop interface is also available to link the 86 to HP-41C calculators, tape drives, timers or other series 80 computers for data collection.

Any Centronics-type parallel printer can be used on the dedicated 86 printer port, though HP has simultaneously released a parallel version of its 82905 dot-matrix printer which can do graphics.

A 9in monitor is offered as an alternative to the 12in one tested. The library of ROM software for the 87 and 86 is now quite large though inevitably heavily biased toward scientific, statistical and engineering applications.

Who would use the 86? Despite HP's intention that this should be seen as a general-purpose computer it still has most appeal to the traditional HP customer in the laboratory and design office. The graph-plotting capabilities

are so powerful that any application which doesn't require them is rather a waste of its talents. That's not to say that there aren't many management and educational applications which could benefit from these features. Nevertheless, I suspect that the 86 will mainly go into those regions of the scientific and engineering market which have been invaded by Apple and PET because hitherto HP was considered to be beyond the budget.

Does it make sense as a pure CP/M machine? You could certainly use it as a small business machine but there are plenty of cheaper CP/M machines to be had; moreover not to use the HP Basic would be rather like putting a Steinway in the public bar, — nice but rather extravagant.

In its ROM-based mode the 86 is very much a programmer's machine; everything has been done to make life pleasant for the owner who writes his own medium-sized but complex programs. As a personal computer on the lab bench it represents good value, since a single drive system could be had for around £2300 if you bought a cheaper monitor and an Epson MX-80 printer. It would be nice if they did something about the COPY command to facilitate this kind of use. There is plenty of scope for upward expansion from such a base system too.

It goes without saying that the 86 is not for hobbyists unless they be wealthy amateurs of science.

## Documentation

The manual I was supplied with was for the HP-87 but since the only material difference is the shape of the screen (even the number of dots is the same) it will require only minor alterations. It is a large ring binder which has a first section of owner's information and abbreviated instructions for getting started, a section on HP-IB operations and then the 300-page Operating and Basic Programming Manual. All are written to the customary HP Standard; clear, readable and comprehensive with the exception that as normal there is no hardware information, not even a memory map. HP definitely does not approve of users wandering round through the innards.

The Basic manual has extensive tables at the end of key codes, expanded explanations of the 131 error messages and a list of the functions, commands

and statements with syntax for quick reference. A full index is provided at the end.

As usual it is difficult to fault HP's documentation; maybe it could be done better but nobody does.

## Prices

|                          |          |
|--------------------------|----------|
| HP-86 Console            | £1251.47 |
| Monitor 9"               | £205.67  |
| 12"                      | £226.59  |
| Disk Drive 9130A         | £592.62  |
| Printer 82905B           | £589.13  |
| Expansion RAM 32k        | £205.67  |
| 64k                      | £313.74  |
| 128k                     | £544.27  |
| CP/M Module              | £345.11  |
| ROM Drawer               | £31.00   |
| ROM Module Plotter       | £101.90  |
| I/O                      | £205.67  |
| Assembler                | £205.67  |
| HB-IB Interface or RS232 | £275.39  |

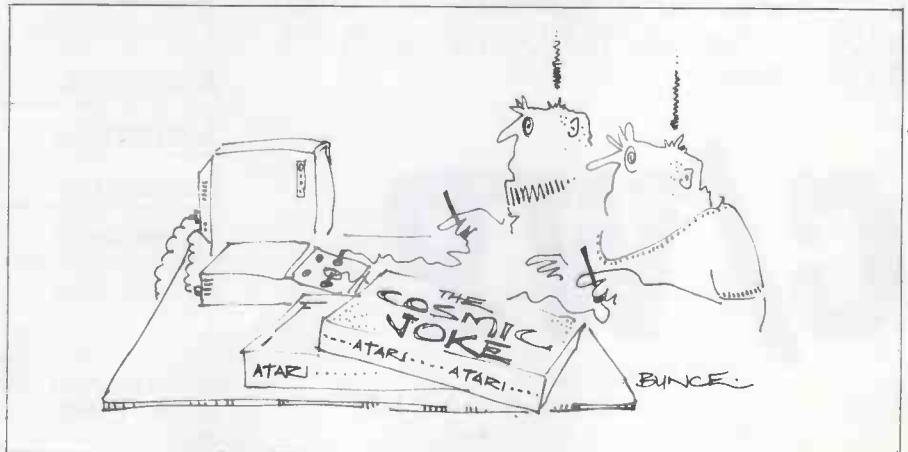
Service contracts are available, price not known.

## Conclusion

Though it is still by no means a budget machine, the HP-86 represents a dramatic saving over the HP-87 and 85. A similarly configured twin disk system will be at least £1200 cheaper while having the same functionality. The disk drives, though much cheaper than previous HP models are still too expensive by half and bump up the system cost. With a bit of shopping around a single disk system could be built for around £2300 with a printer, though backing up data would be inconvenient. At these sort of prices it competes with Apple III, Sirius, IBM, Sharp MZ-80B and the larger Commodores as a laboratory tool. Its plotting facilities and arithmetic are very much more advanced than any of these machines in their standard forms, though it is less flexible in the range of languages available at present. It is nevertheless a welcome sign that HP is ready to do battle in the volume personal computer market and should keep the other manufacturers on their toes.

## Benchmark timings

|     |      |                            |
|-----|------|----------------------------|
| BM1 | 3.0  |                            |
| BM2 | 5.2  |                            |
| BM3 | 19.4 | <i>All timings in</i>      |
| BM4 | 18.8 | <i>seconds. For an</i>     |
| BM5 | 20.4 | <i>explanation of the</i>  |
| BM6 | 36.5 | <i>Benchmark tests see</i> |
| BM7 | 56.5 | <i>PCW Vol 4, No 11,</i>   |
| BM8 | 13.4 | <i>November 1981.</i>      |



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# POSITRON 9000

The 6809 processor is popular among assembler programmers because of its simplicity and power. It hasn't appeared in many microcomputer systems, though, as its announcement post-dated major software development on other processors (the Z80 and 6502). But it has a loyal following and some high-level software.

Positron is a Manchester-based company which has designed a flexible system (the 9000) around its favourite chip. For software it chose OS-9, a multitasking operating system from American software house Microware.

## Hardware

Picture an Apple-style casing (ie, white plastic with an inclined front section containing the keyboard and a flat top to support the monitor), double the length and breadth to 61 x 58 x 10 cms,

## BENCHTEST

MULTI-USER SYSTEM

*Roger Oliver and Chris Sadler test  
a new British colour micro*

and you've got an idea of the main module of the Positron 9000 review system. The keyboard is grouped into four 'pads' — a 61-key qwerty section, an 8-key 'graphics encoding' pad, a 12-key 'video attributes' pad and a standard numeric keypad. The qwerty keypad is designed for Viewdata rather than ASCII input, which means there are fractions and left and right arrows rather than brackets, braces and the backslash. The non-printing keys (dis-

tinguishable by being a lighter shade of grey) include ESC (end-of-file in OS-9), SHIFT LOCK and CAPS LOCK, REPEAT, DEL and a set of cursor control keys. At present only the back-arrow is decoded (it functions as a BACKSPACE). The other arrows and a red BREAK key are not yet decoded. The keyboard is robust, requiring very firm keystrokes to operate, but the main criticism is that DEL (which deletes the current line) is directly beneath RETURN — which can be a bit disconcerting for the habitual mistypist.

The video attributes keypad has eight colour keys which are used to select the current colour (in alpha or graphics mode) and four which select display attributes — flashing/steady, normal/double height characters, background and graphics status. When in graphics mode, blocks in the Viewdata 2x3 matrix at the current character position can be toggled on or off with the corresponding keys in the 2x3 key matrix on the graphics encoding pad.

At the back of the box there are sockets for a cassette (1200 and 300 baud — remember Kansas City?), four RS232 devices (drivers exist for terminals and printers), an IEEE-488 port, and RGB, composite video and UHF output for the display. The review machine was equipped with a Decca colour monitor providing the more-or-less familiar 40 character by 24 line display. The top of the casing is retained by three screws on either side and, once removed, reveals the keyboard circuitry (supported at an ergonomic angle to the horizontal) beyond which lies the main board and a power supply. The logic supporting the Viewdata functions and 240x 240 pixel 'high resolution' graphics is on the keyboard board. Positron is apparently going to produce a 25x80 screen (and presumably an ASCII board) instead of the Prestel format, although it is also possible to buy the 9000 packaged without keyboard and monitor at all (the case, of course, is differently shaped). A wide ribbon cable connects the keyboard to the processor board.



The main board gives the appearance of a clean design with well-labelled areas, and is well made, with all the pricier chips socketed. The standard configuration provides 64k RAM and 36k ROM, although the review system seemed to have 44k's worth including software (8k). These were all in 4k ROMs but the sockets can optionally take 8k ROMs, and with all the sockets filled there is a potential 128k of ROM. The RAM is expandable (on board) up to 256k. The 6809 (Positron provides a 1 MHz version but will supply a 2 MHz chip with the faster memory required) will address only 64k, but this can be overcome by means of a bank of Motorola memory management units. The review machine was fitted with one of these and there were sockets for another seven. Each can cope with up to four concurrent processes, so it's not difficult to work out what the system is theoretically capable of. An extension board (which stacks above the main board, plugging into a socket similar to that used to connect the keyboard) allows both RAM and ROM to be doubled in size and provides another four RS232 sockets. However, OS-9 level 1 can only address 64k so any extension requires a software upgrade as well.

The four RS232 ports can be configured in two ways. Firstly, by repositioning a pair of chips mounted close to each port, the port can be set up as DTE or DCE. Second, a bank of DIP switches allows each port to be configured for speed (75-4800 baud) and handshaking. On the review machine we had problems getting the ports to work outside the factory settings. DIP switches also exist for configuring the IEEE-488 port and (on the keyboard board) for selecting the video display mode.

The disk drives come in metal cabinets the same width as the main processor box so that they can be stacked on top of it with the monitor perched (actually quite stably) on top of the lot. The review machine had a 5 Mbyte winchester in one cabinet (the Positron 9250) and a pair of 5¼in 380 kbyte floppies in another (the 9151). Drives are daisy-chained together on the IEEE-488 bus, each cabinet containing a controller board with its own processor and PROM to manage the actual drives. A single system is set up to take up to two 9151s



The board is neatly designed.

(D0-D3) and up to four 9250s (D4-D7) where D0-D7 are the device numbers used by OS-9. Positron is also developing the 9300, an adapted disk controller whose PROM performs bus arbitration (instead of disk control) among IEEE devices, enabling a network of up to seven Positrons to share the resources of up to seven other devices (disks and a printer, say).

A fully expanded 9000 then would consist of ½ Mbyte of RAM, 256k of ROM, 12 terminal ports, four floppies and 20 Mbyte of winchester disks. Nobody really expects a single 6809 to be able to cope adequately with all that, but the flexibility of a system should be measured in the extent and number of directions in which expansion is possible. The same remarks probably apply to the fully expanded network.

## Software

OS9 is Unix-like. It is a multi-tasking/multi-user operating system based on a tree-like file structure. System utilities are invoked by issuing a command to the 'shell', a monitor program that, possibly, already has the capability to carry out the requested task, or which,



Double disks can sit on top of console

more usually, calls a separate program to accomplish the task. OS9 deviates from the true Unix philosophy in that programs can be locked into memory so that retrieval of often-needed code from floppy disk drives does not degrade system performance.

OS9 fully supports the Unix concept of any process being able to spawn any number of 'daughter' processes (within the limits of availability of main memory); these are then processed concurrently with all the other processes in the system. New processes can be generated within a program, or by communication with the shell.

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# POSITRON 9000

OS9 supports re-entrant code. When the same program is called by more than one user, only one copy of the code is kept in main memory, and separate data areas are maintained for each use of the program. Each module (program) in main memory has a user count; when it is called the user count is incremented by one, and when the program is no longer required, the user count is decremented by one. When the user count reaches zero, the module is discarded.

In tree-structured file systems it is always necessary to specify the complete route through the tree structure to the individual files; this may be done implicitly or explicitly. If many of the files referenced are from a particular directory file, then it is usual to set that directory as the current directory; thereafter only the file name need be supplied, the rest of the path having been supplied implicitly. OS9 is rather unusual (and un-Unixlike) in that the user is regarded as being 'in' two directories simultaneously; a directory for data files and a directory for programs. These are called the data directory and the execution directory respectively. The supposed advantages of this are not very clear. The picture becomes even more complex when you realise that Basic program files that have been **SAVEd** are regarded as being data files, whereas Basic programs that have been compiled are stored in the execution directory.

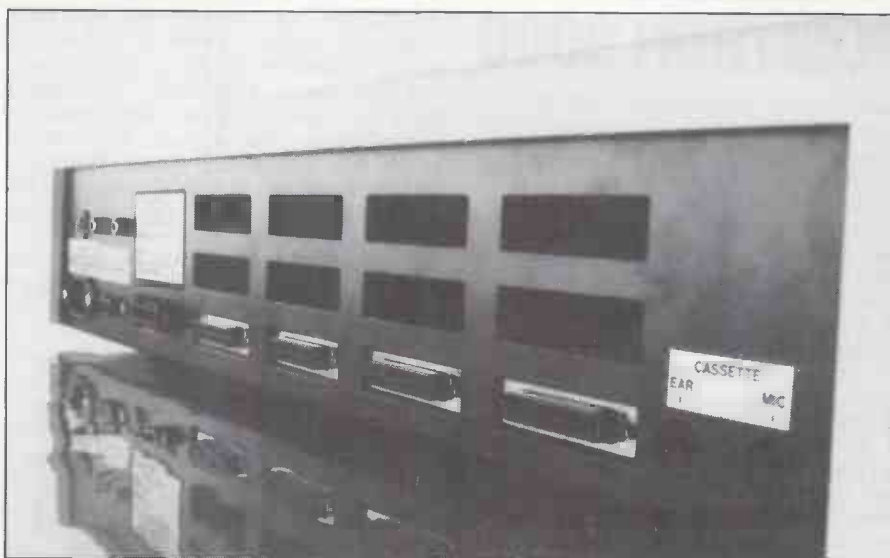
Here's a quick rundown of OS9 commands: **ATTR** operates on the attributes of files; these are directory file/data-program file, file shareable between processes or unshareable (see below), owner readable, owner writeable, owner executable, public readable, public writeable, and public executable. An owner is one with the same user number as the originator of the file.

**DCHECK** checks the integrity of the file structure on the specified disk. Sectors on the disk that are allocated to a user but recorded as free in the disk allocation bit-map are detected, and vice versa. Also, the pointers linking the various directories and files are checked.

The **EX** command allows a utility to be called without creating an additional version of the shell; this conserves memory space.

**LOGIN** together with **TSMON** is used to implement a multi-user System. For example, the command **TSMON/T1** sets up a version of the time-sharing system to monitor terminal 1 for activity. Subsequently, any user of terminal 1 has to interact with the **LOGIN** program before being admitted to the system. The **LOGIN** command asks the user for his user name and password and the supplied values are compared with the contents of the password file which details all the permitted users of the system; access is granted only when acceptable values are supplied for user name and password. The password file also specifies a user number (0 to 65535, with user 0 as superuser, with special privileges), the CPU time priority, and the paths for the initial data and execution directories and the initial program for execution (usually the shell).

**PROCS** displays a list of all the pro-



*Plenty of space for more connectors!*

cesses running on the system. The data given on the processes includes the user number, the process number, the priority level, the state (active, waiting for another process to terminate, or sleeping, suspended by self-request for a specified period or until receipt of a signal from another process). OS9 has a unified input/output system in which data transfers to all I/O devices are performed in almost exactly the same manner, regardless of the specific hardware devices involved. Thus, '**DIR >filedata**' lists the contents of the data directory to the file **filedata**, rather than to the screen. Similarly, the command '**DIR >/P**' would direct the output to the printer (parallel interface).

OS9 supports batch or background working. A command file containing the commands that make up the background job can be created with the **BUILD** command. If that file name is then issued to the shell then the commands will be executed. Background working can be ensured by setting the job priority to be low, with the **SETPR** command.

Multi-user access to individual files can be controlled with the shareable bit, set with the **ATTR** command (see above). When this bit is unset, simultaneous access by several processes is allowed. Unpredictable results caused by simultaneous access with **WRITE** rights is prevented with 'lock-out' of other users from the sector last read by a process; setting the shareable bit enables 'lock-out'.

Unfortunately, the **BACKUP** facility only works between disks of the same format; therefore, it cannot be used to backup the winchester onto floppies. There was supposed to be a **DSAVE** command, which scans the 'A' disk and generates a command file to copy all the files of the disk; we could not find **DSAVE** to test it. Since backup is important, and is done so frequently (isn't it?), and is so tedious and time-consuming, and is done when you are tired at the end of a hard session, then it should be easy to do. What is needed is a facility to scan the complete disk file structure, copy across files until the floppy is full, demand attention when this happens and pause for a response when a new floppy has been loaded, etc, until the backup has been done. There should also be a log of where each file has been stored, for later recovery pur-

poses. Alternatively, a tree copy command would have helped; this would copy all the files and sub-directories that came below a specified directory. This would work okay if you could be sure that the selected sub-tree would fit onto a single floppy; otherwise you would have the problem of breaking up the tree structure.

As a multi-user operating system, OS9 has certain defects. For example, the activities of different users are not isolated from each other; it is possible for a process to access memory outside its legitimate address space (using **POKE** in Basic, for example). Thus, a program with bugs in it (and what program of any size is bug free?), can corrupt another's process. Also, it is possible to redirect input/output between user terminals without the other user's permission; this causes some very interesting effects. More seriously, files on disk backing store cannot be considered to be secure. When the '@' character is appended to the reference to a disk drive, then the whole disk is regarded as being a single file. It is possible to completely circumvent the file security system. A malicious individual could overwrite the complete contents of the disk. We should perhaps also mention, that if you set up the password file as suggested in the manual, it has public reading rights!

## Basic 09

A language that can be compiled, has optional line numbers, needs a line editor to change the program, has Pascal-like control structures (plus some more) and variable typing and declarations (in addition to the usual Basic ones) and has Fortran type integer, real and character descriptors in the **PRINT USING** statements cannot sensibly be called Basic.

Basic09 is strongly orientated towards the use of procedures. When one invokes Basic09 one needs to supply the name of a procedure (by means of the **LOAD** command — load a procedure file, or the **E** command — edit a procedure), or the system chooses the exciting name **PROGRAM**. Editing takes place within one procedure, until you exit from that procedure. One can load more than one procedure into the Basic workspace, and can save one or all the procedures into a named file (the

# POSITRON 9000

name of the procedure(s) are distinct from the file name(s), although the default file name is that of the first procedure in the work space).

The Basic editor is entered with the E (procedure name) command, and thereafter can be used for line or string orientated editing. The former is the usual Basic mode, where numbered lines can be entered in any order, a line is replaced by re-entering it, and lines are deleted by entering the line number alone. However, since line numbers can be omitted (indeed you are encouraged to do so, to make the program more compact and faster in execution), standard text editor commands are also provided. These include, insert lines above the current line, delete one or more lines from the current position, search for a specified string of characters, and replace the specified string by another string (either for the first occurrence, or globally throughout the procedure). Lines are parsed, and converted to an internal format immediately on entering, rather than at run-time as is more usual with microcomputer implementations of Basic. An additional benefit of this approach is that reserved words (eg, FOR, NEXT, etc) are printed in upper case, regardless of the case in which they are entered. This aids clarity; unfortunately, it also means that when you use the string search or string change commands, you may have to remember to SHIFT to upper case (very annoying). What is less nice about the editor is that one backtracks a line with the '-' symbol and moves to the top of the procedure with the '-\*' combination; these characters required a SHIFT on the keyboard, and are therefore two-handed operations. One exits from the editor with the Q command; subsequently the interpreter carries out further syntactic checks that could not have been done on a line by line basis (eg, for undeclared arrays).

Once back in SYSTEM mode (as opposed to EDIT mode above), one can issue many of the usual Basic commands: LOAD, SAVE, LIST, RUN, etc. There is room for criticism of the ease of use of some of these commands; for example, in the editor one enters 'I\*' to list the procedure, but LIST is required in SYSTEM mode to list the last used procedure in the Basic workspace. LIST\*, however, causes all the procedures in the workspace to be listed. Where this really matters is with the SAVE command, which saves the last used procedure, and SAVE\*, which saves all the procedures in the workspace; in both cases the default file name is that of the first procedure in the workspace. Thus, if you enter SAVE (or, even, SAVE \*) instead of SAVE\* onto an existing SAVED file, then you lose all the procedures except for the first.

One unusual command is PACK, which compiles the procedure(s) and stores the result in the execution directory (which you may be sharing with many other users, of course!). Also, commands can be issued to the SHELL from SYSTEM mode, by inserting a '\$' character in front of the command.

The atomic data types of Basic09 are BYTE, INTEGER, REAL, STRING and

BOOLEAN. All can be input, operated upon and output. There is a memory saving advantage to using byte values, but no speed advantage. Obviously, there is both a speed and memory advantage to the use of the integer values rather than real values. There are variables capable of holding values of all these types. The default variable types are REAL or STRING (when the name ends in a '\$' character). Other types have to be declared with a Pascal-type construct (eg, DIM a,b,c:INTEGER; n, m: decimal; x,y,z:BOOLEAN — where decimal is a user defined type). User defined types are created with the TYPE statement. Thus, TYPE cust\_record = name, address (3): STRING; balance creates a type consisting of a name string, an address string vector of three elements, and a balance (of type REAL, by default). Therefore, later in the program the declaration DIM trans\_record: cust\_record can be made.

Both sequential and random access files can be accessed from Basic09. There are statements to CREATE, OPEN, CLOSE and DELETE files; one can specify READ, WRITE, UPDATE (both READ and WRITE access), EXEC (open in the execution directory, rather than the data directory) or DIR (open a directory file — can only be used for READ access). Sequential files contain only ASCII data and are accessed with the usual Basic commands of READ <channel> and write <channel>; these carry out any necessary conversions to ASCII format (eg, of numeric values). Random access files contain identical representations to those used in main memory. Thus, the conversion overhead is avoided (although the files are no longer human-readable with the LIST command). One can move to any byte position in the file with the SEEK command. Transfer to and from the file is accomplished with the PUT and GET Statements. These can operate on simple variables, arrays, strings, or complex user-defined structures. The last is very useful, and can be contrasted with the input/output of structures to the standard I/O paths, where each item of the structure has to be handled individually.

Basic09 is very well served for control statements. These are IF <condition> THEN <linenumber>, IF <condition> THEN <blockofstatements> ENDIF, IF <condition> THEN <blockofstatements> ELSE <blockofstatements> ENDIF, two FOR/NEXT (selected by the interpreter/compiler on the basis of the loop variable type — REAL or INTEGER, the latter is faster), WHILE <condition> DO <blockofstatements> ENDWHILE, and a REPEAT <blockofstatements> UNTIL <condition>. Unlike Microsoft-type Basics, <blockofstatements> can be of any length, and the statements are not confined to one line. If that were not enough, there is a LOOP <blockofstatements> ENDLOOP construct which sets up an 'indefinite' loop. Exiting from this loop is accomplished with an EXITIF <condition> THEN <blockofstatements> ENDEXIT construct. When the condition is satisfied, then the block of statements is executed, before control is transferred to the statement below the ENDLOOP statement. Several of these constructs can be included within one loop. This

provides a very nice answer to the situation when one wishes to exit from a loop for one of a variety of reasons and to carry out various tasks depending on the particular condition. Basic09 also provides the more usual GOTO, GOSUB/RETURN, ON... GOTO, ON... GOSUB and ON ERROR GOTO constructs.

Basic09 procedures are completely self-contained as regards variables and line numbers. Values may be passed by reference (by default) or by value. The former is the more common, and means that the address of the memory location is passed to the called procedure; this allows the location to be modified before returning to the calling procedure. In call-by-value, only the value is passed to the called procedure, and hence the value is protected against modification. The method by which call-by-value is selected is rather clumsy; an expression is supplied to provide the required value. If the value is to be extracted from a single variable then an expression must be forced, by adding 0 to the variable, for example. Unusually, if a procedure is to accept values from a calling procedure then the variables in the called procedure are not declared with a DIM statement, but with the PARAM statement; the syntax is identical to the DIM statement. Whereas the DIM statement causes memory space to be set aside, PARAM does not.

Other minor details of Basic09 are: PEEK and POKE are allowed; commands to the shell can be issued with the SHELL command, followed by the actual command in string quotes (eg, SHELL 'copy file1 file2'); TRON and TROFF set the trace flag; one can set whether the storage locations specified in the DIM Statements run from 0 to N-1 or 1 to N with the BASE0 and BASE1 statements respectively (the latter is the default); the usual READ/DATA internal data system is supported.

PRINT USING is very unusual, being based on Fortran-type descriptors. Thus I4 specifies that the integer should be presented to four digits, R8.2 specifies that the real number must be presented with a field width of eight (including provision for the sign and for the decimal point) and with two decimal places; E10.2 specifies that a number should be presented in standard form, with a total width of 10 places (including the six positions for sign, decimal point and exponent), and two decimal places. Descriptors also exist for outputting numbers in hexadecimal form, for strings and for boolean values.

If during program execution any of the following conditions arise then Basic09 enters DEBUG mode:

- i. an error occurs that is not intercepted by an ON ERROR GOTO statement;
- ii. a PAUSE statement is executed; or
- iii. a keyboard interrupt (CONTRL/C) occurs.

In DEBUG mode you can:

- i. send commands to the shell;
- ii. set up break-points;
- iii. CONTINUE program execution;
- iv. list a DIRECTORY;
- v. Quit DEBUG mode;
- vi. assign values to program variables;
- vii. LIST the suspended procedure;
- viii. PRINT values of procedure variables;
- ix. set the trig function mode to RADian or DEGree; and

x call the 'nesting' order of all active procedures.

Access to the 'high resolution' graphics (240x240) of the system is via a procedure LINE. Little documentation was available on how one could exploit the graphics system, although no doubt something could be worked out using LINE and POKE statements. Nevertheless, in comparison with the very much cheaper BBC and Sinclair Spectrum systems, the graphics facilities can only be described as thin. Access to the 'system console', ie, the main keyboard as opposed to additional user VDUs, would be necessary to display graphics: this could pose security problems when used by school pupils, students, etc, in an educational establishment.

One could take one of two opposing views to Basic09. One could say it's a dog's breakfast of features from Basic, Pascal and Fortran; or one could say that it is a sensible attempt to combine the best of the other three languages, although, inevitably, some will dispute whether it does achieve that. A possible criticism of Basic09 is that it is peculiar (ie, unusual), which nullifies one of the supposed advantages of high level languages — their consistency across many computer systems (hollow laugh in the case of Basic). If one regards Basic as what it was originally intended to be, ie, a beginner's language, then Basic09 is easily defended. It introduces programming constructs such as sophisticated control loops, user-defined structures (cf Pascal and Algol 68), procedures (and pass by reference and value), and so on, in a much easier format than, say, Pascal or Algol 68. If Basic is to be regarded as a standard programming language, with some degree of standardisation, then Basic09 offends more against the minimal Basic standards than do most implementations. Nevertheless, in its own right it is a powerful and easy to use language.

## OS-9 Pascal

Microware Systems' Pascal compiler generates p-code objects which can be interpreted by a 'normal' interpreter (PascalN) or a 'swapping' interpreter (PascalS) for large programs. Alternatively, PascalT is a native-code translator which accepts p-code files as input and produces 6809 assembly language source code. The compiler is invoked by means of a fairly complex command line:

```
Pascal (source p/n)list p/n) stats p/n
exec. options: parameters
(where p/n stands for 'pathname'). Of these, only the source pathname is mandatory (unless you want to type the code straight off the keyboard directly into the compiler). Two standard output files are produced by the compiler, PCODEF (the actual codefile) and PROCTAB, the compiler's workfile which is left in the data directory after the compiler exits (rather untidy). The 'parameters' field in the command-line can be used to redirect these files to other pathnames — essential if two or more users are to share the same data directory. In addition there are parameters to specify the format and extent of source and symbol-table listings, inhibit run-time range-checking and suppress the insertion of (diagnostic) source line-numbers into the p-code.
```

Optional range-checking covers array-bounds, memory references via pointers, and boolean and subrange type assignments. Exec-options define stack, heap and swapping buffer sizes together with string justification (leading or trailing blanks), MOD function algorithm, run-time error response and heap control options. Pseudo-comments covering most of the parameter and exec options may alternatively be embedded in the Pascal source. The list and stats pathnames default to the terminal-convenient for the most interactive program development.

The compiler allocates one byte of storage for each character and boolean, two bytes for each integer and five bytes for reals (ie, about nine significant (decimal) digits \* E±38). String constants may extend to 100 bytes and procedures may contain a maximum of 32 kbytes of p-code each while a program may have up to 254 procedures declared within it. The compiler will accept hexadecimal constants, prefixed with a '\$' sign. The keyword OTHERWISE has been added to the CASE construct as a catch-all clause. The compiler accepts subrange specifiers (eg, 'a'..'z') both within CASE definitions and SET membership assignments.

Both p-code interpreters are invoked by a command line of the following form:

```
PASCALx <input p/n >output p/n >>
syserr pcodename exec.options:params
'x' is either 'N' or 'S' depending on interpreter. Input and Output are the standard Pascal I/O files while Syserr is a standard OS-9 device which has been added to the Pascal standard devices. The pathname 'pcodename' is the only mandatory entry, being the actual codefile. Considering its position in the command line, in relation to the sourcefile in a compiler's command line, one can see that the Pascal environment is not especially 'orthogonal'. Params. is a user-defined string which is passed directly to the program once execution begins (so that a user-written program can behave similarly to an OS-9 utility, accepting a 'command line'). This is a nice feature but not as powerful as it might be under version 1 of OS-9 since the command line operators ('<', '>', '&', etc) are not allowed.
```

The swapping interpreter implements a full fixed-page virtual code swapping algorithm whereby a minimum of eight 256-byte pages are maintained in memory and only the code for locked or active procedures need exist in memory at any time. Strings are stored in separate pages so that additional pages (over the eight) need to be allocated for procedures which reference strings and remain active. Obviously, the more pages allocated the more efficiently the program will run, and the manual emphasises that an experimental approach must be adopted in optimising performance.

PascalT is a Pascal program which translates p-code into 6809 assembler language. Up to 36 reduction rules are employed to optimise for speed and space, although, on average, each byte of p-code generates just under two-and-a-half bytes of native code, so care needs to be exercised when translating large programs, especially on a floppy-based system. PascalT runs under the PascalS interpreter and prompts for

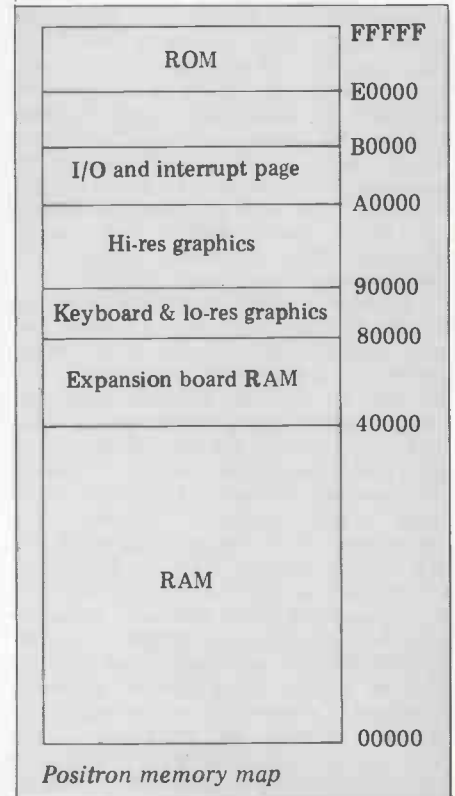
input and output filenames. Not all procedures in a program need to be translated into a single output module with a separate file of (external definition) references for subsequent use by the link/load utility PascalE. It is possible to embed the original source line-numbers in the assembly file. If the partial translation is done, the relevant procedures must be removed from the Pascal source-file and replaced with external references. The modified Pascal source-file is then re-compiled before being linked with the assembled native-code module. Native-code modules may not be swapped (which probably explains why PascalT must run under PascalS).

If an entire program is translated it can be invoked by:

```
program <input >output >>
syserr exec.options :parameters
where all terms are as previously described for the interpreters including the parameter string 'parameters'. For true optimisation it is necessary for the user to provide PascalT with information about local and extended stack and heap space — this is prompted for during execution.
```

Apart from the CASE statement extensions mentioned earlier, OS-9 Pascal differs from standard Pascal in that the underscore character is recognised in identifiers; strings are implemented; procedures and functions may not be passed by name; files may not be passed by value (and may be omitted in the PROGRAM statement); DISPOSE, PACK and UNPACK are not implemented and PACKED is ignored (although variable space is allocated on byte boundaries). Character arrays can be indexed (in their right-most dimension) by the form 'p FOR q' where p and q are integers such that p is the index of the first element to be referenced and p+q is the element of the last element referenced. Thus:

```
String [1 FOR 5] := 'ERROR'.
OS-9 distinguishes between 'terminal-like' (SCF) and 'disk-like' (RBF) devices
```



# POSITRON 9000

and this distinction is carried over into the OS-9 Pascal I/O. RBF files follow the proper language specification while SCF files get around the usual Pascal 'interactive' problem by only loading the buffers when they are needed (lazy I/O). This means the EOLN and EOF functions behave slightly differently for the two types of file. The boolean function INTERACTIVE(filename), which returns a value of TRUE whenever 'filename' refers to an SCF-type file, must be employed to provide the customary interactive I/O. A number of 'standard' procedures and functions are provided for file-handling and interacting with OS-9. These include the ability to access the file of error-messages and to suppress non-fatal OS-9 I/O errors. Other procedures and functions allow, among other things, for the trapping of certain arithmetic errors (overflow, range, divide by zero); bit manipulation within integers and forking to the SHELL. There are three run-time support packages, SUPPORT (9k), which contains all routines, SUPPORT1 (7k), which lacks the transcendental functions and SUPPORT2 (5k) which lacks support for any reals and some of the file-handling procedures.

## Other software

Several other software items which, for one reason or another, we were not able to review in much detail include a full implementation of CIS Cobol; a C compiler; an interactive assembler and debugger; a word-processing package, Stylograph; and RMS, a record management system. According to Positron, negotiations are underway to obtain a rather fruity suite of commercial packages which will run on the system via the CIS Cobol implementation.

Stylograph features normal cursor-controlled screen editing with additional block operations and text-formatting functions like filling, centering, headers/footers, etc. The system is designed to interface to individual terminals and printers by means of separate drivers which seem fairly straightforward to construct. It is possible to direct output to disk files and to pass commands to OS-9 from within Stylograph. Positron claim that a new version will incorporate a 'mail-merge' facility.

RMS is a suite of programs which enable the user to create a record format specification (up to 1022 bytes long), to create and maintain a file of (up to 65,536) records according to the record specification and to output a selection of the records according to a pre-defined print-format. A system of secondary records may be associated with each primary record, one (common) field being designated the KEY field (storage is by hash coding). Fields may be alphanumeric, numeric or in 'money' or 'data' format. Validation can be according to length, range or membership of an explicit list. Output can be driven by a file of symbolic commands created by a text editor. It would probably be preferable if the commands were a bit more wordy as a complicated output 'program' would be

quite difficult to debug. Index files (which merely contain a list of KEY values in some significant order) can be used to access the file selectively — but these must be assembled 'by hand' with a text editor and ordered with a SORT/MERGE package (not supplied). Overall, it seems convenient and flexible to use although not particularly powerful or comprehensive.

## Potential

The Positron 9000 is a difficult system to place in the marketplace. It's too different (and a bit too expensive) to compete with any of the standard, single-user CP/M systems with their huge repertoire of software; it certainly isn't a hobbyist machine; yet it offers a multi-tasking operating system (not necessarily even with disks!), a substantial expansion pathway and the potential for multiple users. At the same time there is the Viewdata terminal capability which doesn't really seem to fit in with the rest of the system.

In fact, the machine has been offered for some time to schools but while Basic09 is a very reasonable language with which to learn programming (as is Pascal), we felt that the multi-user aspects of OS-9 (level 1) were not sufficiently robust to provide a stable programming environment for a number of (beginning) users. Keyboard operations are noticeably affected when more than one user is active (hard to expect beginners to take this into account); and we found that the system rejected processes when memory filled up (instead of, perhaps, queuing them), requiring human intervention (hence a supervisor). Perhaps level 2 of the operating system copes better with these problems.

On the other hand, the 6809 is a processor well-known to and much admired by a number of digital designers and any professional who takes the trouble to learn the intricacies of OS-9 (and that includes Unix programmers) should be able to construct themselves a fairly comfortable development environment. The system has a vast capacity for ROM and provides a cheap route to multi-tasking which should mean that, with careful programming, a fairly robust, turnkey delivery system could be built. We would guess that such a system, with its well-

designed boards and expansion capabilities, should appeal to industrial OEMs, especially those expecting to exploit GPIB devices, provided they don't need to push that single little processor too hard. Additionally, a nationwide maintenance service is provided for Positron by Fisons Scientific.

## Documentation

The documentation was of a quality which computer professionals have grown to expect — that is, most of the information was there if one was prepared to persevere. We estimated that about five passes through the manuals would be necessary to resolve all unknown references! They were

## Basic Benchmarks

|     |      |
|-----|------|
| BM1 | 1.1  |
| BM2 | 2.1  |
| BM3 | 5.4  |
| BM4 | 6.8  |
| BM5 | 7.2  |
| BM6 | 14.9 |
| BM7 | 20.2 |
| BM8 | 12.0 |

All timings in seconds. For an explanation and listing of the Benchmark programs, see PCW Vol 4 no 11.

## Pascal Benchmarks

|                |       |
|----------------|-------|
| magnifier      | 5.2   |
| forloop        | 59.3  |
| whileloop      | 73.3  |
| repeatloop     | 67.0  |
| literalassign  | 72.5  |
| memoryaccess   | 73.4  |
| realarithmetic | 61.8  |
| realalgebra    | 48.1  |
| vector         | 172.9 |
| equalif        | 115.1 |
| unequalif      | 110.4 |
| noparameters   | 38.6  |
| value          | 41.2  |
| reference      | 41.9  |
| maths          | 32.9  |

These figures were obtained with the interpreter PascalN. We would have liked to have obtained figures for the native-code (PascalT) version but ran out of time.

## Prices

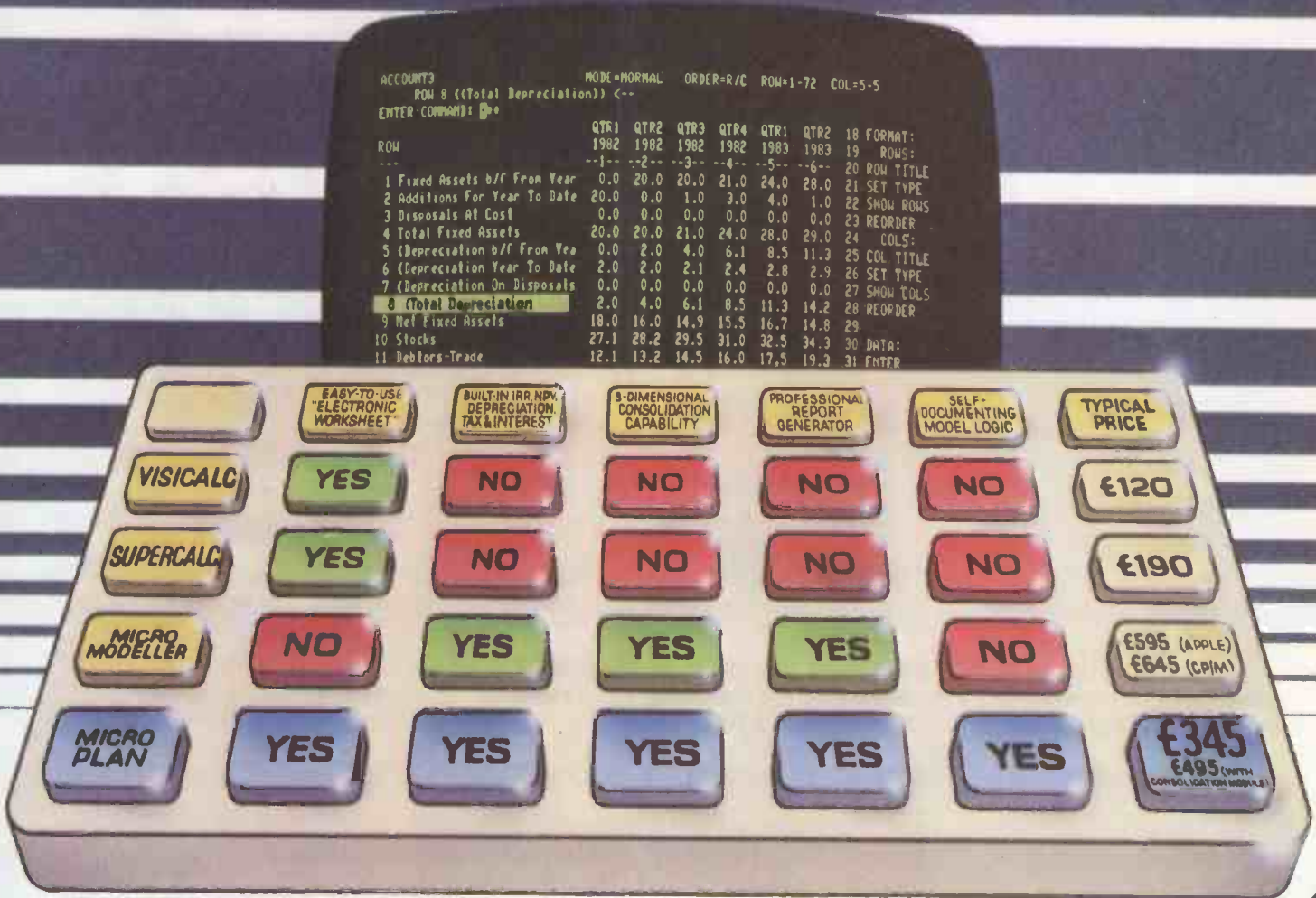
|               |  |       |
|---------------|--|-------|
| Positron 9000 | basic system with 64k RAM,<br>4 x RS232 and IEEE-488 | £1095 |
| 9000/40       | the review system with Viewdata<br>keyboard          | £1536 |
| 14in          | Viewdata colour monitor                              | £320  |
| 9151          | dual 5¼in, 380k floppy drives                        | £950  |
| 9250          | 5 Mbyte winchester                                   | £2750 |

## Technical data

|           |   |
|-----------|---|
| CPU:      | MC6809 (1 MHz)  |
| Video:    | 24x24 Viewdata colour, 240x240 pixels                 |
| RAM:      | 64k — 512k  |
| ROM:      | 36k — 256k  |
| Comms:    | Cassette (300, 1200 baud), IEEE-488, 4—12 RS232       |
| Keyboard: | 61-key Viewdata, graphics and numeric pads            |
| Bus:      | Positron's own  |
| Disks:    | 2 — 4 5¼in 380k floppies<br>1 — 4 5 Mbyte winchesters |

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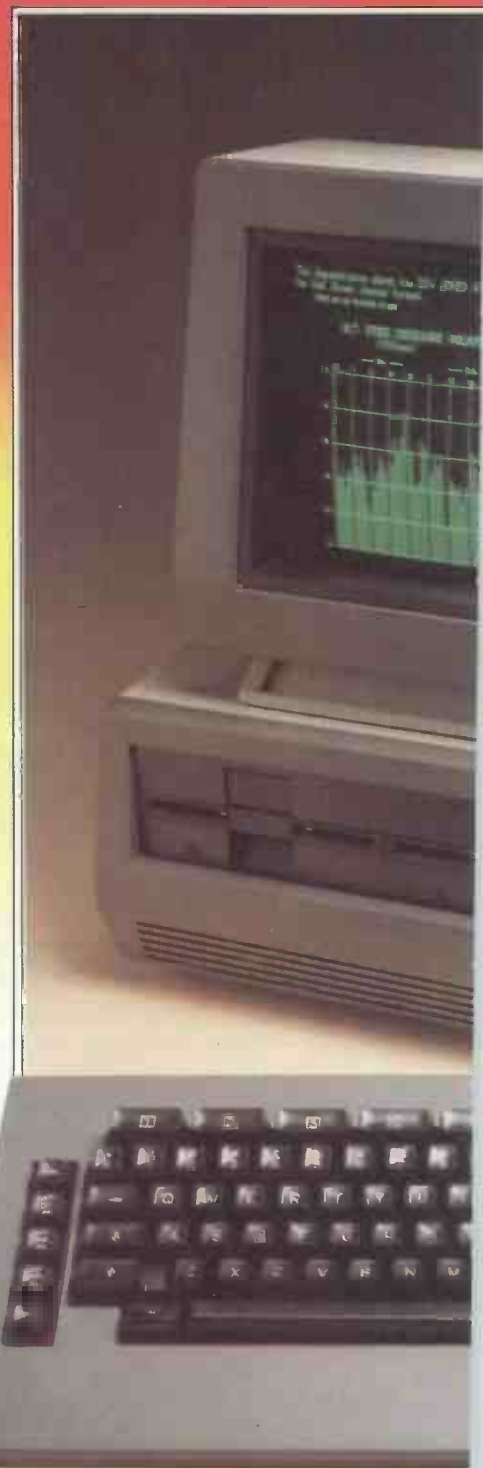
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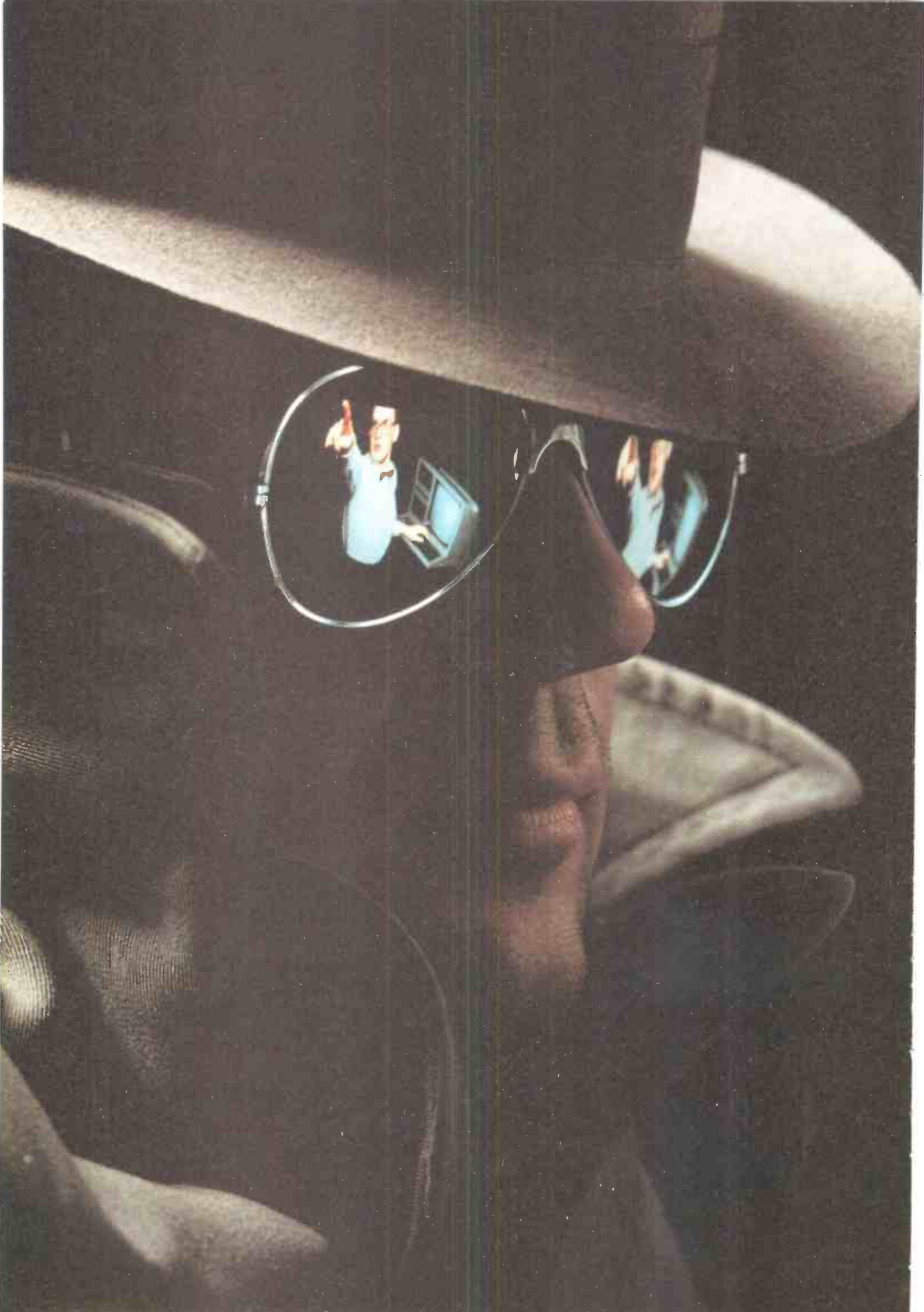
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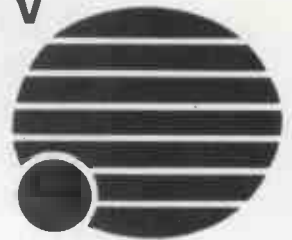
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# THE ULTIMATE TEST?

by Chris Sadler and Sue Eisenbach

In the September issue of *Byte* magazine, Jim Gilbreath, head of the Computer Sciences and Simulations Department of the Naval Ocean Systems Centre in San Diego, published a benchmark program which he had translated into 10 different languages and run on dozens of different machines and compilers.

While preparing last month's article

```

10 REM ERATOSTHENES SIEVE PRIME
    NUMBER PROGRAM IN BASIC
20 INTEGER ALL
30 SYZE = 4094
40 DIM FLAG(4095)
50 DISPLAY "ONLY 1 ITERATION"
60 COUNT = 0
70   FOR I = 0 TO SYZE
80     FLAG(I) = 1
90   NEXT I
100  FOR I = 0 TO SYZE
110   IF FLAG(I) = 0 THEN 180
120   PRIME = I+I+3
130   K = I + PRIME
140   IF K>SYZE THEN 170
150   FLAG(K) = 0
160   K = K + PRIME
170   GOTO 130
180   COUNT = COUNT + 1
185   REM DISPLAY PRIME
190   NEXT I
200 DISPLAY COUNT, " PRIMES"
210 END
    
```

on the different language translators available under SofTech's UCSD (version IV) p-System, we decided to use his program to compare the efficiency of the p-code produced by the p-System's Pascal, Fortran 77 and Basic compilers. Frankly, since the p-System is so well-known for its Pascal, we had expected that only lip-service would have been paid to the problem of optimising the p-code statements generated by the other two compilers. The benchmark uses an algorithm based on the Sieve of Eratosthenes to compute the 1899 prime numbers between 3 and 16384.

Once a prime is found, all multiples within range are eliminated, and this information has to be remembered for subsequent processing, so quite a lot of storage is necessary. Unfortunately, SofTech's Basic did not have room in

RAM for the 8k in reals (we decided not to use virtual arrays as we didn't want to compare disk and RAM accessing) required by the *Byte* program and in the end we had to reduce the array to 4k of integers before it would fit in — ie, all primes from 3 to 8181. The programs in Pascal and Fortran are set up to do 10 iterations of the algorithm (as in the original article), although the figures presented below are for a single pass in order to be comparable with the Basic program. The reason Jim Gilbreath built in the different iteration count was to get similar figures for compiled and interpreted code — but since, on the p-System, all the programs are compiled into p-code which is subsequently interpreted, the need for this distinction disappears.

*GOTO page 207*

| Language    | Compile time | 8k primes | 16k primes |
|-------------|--------------|-----------|------------|
| Basic       | 33.6 secs    | 15.7 secs | —          |
| Fortran     | 27.7 secs    | 14.1 secs | 28.6 secs  |
| Pascal      | 28.1 secs    | 13.0 secs | 26.6 secs  |
| UCSD Pascal | 30.6 secs    | 11.0 secs | 20.4 secs  |

Table 1

Program Primer;  
( Eratosthenes Sieve Prime Number Program  
using UCSD Pascal features )

```

Const size = 4094;

Var flags : Array [0..size] of Boolean ;
    i, prime, k, count, iter : Integer ;

Begin
  Writeln ('10 iterations') ;
  For iter := 1 to 10 Do
    Begin
      count := 0 ;
      fillchar(flags, sizeof(flags), true) ;
      For i := 0 to size Do
        If flags[i]
          Then
            Begin
              prime := i+i+3 ;
              k := i + prime ;
              While k <= size Do
                Begin
                  flags[k] := False ;
                  k := k + prime
                End ;
              count := count + 1
            End
          End ;
      Writeln (count, ' primes')
    End .
    
```

```

20   K = I + PRIME
    IF (K .GT. 8190) GOTO 90
    FLAGS(K) = .FALSE.
    K = K + PRIME
    GOTO 20
90   COUNT = COUNT + 1
    WRITE(1, 100) COUNT
91   CONTINUE
92   CONTINUE
    WRITE(1, 200) COUNT
    STOP
100  FORMAT(1X, I6)
200  FORMAT(1X, I6, ' Primes')
    END
    
```

Program Primer;  
( Eratosthenes Sieve Prime Number  
Program in Pascal )

```

Const size = 8190;

Var flags : Array [0..size] of Boolean ;
    i, prime, k, count, iter : Integer ;

Begin
  Writeln ('10 iterations') ;
  For iter := 1 to 10 Do
    Begin
      count := 0 ;
      For i := 0 to size Do flags [i] := True ;
      For i := 0 to size Do
        If flags[i]
          Then
            Begin
              prime := i+i+3 ;
              k := i + prime ;
              While k <= size Do
                Begin
                  flags[k] := False ;
                  k := k + prime
                End ;
              count := count + 1
            End
          End ;
      End ;
      Writeln (count, ' primes')
    End .
    
```

C Eratosthenes Sieve Prime Number Program  
in FORTRAN

```

LOGICAL FLAGS (8191)
INTEGER I, PRIME, K, COUNT, ITER
WRITE (1,50)
50  FORMAT (' 10 Iterations')
DO 92 ITER = 1, 10
  COUNT = 0
DO 10 I = 0, 8190
10  FLAGS(I) = .TRUE.
DO 91 I = 0, 8190
  IF (FLAGS(I) .EQ. .FALSE.) GOTO 91
  PRIME = I + I + 3
    
```

## A high-level language benchmark

# STEREO GRAPHICS!

Paul Stevenson outlines a neat and novel way to get 3-D on a micro

Now that high resolution colour graphics, in various forms, are becoming available in small computers the possibility exists of generating the traditional red/green image pairs necessary to produce a three-dimensional stereoscopic image when viewed through a pair of spectacles with a red filter over one eye and a green over the other.

The geometrical theory behind the positioning in the red and green parts of the image will be given and one example program for the BBC/Acorn computer is included. Finally, possible applications are considered.

Consider first the red and green images which would have to be produced on the page of a book to give the image of a pyramid standing vertically from the page when viewed from 45 degrees. (see Fig 1). This example is chosen because it works particularly well and because the programming is particularly simple when it is later transferred to a VDU screen.

Assume that eye L is to view through a green filter and that eye R looks through a red one. The desired final image is shown in black WXYZA. The eyes are taken as being 6 cm apart. Since a red line on a white ground should not be visible through a red filter and should appear black through a green one and a green line will similarly not be visible through a green filter but will appear black through a red filter, the images of the intended pyramid as seen by each eye separately can be extrapolated back to lines projected onto the horizontal surface as shown. In fact, for simplicity, the only point in the example which needs extrapolating is the apex of the pyramid A, if one assumes that the base of the pyramid lies in the plane of the page. This gives projected points GA and RA as seen by the right and left eyes respectively. Thus all that has to be done to define the green image on the page (screen) is to join GA to the points WXYZ. The red image can then be joined up in a similar manner. In the example the red and green images are symmetrically placed with respect to the centre line but this need not be so for other objects.

Fig 2 shows the final appearance of the images on the screen or page. Note that around the base WXYZ, where both red and green images overlap each other, the line should be plotted in black since it has to be present at both eyes. The final image received by the brain is in monochrome. Both the BBC and RML 380Z machines make provision for making the logical AND function of the plotted red and green colours equate to black and this is a distinct advantage in the programming.

Fig 3 shows the viewing situation for the example program — it was arranged this way because the final pyramid was required 'correct way up'. (There are other ways of achieving this with the VDU arranged conventionally but the geometry is much harder to explain.)

The effect is very powerful if the filters are closely matched to the colours on the screen (more on that later).

Having decided to replace the page with a VDU screen placed horizontally then essentially all that one has to do is to decide on:

- a) the size (centimetres) of the pyramid base;
  - b) the height of the pyramid;
  - c) the viewing distance and angle (50 cms and 45 degrees in this example);
- a) and b) are both variables presented to the program.

What remains is to calculate the screen coordinates of WXY and Z and of the points GA and RA. This involves only simple ratios in similar triangles. At a late stage in the program the position of points GA and RA will have to be converted from centimetres to plottable screen points. This conversion will depend on the resolution of the graphics employed but in the BBC/Acorn machine used this conveniently works out on both axes at about 55 points per centimetre.

The program is listed in Fig 4 and is written in BBC/Acorn Basic but as far as possible it has been kept to a common subset of Basic. For instance, no graphics offset origin or procedure calls been used, both of which would have simplified the code.

## Extensions to the program

The following extensions to this simple program are possible if there is a drive to experiment.

First offset the apex of the pyramid relative to the base. Secondly raise the base itself off the actual screen. The latter task involves calculating the red and green image positions for all four corners of the base as they will not now overlie each other. The pyramid can now be made to appear suspended

above the screen surface (yes it does work) but the height it appears above the screen surface is limited by the screen size you are using — the images start to plot off the top of the screen area if it is raised too high.

A third possibility is to experiment with the viewing angle, but this has not been tried yet. In relation to this, to avoid the silly situation of a VDU monitor lying on its back, a 45 degree viewing angle can be obtained with the VDU in its 'normal' position but with the view standing 45 degrees 'above' the screen. This is more convenient for viewing — the images are plotted 'down the screen' — GA and RA are near the bottom, but the pyramid 'sticks out' towards the keyboard (not so useful for teaching). Talking about teaching use — here is a snag! The effect can only be seen well by one or two people at a time. There appears to be considerable latitude in both viewing distance and angle of view before the effect disappears altogether but at non optimal positions the pyramid is 'distorted'.

## Depth illusions

A program has been experimented with, whereby a framework cube is made to appear suspended in the space between the viewer and the screen (see Fig 5).

With appropriate image placing on the screen, the cube can be made to appear, say, halfway between the viewer and the screen. Using the same type of geometry as before the projections of the cube corners onto the screen from each eye can be calculated and then plotted. The effect works but it is (or appears) more difficult to 'conjure up' as it needs the eyes to be focused on empty space at the halfway point where there is nothing there to start with. The main source of light — the screen — acts as a distractor. If the image is on or near the screen everything appears to work much better.

This program has, as input variables,

|                  |  |
|------------------|--|
| Lines 40 and 50  | fix the pyramid height and base in centimetres.  |
| Line 60          | sets a variable to half the base length. The 55 converts from centimetres to screen units.   |
| Line 100         | selects the appropriate graphics mode (four colours)   |
| Lines 110 to 116 | sets the colours to red and green, with a white background for the graphics.   |
| Line 130         | clears the graphics area to its white background.  |
| Line 140         | calculates the length of GA to 0 (Fig 1) in cms. The 40.11 is the length of OT (one could almost use 40 cms).  |
| Line 150         | calculates the displacement left of the centre line for the point GA in screen units this time.  |
| Line 160         | calculates a similar displacement up the screen.   |
| Line 410         | chooses colour green.  |
| Lines 420 to 510 | draws the green image.   |
| Line 655         | since the green and red images are symmetrical this sets the displacement right of the centre line for RA. (DU is the same as before.)   |
| Line 660         | The clever one! This chooses red to plot unless the colour already there is green in which case it draws black. This will make the red/green overlap areas the correct colour. |
| Lines 670 to 760 | plots the red image.   |
| Line 998         | waits for any key before restarting.   |

Program explanation — see fig 4.

the distance of the desired cube from the eyes, its size, and its angle to the horizontal.

## Images behind the screen

The principle here is the same as in a) but beware — the relative placings of the red and green images are reversed left for right.

Fig 6 should make this clear and illustrates how a frame cube could be made to appear *inside* the VDU tube. Beware of this red/green reversal effect if you have an object which you wish to intersect the screen. The same difficulties about distraction during focusing apply as in a) — the light from the screen has to be ignored as far as possible.

## Selection and rotation of objects

For trial purposes select simple objects. Each corner on an object has to have a projection calculated onto the image plane, and the fewer there are the better. Leave a scale model of the Starship Enterprise till later!

Rotation has been tried with the cube revolving in space between viewer and screen but Basic is too slow to get a nice effect — machine code must be used here.

## Practical points

The matching of the filter material bandpass to the intensity/depth of the colour red or green is important. Through even the best red filter some vestige of the red line will be visible on the screen. Reducing overall screen brightness seems to help here. The relative 'blackness' of each colour when viewed through its opposite colour filter should be the same. If one is black and

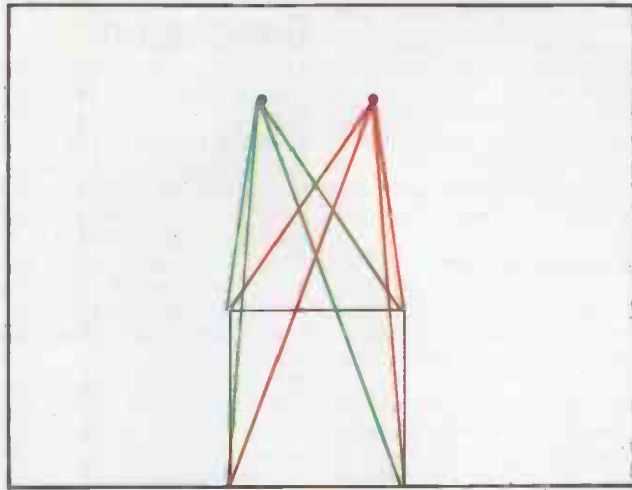


Fig 2. Final images as they appear on the screen or page.

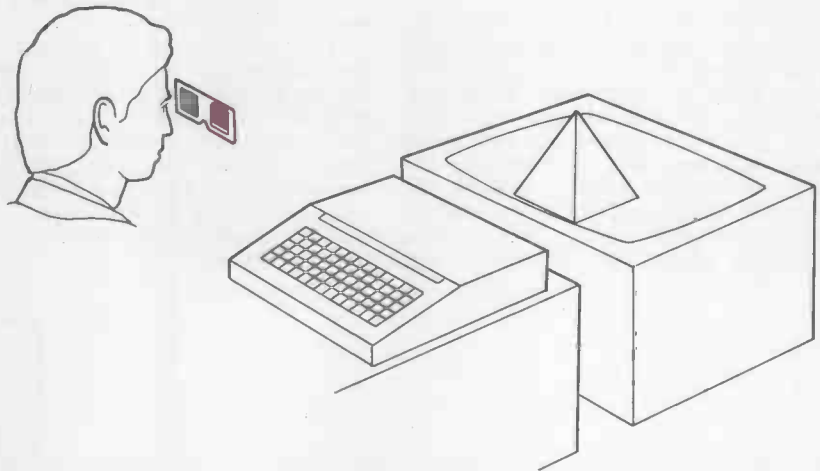


Fig 3. Viewing situation for the example program (put feet on the back of your VDU!!).

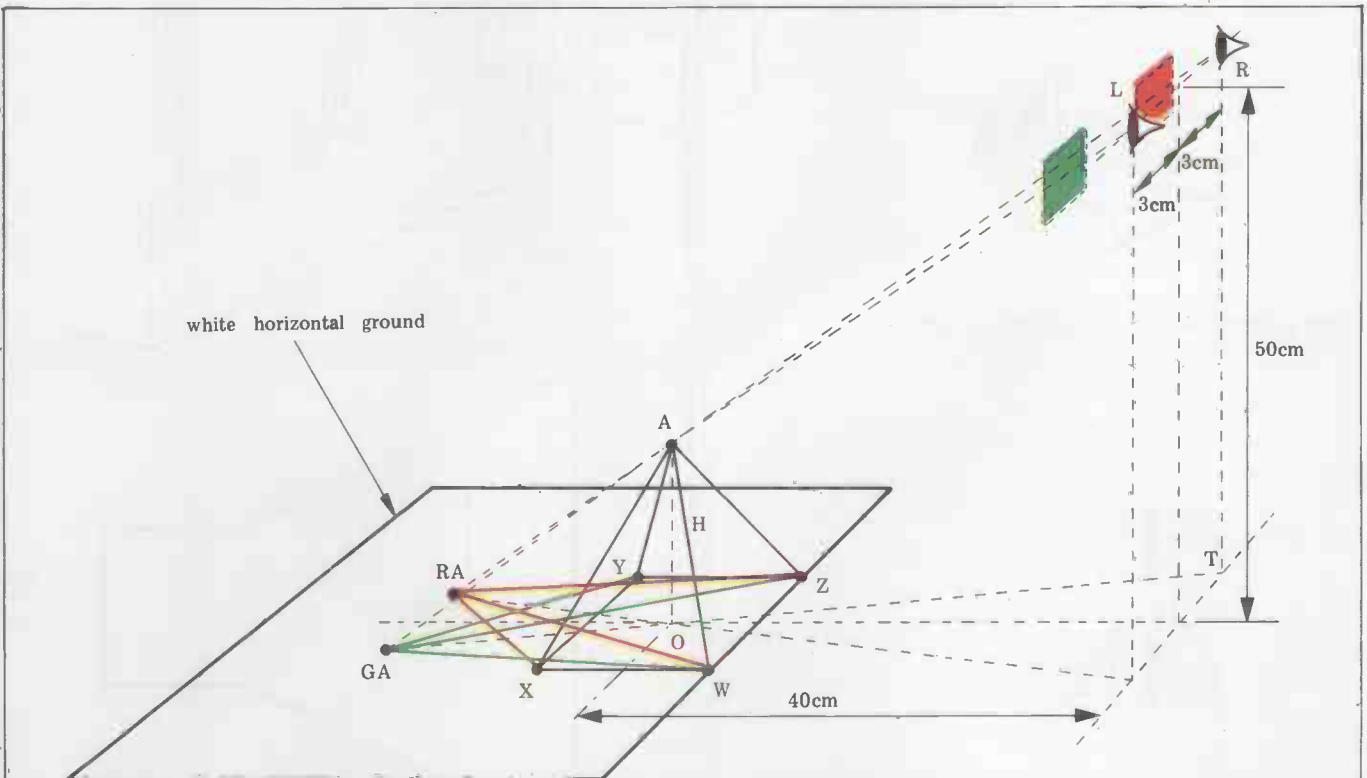


Fig 1. Basic geometry to produce red and green images on a horizontal page or VDU screen.

# STEREO GRAPHICS!

the other a shade of grey the brain will not properly 'pull' the stereo image into the middle and one of the red or green images will dominate.

This is where a facility like the RML 380Z's to 'mix' ones own 'shade' of red or green is very valuable. One then accepts whatever filters one can get hold of and fiddles with the colour mix. This is more elegant.

Wire frame models have been used so far as they do not involve the 'hidden line algorithm'. We now have a need for a hidden line algorithm in three dimensions before real objects can be shown. Who will try?

Although rotation of whole objects is slow it is possible to make a shape 'grow' an extension or 'arm' from a fixed base, and on my first example of the vertical pyramid I have had a small 'character' climb one of the sides 'out' of the screen — hurrah for the BBC's (and the 380Z's) programmable characters!

The ideal to aim for is to have a program which will ask for the coordinates of all corners of an object (or read them from disk if they have been pre-recorded) and a statement about how they are to be joined up and scaled along differing axes if necessary. The program should then request the required position of the object and the viewer and then procede to plot it on the image plane. This is still some way

off as a general package for a wide class of objects.

## Conclusion

The impact of seeing one's first stereo 'object' emerging from the screen is immense. I do encourage you to try. To whet the appetite, how about the following developments for the future?

Computerised chess with graphics-generated 3-D pieces (remember the horizontal screen/board in Fig 1).

'Star Trek' and similar games chasing Klingons 'through' the screen into the distance instead of across it.

'Adventure' type games in genuine 3-D mazes.

Maybe with machine code in a dedicated ROM these are not too far off!

On a more prosaic level, and with more educational content, how about: 'Contour' maps in geography.

Three-dimensional graphs in any setting. Technical drawing projection work — make third angle projection drawings 'come to life'.

Three-dimensional geometry and trigonometry teaching.

This list is probably only scratching the surface but to deflate enthusiasm for the technique a little there is still a need for a convenient or quick way of projecting curved objects onto the screen. Circles are okay, but other curves are more difficult — or are they?

I would like to hear from readers who successfully try these techniques or extend them.,

```

10 REM 3-D PYRAMID P.W. STEVENSON
40 INPUT "PYRAMID HEIGHT (CM)" H
50 INPUT "LENGTH OF BASE (CM)" B
60 D = B*55/2
100 MODE 5
110 VDU 19,2,3,0,0,0
112 VDU 19,131,0,0,0,0
114 VDU 19,128,7,0,0,0
116 VDU 19,130,2,0,0,0
130 CLG
140 X = H * 40.11/(50 - H)
150 DL = 3 * X * 55/40.11
160 DU = 40 * X * 55/40.11
400 REM GREEN IMAGE TO RIGHT EYE
410 GCOL 0,2
420 MOVE 640 - D,0
430 DRAW 640 - D,2 * D
440 DRAW 640 + D,2 * D
450 DRAW 640 + D,0
460 DRAW 640 - D,0
470 DRAW 640 - DL, D + DU
480 DRAW 640 - D,2 * D
490 MOVE 640 + D,0
500 DRAW 640 - DL, D + DU
510 DRAW 640 + D,2 * D
650 REM RED IMAGE TO LEFT EYE
655 DR = DL
660 GCOL 1,1
670 MOVE 640 - D,0
680 DRAW 640 - D,2 * D
690 DRAW 640 + D,2 * D
700 DRAW 640 + D,0
710 DRAW 640 - D,0
720 DRAW 640 + DR, D + DU
730 DRAW 640 - D,2 * D
740 MOVE 640 + D,0
750 DRAW 640 + DR, D + DU
760 DRAW 640 + D,2 * D
998 INPUT T$
999 GOTO 40
    
```

Fig 4.

Reference:- *Descriptive Geometry with 3-D Figures* Imre Pal, Hungarian Technical Publishers 1965. **END**

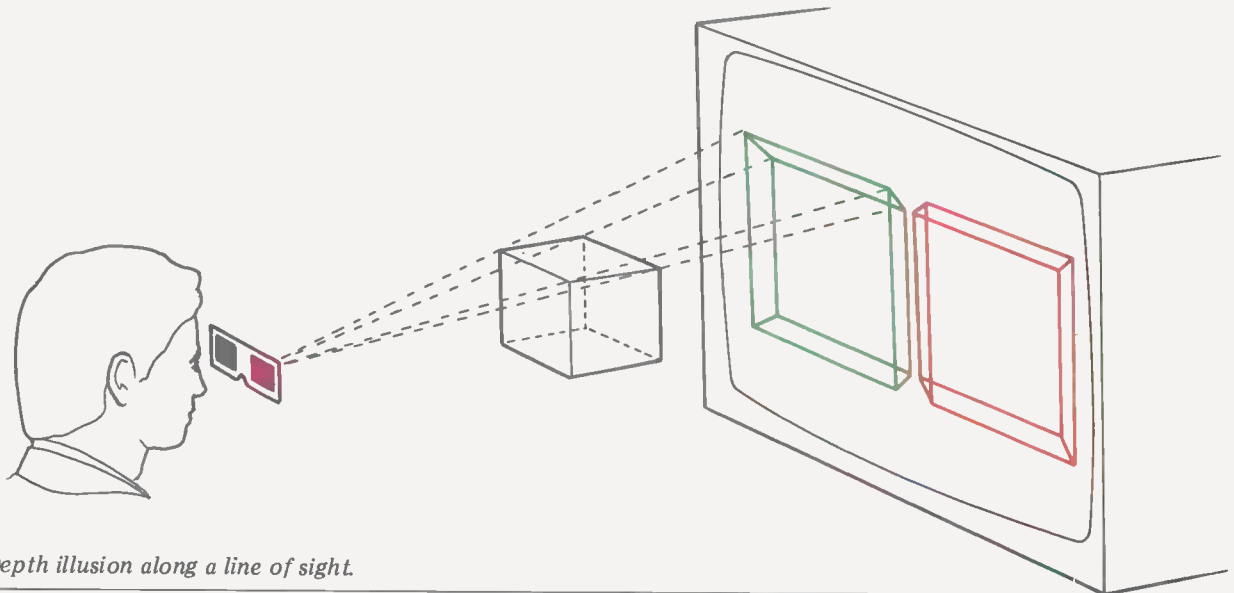


Fig 5. Depth illusion along a line of sight.

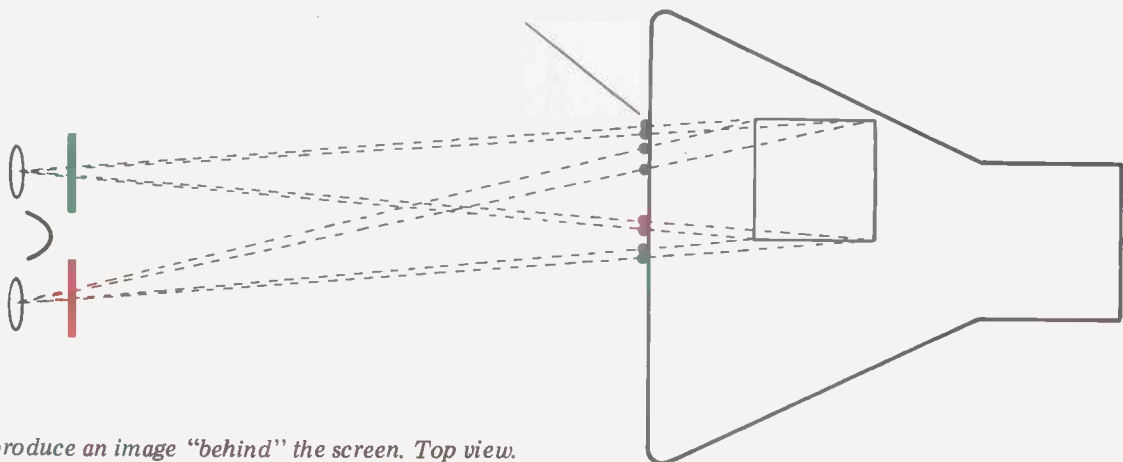


Fig 6. To produce an image "behind" the screen. Top view.

# MAKING A HASH OF IT

Paul Overaa describes hashing, a fast file access method

In many applications it is necessary for sets of data items to be searched in order to rapidly locate an item or items of a specified value. Various approaches exist, including keeping indexes to locate the desired items, but this may require maintaining indexes of the key fields in sorted order so that techniques such as binary searching may be used. Although for some applications this is the best approach there are in many cases alternative solutions. One such alternative is known as 'key to address transformation' or 'hashing' and when used with care (ie, for suitable applications) it is possible to locate records in a fraction of the time that other methods will take.

In a general sense the problem is as follows: you wish to store data in such a way that given particular key fields you could retrieve other data items associated with the keys. As a concrete example, suppose you have a customer file containing records with the following fields or attributes:

CUSTOMER NAME  
CUSTOMER ADDRESS  
INVOICE ADDRESS  
CREDIT STATUS  
CURRENT CREDIT  
DISCOUNT LEVEL

Given the customer name, you would wish to access the particular customer record in order to obtain the remaining details in the customer file. Let us suppose that it would be possible to find some 'rule' or 'function' that would turn the characters of each customer's name into a number each of which was unique and in the range of record numbers you had allotted for your customer file. The existence of such a rule or function would mean that given any customer name you would be able to compute the record number using only the rule. It would therefore be possible to store your records in locations that could subsequently be retrieved without any search at all simply by computing the location of the record from the customer name.

It is fairly obvious that in general no such rules exist, but if we relax the condition that our rules must produce unique numbers and instead be content with a situation where occasionally different keys will produce the same number then we are into the realm of hashing techniques or, as it is often called, key to address transformation techniques. When different keys result in the same hash value being computed then there is going to be a distinct probability that we will attempt to access a record that is not the one we require. Such occurrences are termed 'collisions' and a discussion of how

these are handled is important to the ideas that follow. If the hash function results in a collision then it is necessary to compute a 'second try' and maybe even further tries until the record we require is identified. In the worst possible case all records in the file would be examined before the correct record was located. Such occurrences are extremely unlikely but... because it is possible at all it is necessary to make the following stipulation: any hashing rule used (and we now must include a method for calculating further locations to try in the event of collisions) must in the worst possible case be able to access every possible location available in the file. The frequency of collisions is related to the number of 'used' records in the file. It is a common practice to allocate some 20% more file space than an application requires since this helps to ensure that collisions are kept to an acceptable level.

Addition of data records would use the same rules and would search for the first location that was empty — ie, if the hash function located a record that contained data, then a second try, etc, would be made until an empty record was located. The new data would then be stored at this position in the file.

## Circular files

The concept of a circular file is crucial to the approach I shall use to develop my ideas. I want you to imagine that the computer file is wrapped around a circle with the records of the file spread evenly around the circumference and that possible record numbers range from zero to (N-1).

Those that have studied any modern mathematics will appreciate the connection of my approach with the concept of 'clock arithmetic' — ie, arithmetic modulo N where N is the number of records in our 'Circular File'.

Our problems are as follows:

1. We require a rule that enables a record number to be calculated and a further rule that enables additional 'tries' to be calculated.
2. The rules must in the worst possible cases be able to search the whole of our circular file.
3. The rules must attempt, as far as possible, to distribute the data we store evenly around our circular file otherwise there will be increased chances of collisions which will increase the time required to access a required record.

The most serious immediate problem is 2 — ie, how can we be sure that our circular file will be searched completely

by any rule we could use? We could examine critically every rule that we invent and this approach has been used many times (it frequently results in some quite frightening mathematics) or we can make certain restrictions that will enable us to prove that in the worst cases we are in fact able to search the complete file.

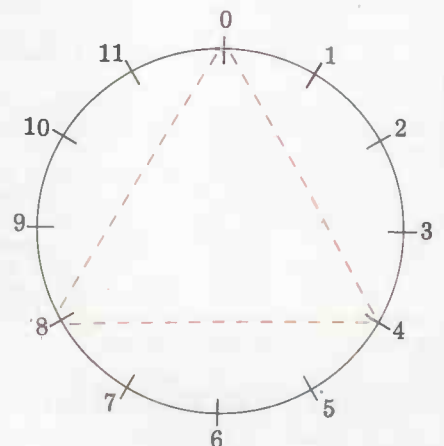
The restrictions that I make are as follows:

1. Our hashing rules must produce two numbers, the first of which lies between zero and (N-1) and the second between 1 and (N-1) where N is the number of record positions in the circular file we are using.

2. The first number is used as the initial attempt value and the second number is used to 'step round' the file using a fixed step-length.

3. The size of the circular file is such that it contains N record positions where N is a prime number, ie, contains no factors other than unity or N itself.

The stipulation of N having to be a prime number enables us to state that any non-zero step length that is less than N will result in every location of the file being examined in the worst possible case. The proof of this is fairly straightforward and has an important corollary... namely that if you do not use a prime number sized file and the 'step-length' calculated has a common factor with your file size N then it will be impossible to search the file completely. To appreciate this image stepping around a file of twelve records using steps of 2,3,4,5,8,9 or 10 all of which have common factors with 12 and all of which will fail to search all of the 12 possible records.



Note: A step length of 4 results in only three records being examined irrespective of how many times we step around the circular file.

# MAKING A HASH OF IT

The calculation of a non zero step-length less than N provides a solution also to the problem of uneven distribution within the file since even if the initial record number produces a collision with another record it would be necessary for the keys to produce identical step lengths as well as before the same path would be followed for more than the first attempt.

At this time a rather important point to be made is that most computer systems do not allow zero as a valid record number. The solution in practice is simply to ensure that computed values are incremented by one, thus avoiding zero values.

Numeric Keys. . . here the problem is relatively straightforward. Suitable functions will depend on the range of values the keys will cover. A single example should indicate a typical method of solution.

The keys are stock numbers ranging from 00100 to 45200. There are approximately 600 different stock items and the wider range of stock numbers is the result of the numbers including check digits, storage area codes and spaces for further stock items.

In this case we could use a file size of say N = 997 and would define variables as follows:

$Q = \text{INT}(\text{STOCK NUMBER}/N)$

$\text{ENTRY POINT} = \text{INT}(\text{STOCK NUMBER} - (N*Q)) + 1$

$\text{STEP LENGTH} = Q \text{ MOD}(N-1) + 1$

Note that our definition of entry point ensures that we will obtain a number between 1 and N similarly the definition of step length ensures a number usually different to the entry point and it will be between 1 and (N-1). (The above type of formula is very common and is able to produce good results in many cases.)

Alphanumeric/alphabetic keys. . . the additional problem is to convert characters into a pure number form before using an approach as for numeric keys. Some methods that may be used are as follows:

1. Convert each character of the key into the ASCII code equivalent then add or multiply them together.
2. Convert to ASCII code as in 1 above but weight each character by a number inversely proportional to its frequency in the language before adding or multiplying.
3. Only convert the consonants in the key to their ASCII equivalents and produce a numeric key from these.

Some procedures will be found to be better than others but in general you may assume that if your key domain is reasonably evenly distributed then most of the procedures will result in a similarly evenly distributed codomain (this is the set of numbers that the hashing function will produce!).

## A typical application

Many simple applications are built around the three basic functions of addition of a record, deletion of a record and searching for a particular record. The example I have chosen was written to illustrate these functions in

```

2 REM -----
3 REM          BEGIN - BLOCK
4 REM -----
5 CLEAR
6 NX=113' IMPORTANT -----> User must set NX to a suitable PRIME NUMBER
10 DIM ADDRESS.LINE$(4),RECORD.LINE$(4),FIELD.NAME$(4),SELECTION$(4)
11 SELECTION$(0)="File full - cannot complete operations";SELECTION$(1)="Addition complete";
   SELECTION$(2)="Retrieval complete";SELECTION$(3)="Record deleted if key existed";
   SELECTION$(4)="All data erased - new file now available"
12 FIELD.NAME$(1)="Name";FIELD.NAME$(2)="First line of address"
13 FIELD.NAME$(3)="Second line of address";FIELD.NAME$(4)="Telephone number"
14 DEF FN CUR$(X,Y)=CHR$(126)+CHR$(17)+CHR$(X+96*INT((SGN(X-30)+1)/2))+CHR$(Y+96)
15 DEF FN CLEARFROM$(X)=CHR$(126)+CHR$(17)+CHR$(96)+CHR$(X+96)+CHR$(126)+CHR$(24)
20 GOSUB 5000'open files
22 REM -----
23 REM          OPTION - SELECTION - BLOCK
24 REM -----
25 WHILE X<5
30 PRINT FN CLEARFROM$(0)
40 PRINT FN CUR$(0,0);"1: Add"
50 PRINT FN CUR$(9,0);"2: Search"
60 PRINT FN CUR$(24,0);"3: Delete"
70 PRINT FN CUR$(38,0);"4: Clear"
75 PRINT FN CUR$(48,0);"5: End"
80 PRINT FN CUR$(60,0);"Which option ";INPUT X
85 ATTEMPTSX=0
90 ON X GOSUB 1000,2000,3000,6000,150
92 PRINT FN CUR$(10,20);"Number of hash attempts required ";ATTEMPTSX
95 PRINT FN CUR$(10,22);SELECTION$(X);" Press RETURN to continue";X$=INPUT$(1)
100 WEND
130 REM -----
140 REM          END - BLOCK
145 REM -----
150 END' -----> This is the logical end of the program
970 REM -----
980 REM          ADDITION - OF - DATA - SUBROUTINE
990 REM -----
1000 PRINT FN CLEARFROM$(0);
1005 GOSUB 4500'input routine
1010 GOSUB 4000'compute initial hash values
1020 WHILE RECORD.LINE$(1)<>STRING$(20,32) AND RECORD.LINE$(1)<>STRING$(20,ASC("*")) AND ATTEMPTSX<NX
1030 GOSUB 4200'compute rehashes until empty record is found
1040 WEND
1050 IF RECORD.LINE$(1)=STRING$(20,32) OR RECORD.LINE$(1)=STRING$(20,ASC("*")) THEN GOSUB 4900
   ELSE X%=0'store data if there is space otherwise prepare to give file full message
1060 RETURN
1970 REM -----
1980 REM          RETRIEVE - DATA - SUBROUTINE
1990 REM -----
2000 PRINT FN CLEARFROM$(0)
2010 GOSUB 4600'input search key subroutine
2015 GOSUB 4000'compute initial hash values
2020 WHILE RECORD.LINE$(1)<>ADDRESS.LINE$(1) AND RECORD.LINE$(1)<>STRING$(20,32) AND ATTEMPTSX<NX
2030 GOSUB 4200'compute rehashes until correct record is found
2040 WEND
2050 IF ADDRESS.LINE$(1)=RECORD.LINE$(1) THEN GOSUB 4800
   ELSE PRINT FN CUR$(10,18);"This record does not exist - request has been ignored"
2060 RETURN
2970 REM -----

```

use is an 'address book' program. The idea being that you create records consisting of a name, two lines of address and a telephone number. The program enables you to locate these details using the name field only. The example is somewhat contrived but it does illustrate the basic ideas involved. Written in Microsoft's Basic 80 using a Rair Black Box/Hazeltine terminal system the program has the following layout:

A 'Begin Block' performs the setting up of variables and opening of a file. Variable N% defines the size of the file and can be altered to suit requirements. Two user defined functions are used: CLEARFROM\$(X) is used to clear the Hazeltine screen from line X downwards. CUR\$(X,Y) is used to position the cursor of the Hazeltine terminal. The cursor co-ordinates are supplied as column X (which may be between 0 and 79) and line Y (which may be between 0 and 23).

An 'Option Select' block enables the

user to add, delete or retrieve data and to initialise the file by writing blank records. This block operates by selecting a subroutine based on the value of the option number selected. Files should be initialised before use since the program identifies unused records as those whose fields contain strings of blank characters.

Two subroutines called 'compute hash values' and 'compute rehash' respectively are used to perform the hashing functions. The name (the key field in this example) is converted to a numeric value which is the sum of the ASCII values of all the characters present. This field is brought to 20 characters in length so that proper comparison may be made with the name field retrieved from the random access file which will be 20 characters in length as defined in the FIELD statement (line 5010). The rehash subroutine increments the last record number calculated by the step length and line 4200 guarantees that we step around our



```

2980 REM      DELETE - DATA - SUBROUTINE
2990 REM -----
3000 GOSUB 2000 'we use the retrieve data option block to locate the record !!
3020 IF ADDRESS.LINE$(1)=RECORD.LINE$(1) THEN ADDRESS.LINE$(1)=STRING$(20,ASC("*")):
      GOSUB 4900 'replace record with asterisks to indicate deletion if record exists
3040 RETURN
3970 REM -----
3980 REM      COMPUTE - HASH - VALUES - SUBROUTINE
3990 REM -----
4090 SUMZ=0:FOR IZ=1 TO 20:SUMZ=SUMZ+ASC(MID$(ADDRESS.LINE$(1),IZ,1)):NEXT IZ
4010 OZ=INT(SUMZ/NZ)
4020 ENTRY.POINTZ=INT(SUMZ-NZ*OZ)+1
4030 STEP.LENGTHZ=OZ MOD(NZ-1)+1
4040 RECORDZ=ENTRY.POINTZ
4045 GET #1,RECORDZ
4047 ATTEMPTSZ=1
4050 RETURN
4090 REM -----
4180 REM      COMPUTE - REHASH - SUBROUTINE
4190 REM -----
4200 RECORDZ=(RECORDZ+STEP.LENGTHZ-1)MOD(NZ)+1 'must keep within file number range !!
4210 GET #1,RECORDZ
4215 ATTEMPTSZ=ATTEMPTSZ+1
4220 RETURN
4480 REM -----
4490 REM      INPUT - SUBROUTINE - A
4495 REM -----
4500 FOR IZ=1 TO 4:PRINT FN CUR$(10,6+2*IZ):FIELD.NAME$(IZ):FN CUR$(40,6+2*IZ):" "":
      ADDRESS.LINE$(IZ)="" :LINE INPUT ADDRESS.LINE$(IZ):PRINT:NEXT IZ
4510 ADDRESS.LINE$(1)=ADDRESS.LINE$(1)+STRING$(20-LEN(ADDRESS.LINE$(1)),32)
4520 RETURN
4550 REM -----
4580 REM      INPUT - SUBROUTINE - B
4590 REM -----
4600 PRINT FN CUR$(10,8):FIELD.NAME$(1):FN CUR$(40,8):" "":ADDRESS.LINE$(1)="" :LINE INPUT ADDRESS.LINE$(1)
4605 ADDRESS.LINE$(1)=ADDRESS.LINE$(1)+STRING$(20-LEN(ADDRESS.LINE$(1)),32)
4610 RETURN
4770 REM -----
4780 REM      DISPLAY - RECORD - DETAILS - SUBROUTINE
4790 REM -----
4800 REM -----
4810 FOR IZ=2 TO 4:PRINT FN CUR$(10,6+2*IZ):FIELD.NAME$(IZ):FN CUR$(40,6+2*IZ)" "":RECORD.LINE$(IZ):NEXT IZ
4820 RETURN
4870 REM -----
4880 REM      STORE - DATA - SUBROUTINE
4890 REM -----
4900 FOR IZ=1 TO 4:LSET RECORD.LINE$(IZ)=ADDRESS.LINE$(IZ):NEXT IZ:PUT #1,RECORDZ:RETURN
4970 REM -----
4980 REM      OPEN - FILES - SUBROUTINE
4990 REM -----
5000 OPEN "R",1,"MASTER"
5010 FIELD #1,20 AS RECORD.LINE$(1),30 AS RECORD.LINE$(2),30 AS RECORD.LINE$(3),18 AS RECORD.LINE$(4)
5020 RETURN
5030 REM -----
5980 REM      CLEAR - FILE - SUBROUTINE
5990 REM -----
6000 FOR IZ=1 TO 4:LSET RECORD.LINE$(IZ)="" :NEXT IZ
6010 FOR IZ=1 TO NZ:PUT #1,IZ:NEXT IZ
6020 RETURN
6030 REM -----

```

'circular file' in uniform steps. The variable ATTEMPTS% keeps track of the number of attempts that have to be made to locate the record and also serves to indicate when the file is full. When the file is full (ie, when the number of attempts equals the file size) the selection variable X% is set to zero to cause a file full message to be printed.

'Addition of data' is accomplished by collecting data with an input subroutine, computing the initial hash values for variables ENTRY.POINT% and STEP.LENGTH% and then stepping around the file using a WHILE/WEND loop until an empty record is found. Option 4 must be used initially to set up the data file by writing blank records. Once an empty record is found (or once all records have been looked at without finding any empty record) the loop is left and if there is available space the new data is stored.

'Retrieval' is performed by collecting the name to be searched for with

the second input routine, computing the initial hash values as before and then performing a 'step-around' search using a WHILE/WEND loop as before. In this case the exit condition is based on three points:

First we may find a key match, ie, we have located required record. Secondly we may reach an empty record, in which case we will have searched all positions where the required record would have been placed. Thirdly we may have looked at all records in the file.

If the record has been located it is displayed by calling a 'Display Record Details' subroutine 4800 otherwise a 'does not exist' message is printed.

'Deletion' is accomplished by setting the name field of the record to a string of asterisks. The effect is to flag the particular record as deleted. Deletion is one of the areas that can provide difficulties since it is not normally appropriate to simply remove the details from the key field. If this were

done then the deleted record would appear to be the 'end of the chain' as it were and the hashing search when reaching such a record would not look any further. This would cause improper searching and so a common solution is to set the key field to some arrangement of characters that can identify the record as being deleted rather than empty. The addition of data routine recognises deleted records by the fact that the key field, ie, the name field, has been set to a string of asterisks.

The remainder of the subroutines used are titled according to their function - eg, 'Open Files', 'Store Data' - and since each one has only two or three lines they should be self-explanatory. You will notice that I keep the individual parts of the program isolated by REM statements which include titles. This helps to split the program up into small units that are more easily understood. I tend also to treat these blocks as subroutines which are called as and when desired. This facilitates alterations, etc, and creates a more readable program. As an example, suppose you wish to change the way the initial hash values are calculated. The subroutine is identified easily by its title 'Compute hash values' and since it has only a few lines of code (which you will note could be written considerably more concisely than I have done for this example) it would only take a short time to understand what the subroutine is doing.

With properly designed screen layouts and the addition of input validation subroutines the program can be used for applications such as a 'computer diary', an 'attribute file', etc, but as a parting thought you may like to consider the following possibility:

An estate agents 'House for sale' file consists of houses that are classified by:

1. Cost Range eg, 10,000-14,999 : 15,000-19,999, etc.
2. Number of bedrooms.

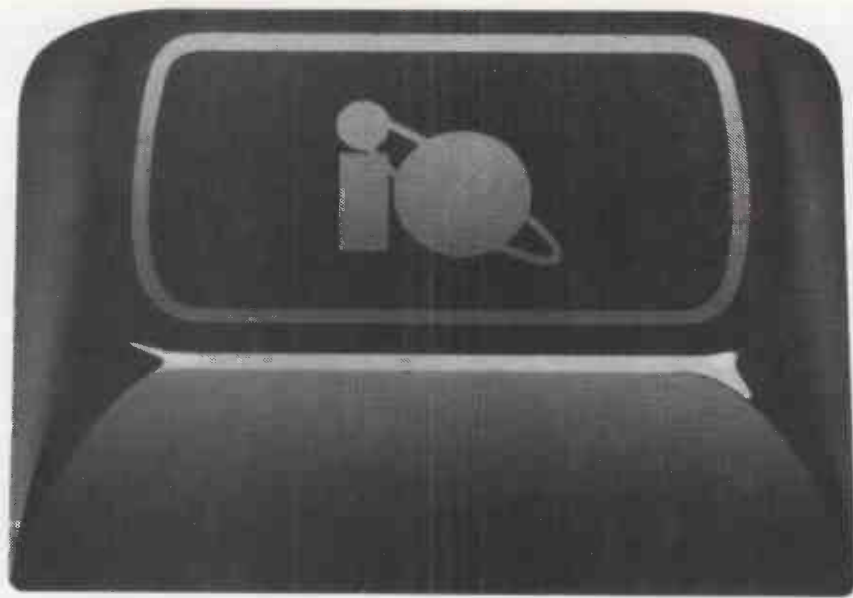
3. Location with geographical areas being coded, say, using the postal code.

If a file was set up that used hash techniques to locate items based on a key produced from the three attributes mentioned and if, instead of storing the data in this file, you regard it as a directory with the file containing pointers to the heads of chains of 'linked' records then we produce what is termed a hashed access multilist directory.

All properties with the same 'attributes' are stored in chained form - ie, each record contains the record number of the next record in the chain. A search for 'all available property in area SS41TD with four bedrooms and in the price range 45,000-49,999' can become virtually instantaneous. The three attributes produce a key that is hashed to rapidly find the 'head' of the chain records with these attributes and then all available property satisfying the criteria given can be retrieved with no further searching required at all.

It is difficult to do justice to any technique in an introductory article of this nature. I have illustrated the approach that I have developed but obviously there are an enormous number of other approaches. Once the basic ideas are understood the transition to more sophisticated applications becomes easier. In the end we are limited only by our own ingenuity.

END



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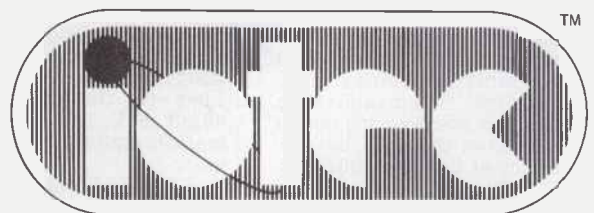
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## Beeb characters

I read with interest the article by M Howlett in the July issue on a Character Generator for the BBC Computer, and would like to make some comments. A number of aspects lead me to suspect that the program may have been converted from another micro as some of the more useful features of the BBC machine have not been exploited.

The choice of the non-graphics Mode 6 seems rather strange since a proper 8x8 grid cannot then be drawn. Further, two colours only are available, despite references in the program to COLOUR 0, COLOUR 3 and COLOUR 5. To draw and fill a grid, at least three colours are desirable. The use of a graphics mode, selected by the user, would seem preferable, and this has the added advantage of drawing the character as it looks in that mode — ie, double width in modes 2 or 5, but only half-width in mode 0.

A more important point, since it has a variety of applications, is to note that it is possible to use the cursor control keys in program mode. Typing \*FX 4 1 at the beginning of the program enables the keys (\*FX 4 0 converts the keys back to their usual editing functions). The keys then generate ASCII codes 136 to 139, and GET or INKEY can be used to detect if they have been pressed. These keys, together with DELETE (code 127) and COPY (code 135), give a rather simpler and more natural way of moving around the grid and filling or deleting squares.

It may be of interest to show how to reverse the logic of the program and draw large characters when given the eight bytes required by the VDU 23 command. The memory map given in the user guide shows that the characters 224-255 are stored in memory locations starting at &0C00. This means that the special character with code C is stored in the eight bytes starting at location &0C00 + (C-224)\*8.

A search of the current operating system on my machine (Eprom 0.10, Model B) shows that the VDU codes for keyboard characters are equally accessible. Characters 32 onwards are stored at the

beginning, ie, from &C000. Thus the character with ASCII code C is stored at &C000 + (C-32)\*8. The following program segment uses the VDU codes to draw large characters, and could form the basis of a 'Bigprint' routine. The same variables are used as are given in the article; a free-standing program would need to declare arrays, etc.

```
1000 MODE 4: NUM=1
1010 INPUT "TYPE 1 FOR
A KEYBOARD CHAR-
ACTER OR 2 FOR A
PREVIOUSLY SAVED
SPECIAL CHARAC-
TER "N
1020 IF N=2 THEN INPUT
"CODE" C ELSE IF
N=1 THEN INPUT
"CHARACTER", C$
:C=ASC(C$) ELSE
END
1030 IF C 223 AND C 256
THEN STORE=&0C00
+(C-224)*8-1
ELSE IF C 31 AND
C 127 THEN STORE=
&C000+(C-32)*8-1
ELSE END
1040 FOR A=1 TO 8
1050 C1(NUM,A)=?(STORE
+A)
1060 W=128
1070 FOR B=1 TO 8
1080 IF C1(NUM,A) AND W
THEN PRINT CHR$(
224); ELSE PRINT
" "
1090 W=W/2
1100 NEXT B
1110 PRINT
1120 NEXT A
```

The ? at line 1050 is the BBC Basic for PEEKing the memory location, and the logical AND at line 1080 is used to decide if the particular bit in the byte is 0 or 1.  
P Whitworth, Lewes

See also 'Beeb Character Generator' in this issue's TJ's Workshop — Ed.

## Back-patting dept.

I'd like to thank you for a superbly useful article on the BBC Computer in July's PCW. I bet even the BBC and Acorn won't make this sort of information available to the general user.

I did find one small fault in that the directory address for the first FN is at &04F8,9 and the PROCs at &04F6,7 — not the other way round.

There are far too few articles of this type in the consumer magazines these days

and thumbing through issues of PCW for '78 and '79 the other day I noted the pioneering interest that was created. Keep up the good work.  
Colin Chatfield, Camborne

## One-liner

Here is another of those one-liners for a Tandy or Video Genie: this one is for Bio-rhythm and sine wave freaks!  
0 X=X+.25: FOR Y=1 TO 6: POKE SIN(X/Y)\*32+16288, Y+48: NEXT: PRINT: GOTO

Points to mention are that GOTO without a line number goes to line zero, and that memory location 16288 is the middle of the bottom line of the screen.

B E Newsam, Sheffield

## Out of the frying pan...

With considerable assistance from the Advertising Standards Authority I finally managed to get delivery of a Sinclair Spectrum in a time approximating to the 'up to 28 days for delivery' of the Sinclair ads.

It was faulty. Tuning to a TV (I tried three Sonys) was very critical and colour was lost, at first intermittently then completely, after about ½ - 1 hour's use.

I would have taken a chance and exchanged it for another, but the two weeks quoted for this (in which I have little faith), together with the attitude of the Sinclair staff at Camberley and Cambridge (particularly the 'Customer Relations' manager at Cambridge) have persuaded me to ask for a refund and buy a BBC Computer.

I feel that back-up and customer relations are important, especially when related to complex devices. Perhaps the BBC was wise in not going to Sinclair.  
A Deacock, London W1

Several thousand would-be BBC owners might dispute your last statement, Mr Deacock — Ed.

## Spectrum of woes

After waiting eight weeks to receive a 16k ZX Spectrum I found that when the colour was used the characters

shimmered, making them difficult to read. I phoned Sinclair and they told me to return the computer: this I did.

Two weeks later I had heard nothing, so I phoned to make enquiries. I was asked by the telephone operator at Sinclair if I had received a card from them — to which I replied 'no'. She then told me that she could give me no information until I had received a card.

A few days later the card arrived, and so I phoned Sinclair, quoting the reference number on the card. I was told by the operator that although I had received the card and quoted the reference number she could not find out any information. She assured me that because I had the card my computer was soon to be dealt with, and I should phone back in a few more days; this I did.

My third call was to bear some fruit. After taking my name and reference number, the operator told me that my Spectrum was nearing the top of the pile and would soon be dealt with. I thanked her, breathed a sigh of relief and waited — two more weeks.

It was now five weeks since I had sent my Spectrum back and, feeling a little annoyed, I phoned Sinclair, gave my name and reference number to the operator and waited. I was told very politely that my computer was nearing the top of the pile. I told the operator, also politely, that this was unacceptable and asked to talk to the manager of the service department. I was then put on to someone who said she was the supervisor.

I explained my case to her, only to be told that my computer was working its way to the top of the pile. I then asked for an immediate replacement. She refused this request, saying that because of delays in despatching new machines, and of course the infamous design fault, she had been instructed by management that no immediate replacements would be possible. But she said that she might be able to rush things along in a few weeks.

I then asked to talk to the management who had given her these instructions. She said she had no access to them and, therefore, nor had I. I was forced to ask for a full refund, which she immediately agreed to.

I may now never take up the hobby of home computing because at the moment there is no comparable machine to the Spectrum in price and function. But if Clive Sinclair thinks he can use this fact to keep his customers happy and loyal to his company then he is sadly mistaken, and his company does not deserve to prosper.

As you may have gathered by now, I am not a very happy person. This sort of bad service does not only reflect on Sinclair, which doesn't seem to care anyway, but it also tends to reflect on British companies as a whole as opposed to Japanese companies who have always given me excellent after-sales service — ie, Vivitar UK and Pioneer UK. If this sort of experience is widespread it must also affect the sales of your magazine.

I have sent a copy of this letter to Mr Sinclair in the hope that it may help other customers and in turn Sinclair itself in the future.

Keith Allen, London SE17

*These are just two of many letters on this theme. Below we publish Clive Sinclair's reply. We also have a mountain of BBC Computer complaints which we can't print; it just gets too repetitious. . . Ed.*

## Uncle Clive replies

In response to the many queries which, I understand, PCW has received, I would like to personally explain the current delivery situation for our new ZX Spectrum personal computer.

The general public's response to our new computer has far exceeded our expectations and we have been swamped with orders. This and some small initial production delays have led in turn to considerable delays in delivery.

Regrettably, many of our customers may have to wait up to 12 weeks, from our receipt of their order, for delivery of their Spectrum and we are writing to them all to apologise for the inconvenience and to offer them the chance of an immediate refund.

For those customers who continue to wait, we shall be sending out with each Spectrum, in compensation for the delay, a £10 voucher which can be used in part-payment for a ZX printer or to buy a complete pack of five rolls of printer paper.

We are also providing customers with a new demonstration tape containing:

1. A complete 'keyboard trainer' to introduce the Spectrum.

2. Three major programs — an exciting game, Through the Wall; a drafting program, Draw; and Character Generator, which demonstrates user-defined graphics.

3. A series of illustrative programs — Bubble Sort, Evolution, Life, Monte Carlo, and Waves.

Finally, I would like to assure you and all our customers that the initial problems with the Spectrum have now been completely overcome. Production is running smoothly at 5000 units per week and will rise sharply over the coming months. We are confident that our present backlog will be cleared by the end of September and hope that you will see current delays in the context of our successful delivery of more than 500,000 computers in the last two years.

Clive Sinclair, Sinclair Research Ltd

## DeVALuation

Poring over the August issue of PCW I came across a letter in Communications which commented on the use of VAL for function evaluation. Upon reading the editorial comment, my eyebrows scuttled up over the back of my head. Can I really have owned my Texas 99/4 for two years and missed this use of VAL? I check and, no, I haven't missed a thing. The function of VAL which you ascribe to the Texas does not exist (unless you were thinking of the Equation Calculator, unique to the 99/4, and totally devoid of programmability), neither is it implemented in the new version 110 Extended Basic.

I have often felt the need for VAL on my TI to really represent the counterpart of STR\$, and I have written in the user group newsletter bemoaning this fact. As it appears that some people have bought computers believing them capable of functions of which they are not capable (myself included), in the interests of accuracy can I ask you to correct your misleading comment? It has been bad enough coping with the many inaccurate reviews of the Texas machines without having to explain to disappointed new owners that their latest purchase can't do the things that even some ads claimed they could.

I feel particularly strongly about this as I bought my 99/4 (£1000 in those days) in the mistaken belief that the PLOT and DRAW commands were available (based on an advertisement that claimed you could plot to 192 x 256 individually addressable screen points) and the irritation was compounded, and is still being compounded, by the lack of machine code programming — and buying the Extended Basic won't do you a ha'porth of good as the machine language subprograms function only when the 32k (and there's a story behind that one, too) £300 Expansion Memory is used. Even worse, there is a mini-memory and an assembler/editor module

available; the latter runs only with disks, and it is rumoured that a rewire of the 99/4 may be necessary in order to use either module.

Peter Brooks, Oxford

## Fuller praise

Outraged shouts about British companies are pretty commonplace — here's a nice story for a change!

In March I ordered a keyboard, case and power supply for my ZX81 from Fuller Microsystems of Liverpool. We are not blessed with the best surface mail in the world and so after it hadn't arrived in July I was getting a bit cross. I'll wait for the next boat, I thought, and it did come in August. However, the letter enclosed with it from Bob Rylands made it clear that my order had been mislaid and as mine was an unusual request they had then made up the order especially. They were all very sorry. I'll be dealing with them again! Expatriates often get a raw deal from companies in the UK. When I return I'll be hoping to set up an export agency dealing in systems and peripherals for expats. Fuller Microsystems would be the sort of supplier I would approach.

Needless to say, I'm not connected with them, etc, etc. Ned Abell, Ascension Island, South Atlantic Ocean

## (( Down (with (brackets)))

Many thanks for printing Michael Liardet's excellent article on Lisp. This looks like a really powerful language, quite easy to learn and a lot more fun than Pascal. The only unattractive feature for the micro enthusiast is the extent of the use of nested brackets. These are a hassle to use and a bore to check. But have you noticed? They are also entirely unnecessary! In fact, the notation used by Lisp (prefixed dyadic operators) was invented just to dispense with the need for nested punctuation.

Mr Liardet's first example of Lisp code can be written out, omitting the brackets, like this:

```
COND
OR
EQ
PLUS A B
2
LESSP
TIMES C D
5
SETQ
E
MINUS C D
```

Here indentation is used to show the structure of the conditional, eg, the arguments of 'COND' are 'OR' and 'SETQ'; those of 'OR' are 'EQ' and 'LESSP', etc. This too is dispensable from the compiler/interpreter's standpoint. The whole conditional could be written as a single line of code, and, if the reserved words were 'tokenised', this would slightly decrease execution time compared with the bracket-ridden version.

The ideal solution is: make brackets optional, on input and on listing. The usual restriction on variable names, that they should contain no spaces, is enough to avoid ambiguity.

John M Kerr, Glasgow

*This works fine for dyadic operators, but the brackets in Lisp are primarily intended to delimit lists. How do you show a list of lists of lists without them? — Ed.*

## Video doctor

First of all I want to congratulate you on producing a consistently excellent magazine. I am by no means an expert in microcomputing but it never fails to stimulate my interest and is educational without being taxing.

I am interested in adapting a video-disc system as a medical encyclopaedia for use in doctors' surgeries, and would be very grateful if any of your readers would be able to supply me with information about current developments in this field.

Walter Mrozinski, 28 Lower Park Road, Victoria Park, Manchester 14.



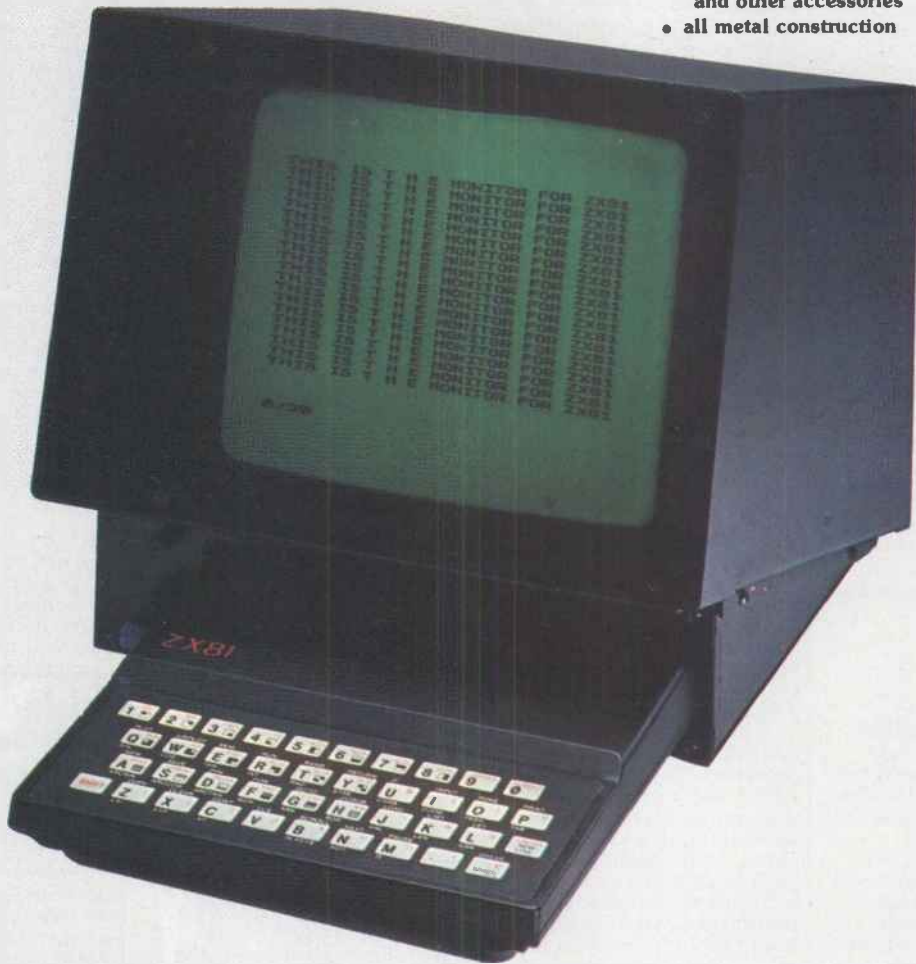
'Case number 3 — Inland Revenue versus Arnold Higginbottom's TRS-80 Accountancy program.'

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unbelievably crisp, clear and steady picture without any adjustments and knob-twiddling. The perspex screen in front of the tube has the same colour temperature as the phosphor enabling you to read characters in direct sunlight.

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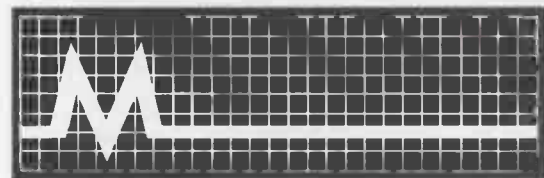
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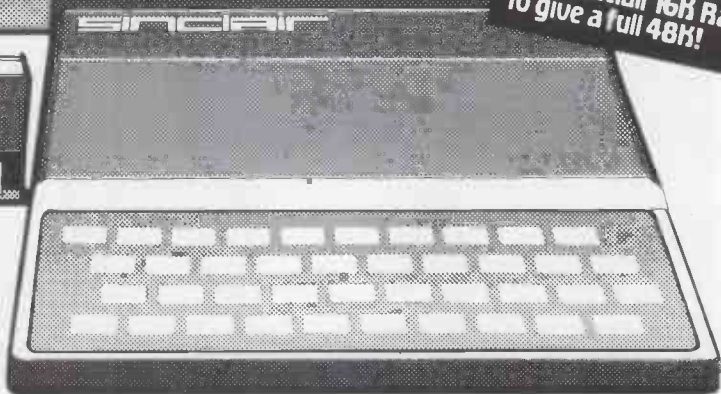
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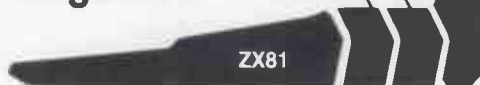
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# DATA DABBLING

## A MULTI-FILE DATABASE SYSTEM

*J A B Leeser describes how he wrote his own UCSD Pascal relational database system.*

The idea of writing a type of relational database system for a microcomputer was born just prior to my arrival in Brazil. By this time I felt that I had sufficient mastery of Pascal (UCSD), had done some preliminary studies on tree structures and written a general routine for the binary search of an array — the last two without any specific objective in mind.

My interest in relational databases had been stimulated some three years before by V Nederhof, of UIMC BV, Rotterdam, who had lent me C J Date's *An Introduction to Database Systems*. A time of much travelling and too little home life intervened, but the conviction that the relational approach ought to offer the simplest solution to retrieving information from structured data had stayed with me. Once settled in our new home, I resolved to use what little spare time I had to write the index-driven database system for a micro.

### Overall structure

The decision to use only standard Pascal data structures was made at an early stage. Next, the central database subsystem had to be built on a data file structure, consisting of records with a number of header fields followed by ten general-purpose string fields meant to contain the main data. Clearly, this general structure had to be given a specific form to reflect a particular data file. Thus it had to be associated with a format derived from a format, or Data Dictionary sub-system. On the other hand, data files were to be manipulated by means of indexes. Thus an index subsystem was required, leading into some form of output system to provide results. Connecting these sub-systems by a menu, the overall structure of DABS, as it came to be called, is shown in Fig 1.

This structure turned out to be adequate in the end and is described in more detail below.

### Data dictionary subsystem

The Data Dictionary subsystem consists of three main functions, effectively three programs, which may be represented as in Fig 2.

The first task is to create a format file (when necessary) to insert records carrying file and field names and to delete unwanted records. The second is to create an inverted file listing field names of all records in alphabetic order, giving the appropriate file name. Both these functions use binary tree structures

(B trees) for sorting in main memory. The third function lists either file on the printer.

The file name of the appropriate format record is a prerequisite for operating with a particular data file. The

field names held in the format file define the data file fields. Thus no data file operation can take place unless a format record for that data file exists. The alphabetic list of field names is included as a very simple reference to

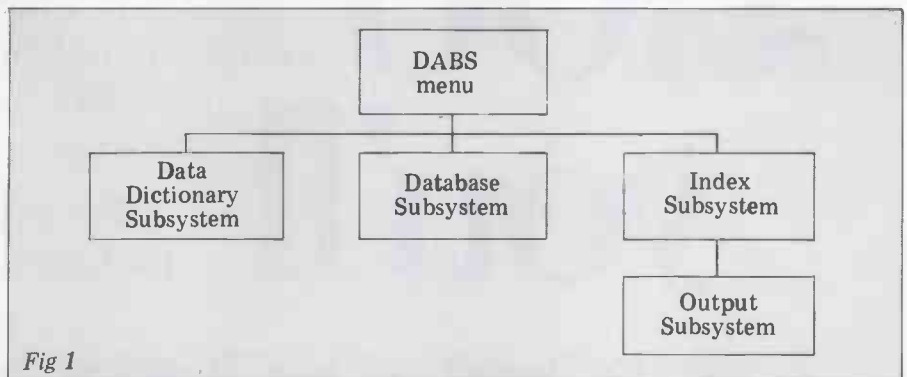


Fig 1

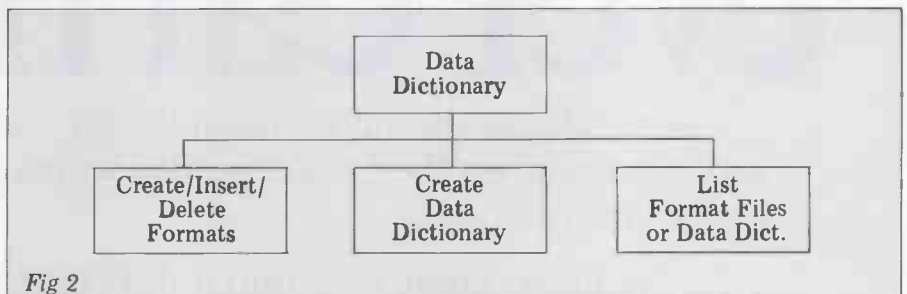


Fig 2

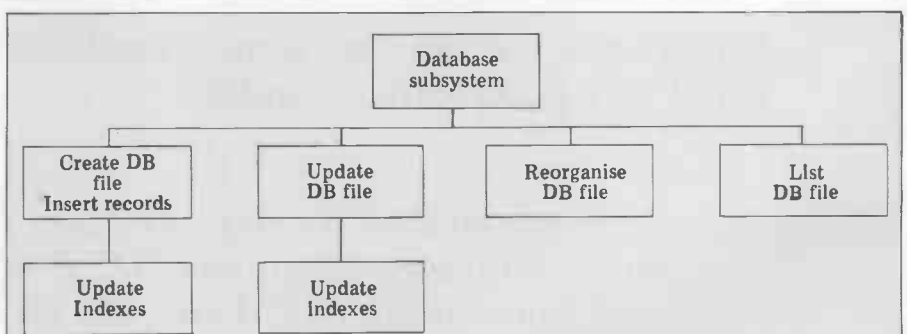


Fig 3

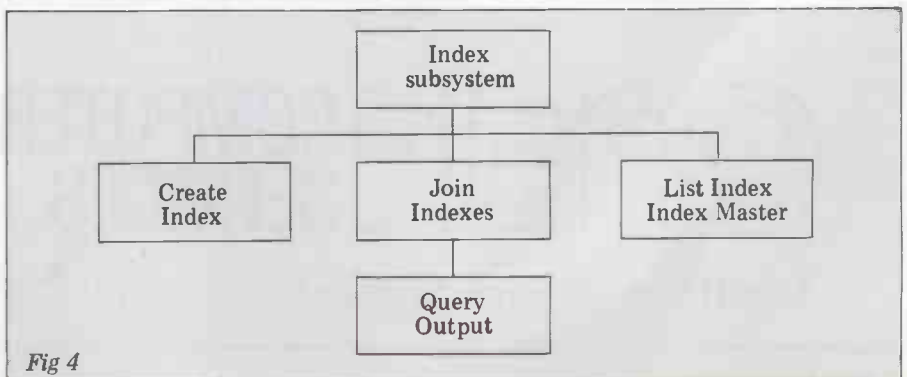


Fig 4

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# DATA DABBING

field names and where they are used, but is of no further importance in the system as a whole.

## Database subsystem

The Database subsystem's functions are: to create files and insert records, to update fields of all or specific records (including deletion of records), to reorganise files and to list them, as depicted in Fig 3.

It will be noted that both the Create/Insert function and the Update function automatically update all indexes related to the data file, at least in all those cases where they exist, having been created in the first place by the Index sub-system (an index is a file holding records or elements of key fields and the relevant data file record numbers, ordered in key field sequence and, optionally, obeying specifiable selection criteria). Thus an index will always reflect the correct state of the data file within the rules relevant to the original definition of that index (its 'scope').

The Update function is itself controlled by an index. It permits changing one or more fields, including the status field, over the scope of the index and offers the choice of a 'global' or a record-by-record update. The status field has either the value L(ive) or the value D(ead). Dead records are intended to be deleted by the Reorganisation function and, pending this final decision, are ignored by the system.

## The index system

Just as the format file record is essential to the creation, etc, of a data file, so is the index (or indexes) for the retrieval of information from that data file. The index specifies which records of the data file are to be used for retrieval of results. As we have seen, indexes are automatically updated by two of the database functions. However, they have to be specified and created in the first place. This is one of the tasks of the Index subsystem, the other being to join two indexes over a given field. The result of this sort of 'join' is, normally, a table formed by concatenating elements from two indexes, such that the elements of each index have the same key-field value. The general scheme of the sub-system is shown in Fig 4.

Index creation offers a number of special facilities:

1. An index may be created, and ordered in ascending sequence, on any data field in the data file record, or on the record number.
2. Selected indexes may be created depending on whether a chosen field is equal to, not equal to, greater than or smaller than a given value or is a member of a user-specified range of values.
3. Use of the 'unique' feature excludes all data file items with the same key field, except the first.
4. A secondary sort of field may be specified for use in cases where a two-key index has to be 'joined' with two other indexes, one having one of the two key fields and one the other.

5. An index will automatically be added to the number of existing indexes, unless specified to replace an existing index.

Details of decisions made in respect of items 1 - 5 are registered in an Index Master File whose primary use is to provide information for automatic updates of indexes, as described above.

The Join function specific to DABS relates two indexes, ordered in the same

sequence, such that, if the key field of an element of the 'argument' index is equal to any key field of an element belonging to the second or 'target' index, the record number of the data file record forming part of the element of the target index is stored in a result table under the data file number to which the target index belongs. Inequality resulting from a particular set of comparisons, that is, absence of a matching element, leaves a zero in the table. A number of such binary 'joins' can be carried out, the current limit being three. The completed table is stored in a temporary file from which

|             |                        |            |           |           |     |     |     |  |
|-------------|------------------------|------------|-----------|-----------|-----|-----|-----|--|
| File 1 :    | SUP (PLIER)/MAT(ERIAL) |            |           |           |     |     |     |  |
| Record no : | 1                      | 2          | 3         | 4         | 5   | 7   | 7   |  |
| Scode :     | 20                     | 10         | 10        | 5         | 15  | 6   | 6   |  |
| Mcode :     | 100                    | 110        | 100       | 120       | 100 | 130 | 140 |  |
| Mprice :    | 1.9                    | 2.7        | 2.0       | 1.9       | 2.4 | 2.1 | 2.2 |  |
| Mquality :  | 4                      | 5          | 5         | 4         | 4   | 5   | 3   |  |
| File 2 :    | SUP(PLIER)             |            |           |           |     |     |     |  |
| Record No : | 1                      | 2          | 3         | 4         |     |     |     |  |
| Scode :     | 5                      | 10         | 15        | 20        |     |     |     |  |
| Sname :     | Ferreira               | Smith      | Perez     | Armando   |     |     |     |  |
| Scity :     | Sao Paulo              | Londres    | Lisboa    | Sao Paulo |     |     |     |  |
| Scountry :  | Brazil                 | Inglaterra | Portugal  | Brazil    |     |     |     |  |
| File 3 :    | MAT(ERIAL)             |            |           |           |     |     |     |  |
| Record no : | 1                      | 2          | 3         | 4         |     |     |     |  |
| Mcode :     | 100                    | 120        | 110       | 130       |     |     |     |  |
| Mname :     | Armchairs              | Chairs     | Cupboards | Tables    |     |     |     |  |
| Mstock :    | 60                     | 36         | 24        | 48        |     |     |     |  |
| Depot :     | Hayden                 | Hayden     | Hayden    | Hayden    |     |     |     |  |

Fig 5

## Example 1

**Task:** Print — Sname, Scity, Scountry from the Sup(plier) file for all records of that file having:  
Scountry < Portugal (lexically) and Scity in the alphabetic range A to M (both inclusive)

### Indexes

The following two indexes are established:

|              | INDEX 8 (Supplier)   | INDEX 9 (Supplier)   |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
|--------------|--|--|------|--------|-------|----|----|---|---|---|----|---|---|----|---|---|--|------|------|--------|-------|----|----|----|---|---|----|---|---|
| Instructions | Sortfield : Scode<br>Selec field : Scountry<br>Selec criter : < Portugal   | Sortfield : Scode<br>Selec field : Scity<br>Selec criter : Range A>M |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| Result       | <table border="1"> <thead> <tr> <th>DATA</th> <th>File</th> <th>Record</th> </tr> <tr> <th>Scode</th> <th>no</th> <th>no</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>2</td> <td>1</td> </tr> <tr> <td>10</td> <td>2</td> <td>2</td> </tr> <tr> <td>20</td> <td>2</td> <td>4</td> </tr> </tbody> </table> | DATA   | File | Record | Scode | no | no | 5 | 2 | 1 | 10 | 2 | 2 | 20 | 2 | 4 | <table border="1"> <thead> <tr> <th>DATA</th> <th>File</th> <th>Record</th> </tr> <tr> <th>Scode</th> <th>no</th> <th>no</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>2</td> <td>2</td> </tr> <tr> <td>15</td> <td>2</td> <td>3</td> </tr> </tbody> </table> | DATA | File | Record | Scode | no | no | 10 | 2 | 2 | 15 | 2 | 3 |
| DATA         | File   | Record   |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| Scode        | no   | no   |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| 5            | 2  | 1  |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| 10           | 2  | 2  |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| 20           | 2  | 4  |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| DATA         | File   | Record   |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| Scode        | no   | no   |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| 10           | 2  | 2  |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |
| 15           | 2  | 3  |      |        |       |    |    |   |   |   |    |   |   |    |   |   |  |      |      |        |       |    |    |    |   |   |    |   |   |

### Join table

When index 8 is joined to index 9 on the sortfield, the following table results:

|       |            |       |       |       |
|-------|------------|-------|-------|-------|
| 0.    | File no.   | 2     | 0     | 0     |
| 1.    | Record row | 0     | 0     | 0     |
| 2.    | Record row | 2     | 0     | 0     |
| 3.    | Record row | 0     | 0     | 0     |
| ..... | .....      | ..... | ..... | ..... |
| n.    | Record row | 0     | 0     | 0     |

### Output

The output program will recognise only the first column and, within that, the row numbered 2. It will seek record 2 of file 2, having first requested identification of fields to be printed. It will then write these details from the record (either on the screen or the printer):

Sname : Smith  
Scity : Londres  
Scountry : Inglaterra

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# DATA DABBLING

it is picked up by the Output function. The Output function then examines the table horizontally over the columns in which entries were made by the Join operation, starting from the beginning of the table. For any row of data file record numbers, which does not have a zero in it, the corresponding data file

and data file records are accessed and the fields previously stipulated by the user are then written to the screen or to the printer, as required.

Two examples are given of the use of the Index-create, Join and Output functions, based on the data files in Fig 5.

It will be noted that all three files are normalised and that the only connection between them is provided by the Scode and Mcode fields of File 1. Normalisation, while obviously desirable, is however, not a prerequisite of the system as such.

It will be noted that records 6 and 7 of the Supplier/Material data file are excluded. This is because the appropriate records in the other two data files are missing. Note, too, that in order to move index 13 into the table, a unique form of index 13, namely index 15, had to be joined to index 13. Joining index 13 to itself, although perfectly possible, would result in undesirable, additional combinations.

This example indicates the maximum use of the present system — matching three files to provide an answer drawn from all three.

## Example 2

**Task:** Print — Sname from the Sup(plier) file  
Mname from the Mat(erial) file  
Mquality from the Sup(plier)/Mat(erial) file

for all records of the Sup(plier)/Mat(erial) file having Mprice > 1.9

### Indexes

The following indexes are established:

|              |                     |         |           |  |       |         |           |
|--------------|---------------------|---------|-----------|--|-------|---------|-----------|
| Instructions | INDEX 12 (Supplier) |         |           | INDEX 13 (Supplier/Material)   |       |         |           |
|              | Sortfield: Scode    |         |           | Sortfield: Scode<br>2nd Sortfield: Mcode<br>Selection field: Mprice<br>Selec Criterion: >1.9 |       |         |           |
| Result       | DATA                |         |           | DATA   |       |         |           |
|              | Scode               | File no | Record no | Scode  | Mcode | File no | Record no |
|              | 5                   | 2       | 1         | 5  | 140   | 1       | 7         |
|              | 10                  | 2       | 2         | 6  | 130   | 1       | 6         |
|              | 15                  | 2       | 3         | 10   | 100   | 1       | 3         |
|              | 20                  | 2       | 4         | 10   | 110   | 1       | 2         |
|              |                     |         |           | 15   | 100   | 1       | 5         |

|              |                     |         |           |   |         |           |  |
|--------------|---------------------|---------|-----------|---|---------|-----------|--|
| Instructions | INDEX 14 (Material) |         |           | INDEX 15 (Supplier/Material)  |         |           |  |
|              | Sortfield: Mcode    |         |           | Sortfield: Scode<br>Selec field: Mprice<br>Selec Criterion: >1.9<br>Unique: Yes |         |           |  |
| Result       | DATA                |         |           | DATA  |         |           |  |
|              | Mcode               | File no | Record no | Scode   | File no | Record no |  |
|              | 100                 | 3       | 1         | 5   | 1       | 7         |  |
|              | 110                 | 3       | 3         | 6   | 1       | 6         |  |
|              | 120                 | 3       | 2         | 10  | 1       | 2         |  |
|              | 130                 | 3       | 4         | 15  | 1       | 5         |  |

### Join table

Index 13 is joined on Index 12 on Scode }  
Index 13 is joined on Index 14 on Mcode } all in Scode sequence  
Index 15 is joined on Index 13 on Scode }

giving the following table:

|       |            |   |   |   |
|-------|------------|---|---|---|
| 0.    | File no.   | 2 | 3 | 1 |
| 1.    | Record row | 1 | 0 | 7 |
| 2.    | Record row | 0 | 4 | 6 |
| 3.    | Record row | 2 | 1 | 3 |
| 4.    | Record row | 2 | 3 | 2 |
| 5.    | Record row | 3 | 1 | 5 |
| 6.    | Record row | 0 | 0 | 0 |
| ..... |            |   |   |   |
| n.    | Record row | 0 | 0 | 0 |

### Output

The output program recognises all three columns but, of them, only rows 3, 4 and 5, these being the only rows which are completely non-zero. It then seeks the records in each row, first requesting identification of fields to be printed. The results written are as follows:

|          |   |           |           |           |
|----------|---|-----------|-----------|-----------|
| Sname    | : | Smith     | Smith     | Perez     |
| Mname    | : | Armchairs | Cupboards | Armchairs |
| Mquality | : | 5         | 5         | 4         |

## Footnote

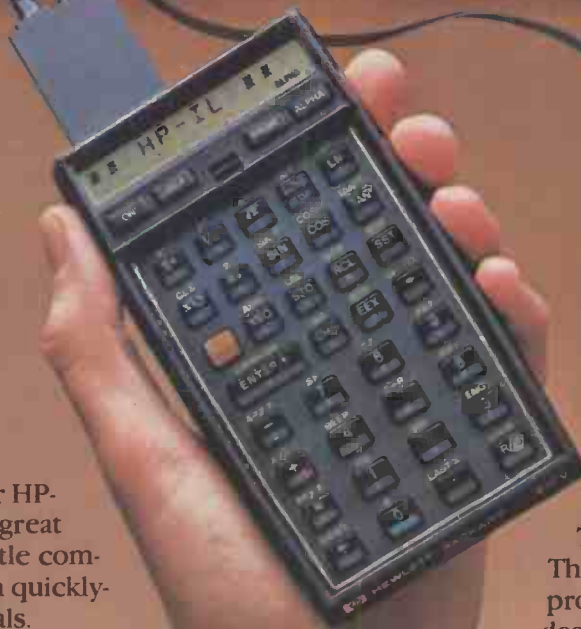
Clearly, a multi-file system for a micro has its limitations, primarily of space. DABS, at present, handles 768 records of ten data fields each — not a great deal, but file number, record number and record status are taken care of separately. Given a third disk-drive, somewhere between 900 and 950 records could be handled, after which main memory becomes the restricting factor. A virtue of the system is, however, that it is fast. Sorting, searching and insertion of records (the latter, in some cases only) take place in main memory and access to the main data files is direct, B trees and binary array search methods being used wherever practical.

Two noteworthy points — UCSD Pascal proved entirely adequate for the task, producing code with very few errors. Pascal friends will recognise at once that this is a compliment to the language, rather than to the programmer. Secondly, while an attempt has been made to make DABS as user-friendly as practical, space considerations have made this difficult in at least one case. What can be done to overcome this, remains an interesting exercise for future leisure moments.

END



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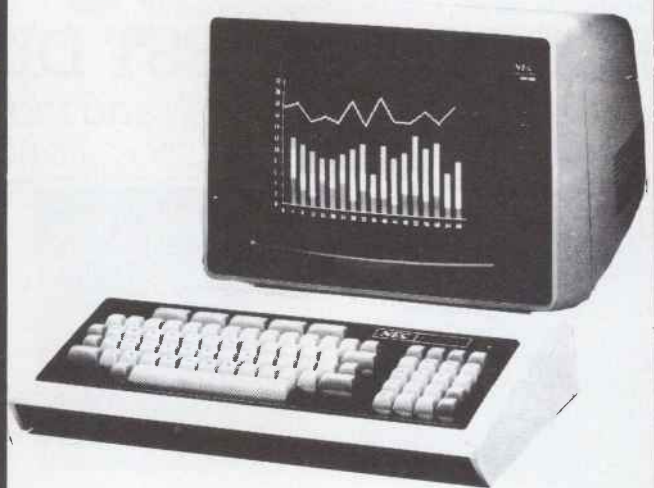
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# PERSONAL PEARL

Pearl is described by its authors as enabling the user 'to create a library of the highest quality programs designed by you, for your Personal Pearl leads you through the program design'. In use, however, it is very similar to a number of information management packages I've reviewed over recent months. Pearl begins by asking the user to define a record format, including screen layout and indexed fields, goes on to provide facilities for data entry, and then gives options to design report formats for getting information from the database. These functions are made available either through a 'service directory menu', which is shown in Figure 1, or by the user typing the program name for the particular function.

Pearl is closer to being a true database system than many I've seen, as it builds a data dictionary for indexing which is designed to permit extraction of information from one file by reference to fields in another. So, although Pearl is billed as a program generator, from a user's point of view it's much more like a data management system — you would, for instance, have a hard time trying to write production control programs with it. This is especially true as Pearl doesn't allow you to display or modify directly the programs you've 'written', only execute them and therefore it seems of little importance to the user whether particular applications are provided by parameter-driven programs or parameter-written programs. However, bearing those comments in mind, Pearl does compete quite well with some of the other data management packages around.

## Constraints

Pearl files can be as big as the CP/M limit of 8 Mb. Maximum record size is determined by layout: up to three screens' worth is permitted provided you don't exceed 250 fields. Screen displays are limited to 17 lines if you want to preserve the facility for providing HELP information on the bottom of the screen. Fields may not occupy more than one screen line, though if the screen width permits you can go up to 127 characters. Numerical accuracy is to 15 digits. Three types of field are provided: numbers, characters and dates.

One or more fields may be designated as key fields, which may be unique or may contain repeated values. Once the format of the record has been decided, changes may still be made even after the file contains data records, but only changes to and additions of non-key fields are allowed. During form

*Kathy Lang continues her series of database evaluations with a look at Pearl*

design a maximum length for each field is given, but data is actually stored in packed form — so that, for instance, a field which has no value occupies no space.

## Input and validation

The data input process consists of four stages. The first involves designing the layout the record is to have on the screen. This layout will be used for displaying each record when the data is input, edited or deleted. (At present only one format per data file is possible; in later releases Pearl is likely to permit several formats 'overlying' the records in a file.) The layout process involves giving each field a label or caption and showing (for instance by using underline characters) where data will be placed for the field. The placing is at this stage

## Straightforward facilities for the novice user

purely visual, and has no implications for record formats: this comes in the next stage, which involves defining data areas.

Data areas are defined by placing the cursor at the start of an area; Pearl then assumes that the field extends up to the next space (on the same line — fields may not spill over two lines). For each data area you must define an abbreviated name of not more than seven letters, which is the name by which the field will be known for Pearl operations; the label is purely to help the operator, and the two could be quite different if you really wanted to do things the hard way. You then indicate the type of field, whether its presence is mandatory or not, and whether it is to be calculated from other field(s) in the same record. Index or key fields are not indicated at this stage; that is done in stage three.

To allow the user to define key fields, Pearl displays the record format just set up and asks to be told which fields are key fields, and whether each is to contain a unique key or whether more than one record may have the same value. It is not essential to define key fields; if you don't, Pearl will

assume that the first field is the only key, and direct access to individual records will be possible only with that key. The fourth and final step is to establish any links there may be between this file and others set up by Pearl; it is possible to have fields copied from another file, calculated from data in another file, or just brought into the record layout for display purposes.

Once you have designed a format you can use it to enter data. The same section of Pearl is used to enter new data and to edit existing records. Data validation is quite thorough. Dates are checked for plausibility, number fields may only contain numbers, and you aren't allowed to save a record if any of the 'mandatory' fields do not have data in them. (Unfortunately Pearl only tells you about one at a time, so if you miss two you have to go round the save/re-edit cycle twice, but it's very quick.) If you enter a value in a supposedly unique key field which is already present in the file, that error too is flagged.

When retrieving existing records for editing or display, you just put the cursor on the particular key field(s) you want to match and type in the required value. Matching is by identity only while editing, although partial matches are permitted to some extent — for instance, if you are searching a key field containing names, typing 'Hill' will result in Pearl finding a record with 'Hill' in that field if there is one, if not it will find the nearest — 'Hills' for instance. You can scroll through the file by asking for the 'next record', so if there are several people called Hill you will get each one in turn, followed by Hills, etc, if they exist, and then the less closely related values such as Smith. When a record is displayed, you can get a copy of it on the printer.

## Displaying data

Individual records retrieved by key can be displayed or printed as I've already described. This mechanism doesn't allow you to access records matched other than by identity, nor does it let you see them sorted or displayed using some format other than that used for input. For any of these facilities, you must use the Design Report and Produce Report functions, which are primarily provided for printed output but which can also be used to display information on the screen.

## Printed reports

The second option in the Service menu allows the user to design report formats. No reports can be printed without a predefined format, apart from direct copies of the screen display. A report

# PERSONAL PEARL

may display information in exactly the same way as the record is shown on the screen, or you may design appropriate separate layouts, either from scratch or by editing a layout you have used before. The process of designing report formats is very similar to that for screen formats. Reports may be of two kinds: a Fixed report format displays one record per page, while the List report format gives one line per record plus heading information and the ability to display sub-totals and totals. While designing a report format, you can request that the records are produced sorted in a particular order; if the report format requests sub-totals, these are produced when the value of the first sort field (which is the most significant) changes. Fixed format reports can be produced spaced out across the page to allow the printing of address labels. Any report may be sent to the screen, to the printer or to a file; this is decided not when the report format is designed but when the production of the report is requested.

## Selection

When a report is produced, one of the options is to select records which lie within certain ranges. For instance, you might want to find which of your customers had been owing you money for between one and two months; you would then request a report of all records where the 'date due' was more than a month ago but less than two months ago. To match records which are equal to a particular value, you specify the same value for both maximum and minimum. Range comparisons work with all three data types, and you can specify such selections for every field in the record if you really need to. The limitations are that you can only have one selection per field — you can't for instance, select records for people who live either in Birmingham or Wolverhampton — and all the selections are combined together so that a record is displayed only if it matches all the selections, not any one of them or some

other combination. Nor can you select records which contain particular values as part of a field.

## Sorting

Also at the reporting stage, you can have the records sorted on a maximum of five fields, in ascending or descending order. This is requested when the report format is produced, so you can't change it when you actually come to produce (print or display) the information. You can't sort on parts of fields.

## Calculations

Calculations using addition, subtraction, multiplication and division, and parentheses, can be carried out either as part of the data input process or when preparing reports. In both cases, the calculations have to be specified when the display format is set up.

## Security and integrity

There aren't any mechanisms at the moment for securing the data against unauthorised access, other than the crude method of locking up the disks, or allowing people to have only the part of Pearl that permits production of reports. You can't, for instance, allow selective updating by giving someone access only to an 'overlay' which displays names and addresses but not sensitive information like salaries. As to integrity, there is a file maintenance program which will rebuild the data dictionary if there has been some problem during file updating. This program will reset the dictionary to the point before the start of editing session, so that only a few records are likely to have been lost.

As far as file and disk security are concerned, and general housekeeping such as erasing files, the user has to rely upon CP/M commands.

## Tailoring

The only tailoring supplied is the ability to select a particular terminal, and to configure Pearl for different terminals if they meet some fairly specific conditions for cursor control — the system I have previously used to run Benchtests didn't conform, but fortunately we now have a Z80 card and CP/M-80 for our Sirius and I was able to run Pearl successfully on that. Would-be users

would be well advised to see Pearl working on their type of terminal before buying, just in case.

## Use with other programs

Pearl can write data out to ASCII sequential files, so you can use it to create files which Wordstar and other packages can read; you can also create Supercalc files. You can't read 'stranger' files into Pearl at the moment, so I couldn't run my Benchmarks, which rely on the ability to read a data file which is the same for all packages and which contains data stored in a 'predictable' way. My initial reaction is that Pearl in its 'special release' form is rather slow, particularly when loading and formatting — data access by keys was quick on a small file.

## User image

The software is on the whole well designed for naive users, with menus, a pretty straightforward structure and lots of HELP on the screen. I particularly liked the display of special characters available for editing at each stage, though they did take up quite a lot of room — a perennial tradeoff. The user is also protected from him/herself in some quite nice ways, such as not being allowed to save records with duplicate keys where they should be unique. I felt that an expert user might find the menu structure tedious quite quickly. Also I must confess to a strong prejudice against gimmicks — such as the message 'My Pleasure' displayed when you leave Pearl!

The documentation is rather mixed. The tutorial sections displayed a remorseless thoroughness which I found a bit off-putting, but the tutorials did introduce enough features to let the user get off the ground without blinding him with detail. However, because the screens were displayed using ordinary type rather than being typeset, the manual was very bulky for what is basically quite a simple package which is fairly self-explanatory in use. Presumably the next release will remedy this defect, and also make some changes to the reference sections.

The reader was instructed firmly to go through the tutorial sections before reading these, and then given nearly as verbose an explanation of the material already covered all over again, as well as covering the more advanced features. The reference section of my manual covered more than than 40 pages, compared with nine in the pre-release version I had previously which seemed to have virtually all the same features. It did seem to be rather a case of 'never mind the quality feel the width'. I'd much rather have seen some effort put into a decent reference card covering all the options briefly, together with the ability to dispense with screen HELP when one became familiar with the commands and could get by with checking the occasional special key function on the reference card.

## Costs

Pearl costs £150, and needs a CP/M system with at least 48k of memory. It

GOTO page 206

```
*****
(
(          DESIGN          OPERATE          )
(          1:  DESIGN FORMS      3:  ENTER DATA      )
(          2:  DESIGN REPORTS    4:  PRODUCE REPORTS    )
(-----)
(Program Name: PCWBTDI )
(ENTER A SERVICE NUMBER: _ )
(Press RETURN to continue, ? for HELP, or ESC to EXIT )
*****
Fig 1
```

# MS-DOS v CP/M-86

*Peter Rodwell compares the two operating systems which — at the moment at least — are fighting it out for supremacy in the 16-bit market*

Right now the business micro market is dominated by twin disk, 8-bit computers running CP/M as their operating system. In fact it's fair to say that CP/M, more than any other single development, has enabled business microcomputing to develop at the pace it has. By providing a standard environment which is easily adaptable to any machine with a Z80, 8080 or 8085 processor, more than 16 kbytes of RAM and at least one disk drive, it has brought order to what could otherwise quite quickly become a very chaotic situation indeed.

CP/M-80 (as we must call it, now that there's a 16-bit version), enabled programmers to produce standard software packages which could be guaranteed to run on any CP/M-80 micro. Hardware manufacturers have been able to produce machines more easily, confident in the knowledge that there was an 'industry standard' operating system which could be placed on their micro and would immediately allow buyers to choose from a wide selection of packages. The design of a Z80, twin-disk CP/M machine is now so easy that it's possible, with mass-production techniques, to churn them out in large quantities at exceptionally low prices, even with a bundle of standard software thrown in — witness the Osborne 01 at under £1300.

Originally CP/M was written for the Intel 8080 chip, as its creator, Gary Kildall, was closely associated with Intel at the time. By happy chance (well, actually, it was more than chance but I'm sure Kildall didn't predict it), Zilog produced a more powerful microprocessor chip, the Z80, which incorporated the 8080's instruction set as a subset of its own, more powerful set. Thus programs written for the 8080 could run without modification on the Z80, although Z80 programs cannot necessarily run on the 8080 unless they are confined to using only the 8080-compatible instructions and make no use of the Z80's more powerful features.

Kildall wrote CP/M-80 primarily as a software development aid; at that time personal computers were unknown and microprocessors had only just made their appearance. Designs for personal computer systems soon began to appear in American electronics magazines, however, and it was quickly realised that CP/M-80 offered tremendous advantages when used as the operating system for these machines; it meant that pioneer computerists could easily exchange software for a start and, not surprisingly, it didn't take long for people to start producing small business machines, running CP/M-80 and using the standard packages being churned out by the escalating microcomputer software business.

Interestingly, the most successful 'big three' microcomputer manufacturers —

Apple, Tandy and Commodore — earned their success quite independently of CP/M-80. Apple and Commodore had no choice because their machines were based around the 6502 chip, which is totally incompatible with the 8080/Z80 family; they each developed their own (incompatible) operating systems instead. Tandy chose the Z80 for its TRS-80 range but went its own way with its own operating system, which, naturally, was incompatible with anyone else's. The 'Big Three' succeeded because they got into the market quickly with good, well-made systems which were easier to use and cheaper than most of the hobby-based systems.

Since those early micro days, the situation has of course changed. Exact figures are very hard to come by in this business but it's fair to say that the Big Three together have about a 50 percent share of the business market while CP/M-80 machines have taken the other half. The number of software packages available for CP/M-80 systems is staggeringly huge and ranges from system utilities through language compilers and interpreters to all sorts of applications packages.

When 16-bit microprocessors appeared, everyone realised that the industry was heading for a rather awkward situation. A vast user base had been established and a massive range of (mostly) well tried and tested standard software was available. But none of the three important 16-bit chips — the Intel 8086, the Motorola 68000 and the Zilog Z8000 — could run any of this software; not even Zilog had had the consideration to make its new heavyweight code-compatible with its old success, the Z80. So all that standard software, into which a lot of money had been poured and with which hundreds of thousands of users were familiar, wouldn't run on the new machine, and neither would CP/M-80 itself.

Clearly the industry had to come up with a new standard operating system so that software producers could get down to converting their packages and users could get their hands on the new generation of machines. But as the three 16-bit chips all had totally different, incompatible instruction sets, no operating system could be adopted as a standard until it was known which chip was going to lead the field.

At this stage in the game, Digital Research (the company founded by Kildall once he realised he was onto a good thing with CP/M-80) was in a very powerful position. There are operating systems which can be run on any machine and for which programs can be written that are totally transportable. One such is the UCSD p-System (read about it in the last three issues of *PCW*), in which only a small central core needs to be written in the 'native code' of the processor involved; all

programs are written in a high-level language, typically Pascal, and compiled into an intermediate code, p-code, which is translated into native code as the program is run by the central core. But a whole generation of microcomputer programmers have been weaned on CP/M-80 and are familiar with its innards. To convert CP/M-80 packages to a totally alien environment would have been expensive and time-consuming. These people looked to Digital Research to provide as familiar 16-bit environment as possible so that conversion involved a straight translation of assembler source code plus a few other tweaks, rather than the entire restructuring that an alien environment might require.

The difficulty was to know which processor would be the favourite with hardware manufacturers. The Zilog Z8000 was an early front-runner but hardware makers were put off when AMD decided not to second-source the chip (a decision it recently reversed); no manufacturer wants to base a product around a chip coming from a single source because he'll be high and dry if that source disappears — and despite the success of the Z80, Zilog has never managed to run at a profit.

That left the 8086 and the 68000. Chip buffs are unanimous that the 68k is the more powerful of the two but legend has it that when Digital Research went knocking on Motorola's door, asking for 68000 details because they wanted to write the new CP/M for it, they found that nobody at Motorola had even heard of CP/M-80 and they were gently but firmly shown the exit. Whether this is true or not I don't know and neither have I ever been able to find out exactly why Digital opted for the 8086. But go for the '86 they did, and produced CP/M-86, even though nobody seemed too interested in using it in a real system.

One factor which may have tipped the scales was a new microcomputer from a company which, while unknown in the micro world, had been doing quite nicely in the world of big computers. The long-awaited, long-heralded, much-speculated-about IBM Personal Computer turned out to be based on the Intel 8088, a 'sawn-off' version of the 8086. (Internally it's a 16-bit processor but it addresses memory as 8-bit bytes rather than as 16-bit words, which is what the '86 does; it is, however, code-compatible with the 8086.)

Meanwhile, with the sort of arrogance a big company accumulates when it's three-quarters of the way to dominating the world, IBM felt that a CP/M operating system wasn't quite good enough and chose a Microsoft product instead, calling it PC-DOS. But Digital Research produced CP/M-86 for the IBM machine anyway and other

# MS-DOS v CP/M-86

manufacturers, figuring that IBM would be a safe bet to imitate, began work on 8088 and 8086-based computers. Microsoft, too, realised that if PC-DOS was good enough for IBM it should be good enough for the rest of the microworld and released its 16-bit operating system to us all, under the name MS-DOS.

Thus, as more and more 16-bit systems appear, we can detect a distinct leaning towards the 8086/8088 family and towards CP/M-86 and/or MS-DOS. The ACT Sirius 1 is already here, British Micro is about to launch an 8088-based machine and on their way are at least half a dozen Japanese 'IBM lookalikes', lead by Hitachi and using one or both of these operating systems.

Before I look into MS-DOS and CP/M-86 in detail, though, I think a few words on the subject of operating systems as a whole are in order.

## The perfect operating system

There is, of course, no such thing as the perfect operating system. For reasons which totally escape me, operating systems, like programming languages, religion and politics, seem to inspire quite ridiculous degrees of fanaticism, frequently bordering on bigoted blindness, if some of the hate-mail we receive here is anything to go by. (I cannot understand why anyone should get so upset about a subject like operating systems, which, in the global scale of things, are pretty insignificant — but people do.)

Before microcomputers appeared, computers were large, isolated machines tended by highly-trained people — programmers, operators and so on — who, because they were highly trained, were able to make sense of the arcane jargon and terminology which surrounded the machines. It mattered little that the man in the street was totally mystified by the whole business because no ordinary men in the street ever came anywhere near a computer.

Microcomputers have changed all that. Not only are they appearing on desktops in every conceivable kind of business, but they are flooding homes as well, now that anyone with £50 to spare can buy a computer. Most of the people who are now using personal computers in their work places have no computing knowledge or experience and neither do they want to become computerists: the modern business personal computer is a tool, purchased to improve business efficiency and make life easier. Within three years' time, businessmen will walk into their local business equipment shop to buy a computer in much the same way as they now buy a typewriter or photocopier; they will have a business problem of some sort and will be looking for a piece of office equipment which will help solve that problem.

The average businessman simply does not want to have to learn about computers; he wants to know which software will do the job he wants done, which piece of hardware will run that software properly and that's all,

basically. All he wants to do then is to buy the system, plug it in and get down to work with it. Anything which prevents his doing exactly that is an obstruction, an inconvenience and a disincentive for him to get involved with computers at all. After all, if you buy a photocopier, you don't want to have to learn about photocopier technology before you can use the thing.

When he sits down to operate his computer, the businessman has three 'levels' at which he could come across problems. Firstly there's the hardware. These days, it's possible to make this pretty foolproof, with the only specialised knowledge being confined to knowing how to turn the machine on, how to put in a disk and how to look after floppy disks correctly. Then there's the applications package he wants to run. Early business packages for micros were pitifully awful, requiring careful use to avoid crashing, demanding rigid syntax and being accompanied by unreadable documentation. Slowly this situation has changed, as software writers realise that their products are being used by computer-naive people who will never understand phrases like 'default back-up store' or who will always accidentally type a letter of the alphabet when they should be typing a number. Gradually we are seeing packages which isolate the user from the bits-and-bytes end of computing and actually cope with mistakes in a helpful and useful way. Documentation, too, is improving, although horrors still abound — take a look at a Wordstar or a Newbrain manual and you'll see what I mean.

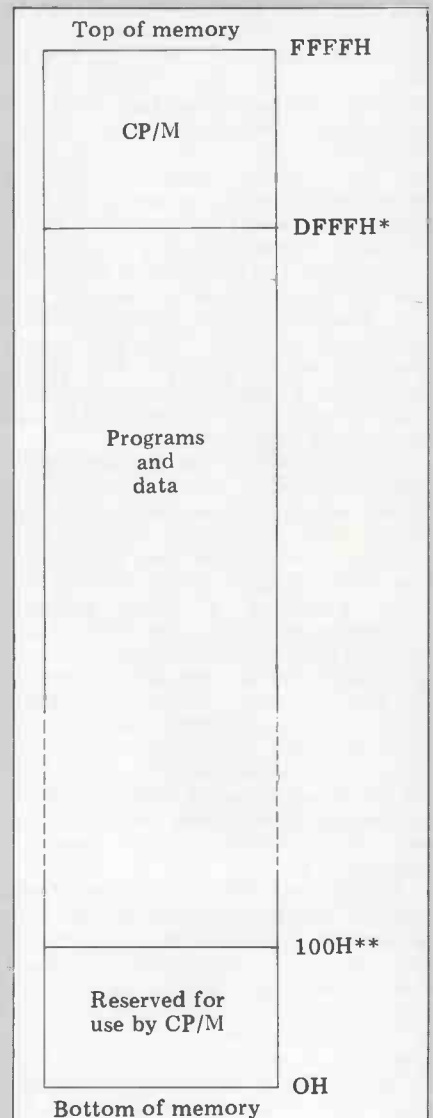
But although considerable steps are being taken to make both applications packages and their documentation user friendly, it's important to realise that operating systems, too, need to be just as friendly and easy to use. When he sits down in front of his computer, the businessman needs the maximum amount of help to achieve his goal; he should not have to wade through pages of instruction manuals in order to understand how to work the machine and he should not be required to learn any special vocabulary before he can make the machine do something sensible. The operating system should enable him to get his application program running as quickly as possible and allow him to carry out whatever 'housekeeping' jobs he has to perform (formatting new disks, taking back-up copies of files, etc) with ease.

Operating systems in the micro world have thus to fulfill two distinct — but by no means mutually exclusive — roles. They must firstly enable software houses and programmers to produce good applications software as quickly — and therefore as cheaply — as possible by providing a useful set of 'interfaces' between the program and the hardware. And — maybe more importantly — they should enable the fast-growing pool of naive users to use their micros as efficiently as possible, with minimal training and/or specialised knowledge.

There are two other, less immediately obvious, qualities that our

## What is CP/M?

In a microcomputer, the operating system is the link between the computer's hardware and the program actually in use. An operating system such as CP/M consists in essence of a series of routines which perform all the boring, mundane but essential tasks involved in computing. This includes things like accepting a character typed at the keyboard, displaying it on the screen, sending characters to the printer and handling the detailed work involved in dealing with disk files. Figure 1 shows how this works on a micro: at the centre is the hardware; between this and whatever programs are being used is the operating system, the program called CP/M (which stands, in case you wondered, for Control Program/Microprocessor). The operating system thus acts as a 'buffer' between the hardware and other software, which could be either applications programs written in assembler language, as



a) A 64k system

\* Approx address - depends on size of BIOS

\*\* Area below 100H not shown to scale!

Fig 2 Memory maps for CP/M systems

shown in the left half of the circle, or a language interpreter which is interpreting an applications program written in a high-level language such as Basic.

## Programming under CP/M

As most programs need at least the ability to accept keyboard input and to display something on the screen, it makes life a lot easier for the programmer if the routines to do this are already available and don't have to be re-written every time a new program is being developed. In addition, the way the computer's hardware is arranged differs from machine to machine, so that while one computer may have Port 0 as its keyboard port, another might use Port 50 for this purpose. A special section of CP/M, called the BIOS (Basic Input/Output Section) contains all the routines which are 'machine specific' (ie, which involve special hardware features which differ between micros) so that, to install CP/M on his product, a manufacturer has only to re-write portions of the BIOS as appropriate.

With the BIOS suitably customised and CP/M successfully installed, any program written for CP/M will then be able to run on it without modification because to perform any of the basic system functions (getting or displaying a character, for instance), the program has merely to execute a subroutine call to an address in a reserved part of memory which is *always* the same, no matter which machine is being used.

As an example of how this works, let's suppose we want to send the character 'A' to the screen. Figure 2a shows the memory map of a typical CP/M computer, from which you will

see that the first 256 bytes of RAM, from locations 0H to 0FFH are reserved for CP/M and that CP/M itself occupies the topmost portion of RAM, typically about 8k or so. In between, starting at location 100H, is the area where programs and data are kept; all CP/M programs must therefore be written to start at 100H. Exactly what CP/M does with all of those 256 bytes needn't concern us here; we're interested in just one location, at 5H. To put the character 'A' on the screen, we must first load it into the processor's E register (remember we're dealing only with the 8080 and Z80 chips), and the *system call* number in the C register. The system call number is simply the number of the operating system routine we wish to execute, obtained from the CP/M documentation which lists all the calls — in this case we want system call 2, so we place the value 2 in C. We now execute a subroutine CALL to location 5. Locations 5, 6 and 7 contain a JUMP instruction to the address inside CP/M up at the top of memory where the routine to work out which function we want and then to execute it lies. The function is executed and CP/M then carries out a RETURN from subroutine instruction to return us to our program.

This may at first sight look a little tedious but in fact it's done for a very good reason. With CP/M you get a utility program to generate a version for any memory size (above 16k); if you want to generate a version of CP/M for a 48k system instead of the standard 64k, you run this program, feed in the relevant details and it produces a new version, which would look something like the memory map in Figure 2b. Notice, though, that this new version still requires those 256 bytes at the bottom; if you were to compare the contents of locations 5, 6 and 7 in the two versions, you'd find they JUMPed to different addresses — the configuration program had so arranged things that, while the addresses of the actual systems calls themselves had changed, a program using them would still work — all that would happen is that when the CALL to location 5 was made, a different address would be JUMPed to automatically, without any modifications being required to the actual program.

CP/M thus frees the programmer of two major headaches: hardware features and memory size. Provided a system has enough memory to contain the program plus whatever extra space the program needs for data storage, it will run on any CP/M machine regardless of the machine's hardware configuration and memory size.

The example I have given is based on the way CP/M-80 works; CP/M-86 and MS-DOS are slightly more complicated but are based on the same principles.

## In use

When the user switches on his machine and inserts the system disk, CP/M is loaded into memory and control is passed to a section of it which displays the 'A>' prompt and waits for something to be typed in at the keyboard.

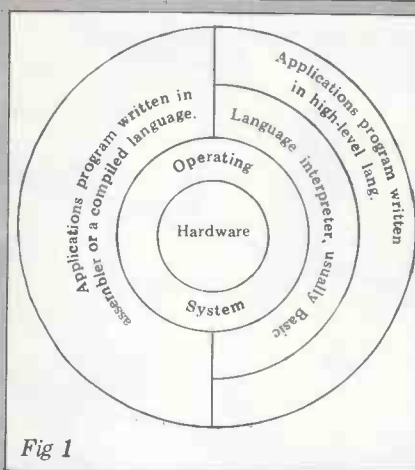


Fig 1

As each letter is typed in, CP/M places it in a reserved area of memory (within that 256-byte lower section) and waits for the next character. It keeps doing this until a carriage return is typed, to signify the end of the command. CP/M then checks first to see whether what has been typed is the name of one of its built-in or *intrinsic* commands, such as DIR, the command to display a disk directory; if it is an intrinsic command, CP/M executes it and goes back to displaying the 'A>' prompt and waiting for the next command.

If the command isn't an intrinsic command, CP/M then searches the disk directory for a program with the same name. If found, the program is loaded into memory from location 100H onwards and control is passed to that program. If there isn't a program with that name on disk, CP/M indicates this fact by the rather crude expedient of re-displaying what you typed followed by a '?' and going back to waiting for another command.

CP/M-80, CP/M-86 and MS-DOS are all single user, single task operating systems. This means that only one person at a time can use the machine to perform only one task at a time. There are operating systems for micros which will allow single user multi-tasking operation, in which one user can have several jobs running at the same time; such a version of CP/M-86, called Concurrent CP/M-86, is promised for the future and it seems logical to assume that a similar version of MS-DOS could also be on its way.

Attempts have been made to produce multi-user operating systems for micros. Trying to do this with an 8-bit system has proved fairly unsuccessful as the poor little processor gets swamped pretty quickly. Even on a 16- or 32-bit micro, the exercise is, frankly, pointless; each user must be provided with a screen and keyboard, both of which are relatively expensive. The processor is made to serve several users by means of a complex (and therefore expensive) operating system yet the processor is the cheapest part of all! It makes far better economic sense to give each user a processor of his/her own — ie, to give them each a micro-computer — and network the micros together to share just the expensive parts such as hard disk drives and daisywheel printers.

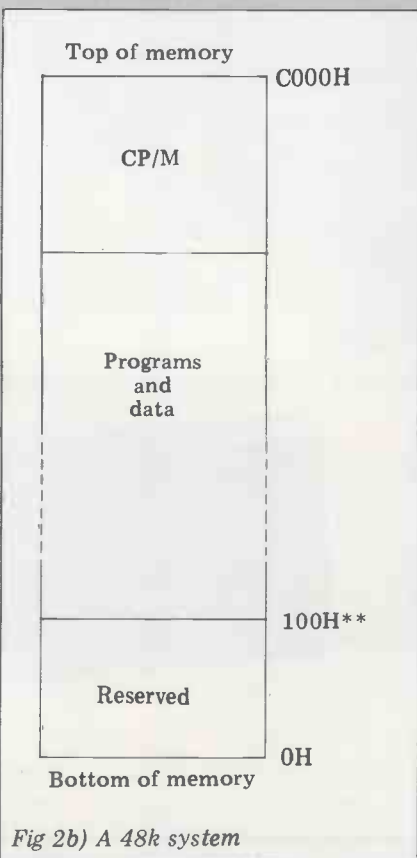


Fig 2b) A 48k system

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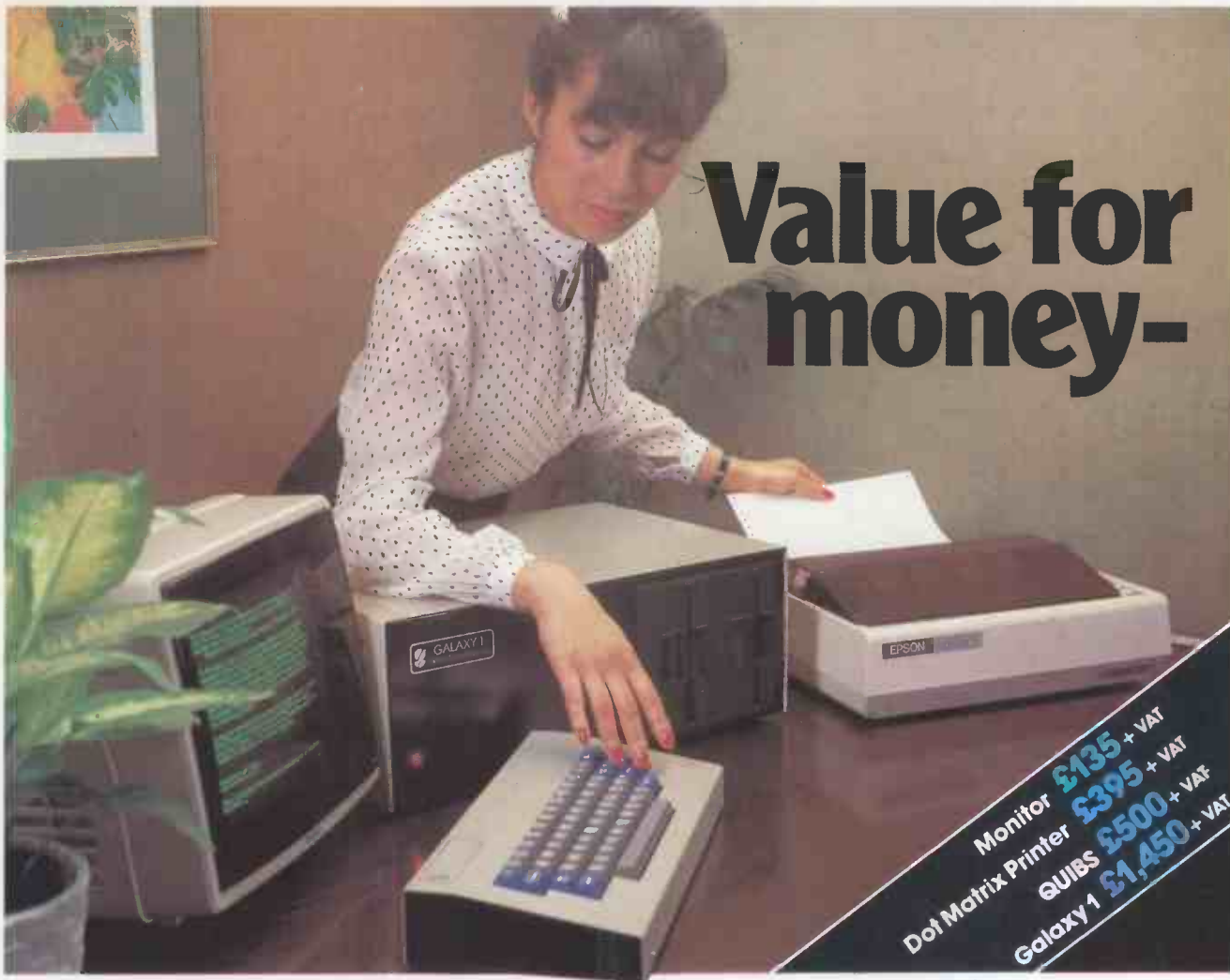
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# MS-DOS v CP/M-86

'perfect' operating system should have: robustness and consistency. Robustness means that if the user does something wrong — say he tries to write to a write-protected disk — the operating system should recognise the error, give the user a useful error message ('That disk is write-protected, nerd!') and allow him

to correct the error quickly and easily. He should be able to recover from the error situation and continue with his applications program unhindered. Consistency means that the command syntax should always follow the same style, so that if he needs to use one of the system's more obscure commands — maybe one he's never used before, or has used very infrequently — he should be able to guess the correct syntax simply by using the same format as is required by all the other commands; there should be no unpleasant, difficult-to-remember exceptions to the command syntax and, as far as our upcoming band of naive users is concerned, the command language should be in something closely resembling English as she is spoke, rather than in terse, arcane abbreviations.

Such a 'perfect' system would have to be a fairly large piece of software, and there was never really any question of developing such a thing for 8-bit micros because they are limited to

64k of memory; there's not enough space to hold a big operating system and leave a sensible amount of room for a business package and its data. But 16-bit micros, with their much larger addressing capacity, do give us the room we need, especially as the price of memory is falling continually. Their increased processing power means that, although there would be a far greater amount of thrashing about to be done, the net result should still provide the end user with faster response times and a quicker-running programs than he currently gets with an 8-bit machine.

I have gone on at some length about the requirements of the naive computer user because, after all, it is he for whom the microcomputer is designed (a fact which seems to escape some hardware and software producers, even now). As I said earlier, nearly all business micros are — and will be in even greater numbers — sold to such users and it's up to the industry as a whole to give them what they need and want, not what some cloistered academic feels they ought to get or what some manufacturer decides is the cheapest and easiest thing to give them.

In the following comparison between MS-DOS and CP/M-86, then, I have very firmly taken the user's side. Although a good operating system should make life easier for the programmer too, to lower software development costs and development times, in the end it's the attractiveness or otherwise of the system to the user that's the most important consideration.

## On the surface

Both operating systems make no secret of their lineage: they both betray strong influences of CP/M-80 to the extent that it's frequently impossible to tell that you're using a 16-bit system. Many of the commands used by both systems are identical to those of CP/M-80, which is a mixed blessing indeed: anyone moving from CP/M-80 to either 16-bit system would find the transition easy but all the boring, awkward things are there too.

When first booted up, CP/M-86 behaves exactly like CP/M-80 and gives you the famous 'A>' prompt. MS-DOS asks for the date and time, for reasons I'll come to in a moment, and then gives the same prompt. This 'A>' prompt can be very confusing, especially in the environment in which I have been running both systems, a Sirius 1 equipped with a Z80 card to allow it to run CP/M-80 as well — three operating systems on one machine, all with the same prompt!

Typing DIR for a directory gives the first major difference. CP/M-86 displays exactly the same directory listing as CP/M-80, a list of file names across the screen and that's all — see Figure 1. MS-DOS is much more helpful, presenting a list of names, the exact size in bytes and the date and time each file was created or last altered, plus the total number of files on the disk — see Figure 2. This finer 'granularity' of MS-DOS is said to indicate that it uses the disk space more efficiently than CP/M-86, in which the minimum recognised file length is a rather hefty 2 kbytes. All this information is extremely useful and I can see no excuse for

|         |     |       |         |        |
|---------|-----|-------|---------|--------|
| COMMAND | COM | 5151  | 5-25-82 | 9:11p  |
| FORMAT  | COM | 16894 | 5-26-82 | 3:40p  |
| DCOPY   | COM | 15719 | 5-26-82 | 3:32p  |
| RDCPM   | COM | 11143 | 5-25-82 | 11:59a |
| MBASIC  | COM | 30720 | 5-20-82 | 2:13p  |
| CHKDSK  | COM | 1976  | 5-26-82 | 2:54a  |
| SETIO   | COM | 935   | 5-20-82 | 12:46a |
| EDLIN   | COM | 2304  | 8-04-81 |        |
| ARCHIVE |     | 0     | 1-01-80 | 12:09a |
| TO      |     | 30720 | 5-20-82 | 2:13p  |
| BASCOM  | COM | 39552 | 5-20-82 | 7:44p  |
| BASCOM  | LIB | 75264 | 5-20-82 | 7:48p  |
| BASRUN  | EXE | 20608 | 5-20-82 | 7:50p  |
| BASRUN  | LIB | 3072  | 5-20-82 | 7:52p  |
| DEMO    | BAS | 512   | 5-07-82 | 12:00a |
| LINK    | EXE | 41216 | 2-04-82 | 1:47p  |
| MP      | COM | 7781  | 5-20-82 | 7:13p  |
| MP      | LDD | 19840 | 5-20-82 | 7:07p  |
| MP      | HLP | 36224 | 5-16-82 | 5:14p  |
| MP      | SYS | 22656 | 5-20-82 | 7:10p  |
| MP      | DAT | 6272  | 5-20-82 | 7:15p  |

Fig 2

|    |          |     |   |          |     |   |          |     |   |         |     |
|----|----------|-----|---|----------|-----|---|----------|-----|---|---------|-----|
| A: | FBASIC66 | CMD | : | MAILMRGE | OVR | : | WS       | CMD | : | SUBMIT  | CMD |
| A: | FORMAT   | CMD | : | WSM565   | OVR | : | FIXLABEL | CMD | : | DDT86   | CMD |
| A: | WS       | KEY | : | FRED     | KB  | : | TIME     | CMD | : | WSQVLY1 | OVR |
| A: | code     | BAS | : | EDIT     | SUB | : | PRINT    | SUB | : | SET     | CMD |
| A: | DIAB66   | CMD | : | CARDBOX  | COM | : | EDIT     | BAK | : | FRED    | KEY |
| A: | DCOPY    | CMD | : | STAT     | CMD | : | BOOTCOPY | CMD | : | ERIC    | KEY |
| A: | ERIC     | KB  | : | PIP      | CMD | : | ASMB6    | CMD | : | GENCMD  | CMD |
| A: | ALLOC    | CMD | : | 1320     | CMD | : | UDCCALC  | CMD | : | BASIC   | CMD |
| A: | SETKEY   | CDE | : | TEMP     | BAS | : | KEY      | BAS | : | KEYGEN  | BAS |
| A: | CEDIT    | BAS | : | SETKEY   | BAS | : | NEWSYS   | COM | : | B6      | COM |
| A: | STAT     | COM | : | PIP      | COM | : | ASM      | COM | : | DDT     | COM |

Fig 1

|                                |   |
|--------------------------------|---|
| dir                            | Display directory of disk in default drive                                    |
| dir d:                         | Display directory of disk in named drive                                      |
| dir filename.ext               | Search for named file on disk in default drive                                |
| dir d: filename.ext            | Search for named file on disk in named drive                                  |
| dir *.ext                      | Search for files with named extension on default drive                        |
| dir filename.*                 | Search for all named files with any extension on default drive                |
| dir x????????.*                | Search for all filenames beginning with x with any extension on default drive |
| era filename.ext               | Erase named file on default drive   |
| era d: filename.ext            | Erase named file on named drive   |
| era *.*                        | Erase all files on default drive  |
| era *.ext                      | Erase all files with named extension on default drive                         |
| era filename.*                 | Erase all named files with any extension on default drive                     |
| ren newname.ext=oldname.ext    | Rename file on default drive  |
| ren d: newname.ext=oldname.ext | Rename file on named drive  |
| type filename.ext              | Display the named file on default drive                                       |
| type d:filename.ext            | Display named file on named drive   |

Fig 3 CP/M-86 intrinsic commands

|          |   |
|----------|---|
| bootcopy | Copies the operating system from the system sectors of one disk to those of another   |
| dcopy    | Copies entire contents of disk in one drive to disk in another, simultaneously formatting the second disk if necessary  |
| format   | Formats disk  |
| pip      | Similar to CP/M-80's PIP but more powerful than MS-DOS's intrinsic copy command as it can copy files to the console or other peripheral device as well as having concatenation capabilities                                       |
| stat     | Also similar to corresponding CP/M-80 command — displays information about files on a disk and space remaining but also allows different devices to be configured to the computer, eg, a serial printer instead of a parallel one |
| submit   | Batch processor which takes a list of commands in a prepared file and executes them sequentially  |

Fig 4 CP/M-86 utilities



Digital Research's failure to provide a similar facility in CP/M-86; it would be even nicer if MS-DOS also indicated how much disk space was occupied and how much was left free. Typing 'DIR/P' with MS-DOS gives a paged version of the directory — the listing stops when a screenful has been presented and prompts you to press any key to list the next screenful when you're ready.

Both systems have wildcard capabilities in the DIR command: typing 'DIR \*.BAS' will display only those files with the '.BAS' extension in both systems. And both allow the use of '?' to match any character in a filename, so that DIR BANK???.\* will display all files beginning with BANK and having three other letters in their names, such as BANKERS, BANKING, etc.

Programs which are executable directly from the operating system (ie, those which have been written in assembler language or compiled) are fired up merely by typing their name. Under CP/M-86 these programs have the extension '.CMD' while MS-DOS sticks to the original CP/M convention of '.COM'.

An interesting and demi-useful feature of MS-DOS is its 'template'. When a command (such as a program name) is typed in at the keyboard and the return key is pressed, the command is copied into an area of memory called the template. A series of editing commands is available, actioned by pressing the escape key followed by a letter, which allows you to insert or delete characters within the template and to copy the template back into the command line. This means that a complicated command such as COPY A:PROGNAME.BAS B: PROGNAME.BAS can be altered to COPY A: PROGNAME.COM B: PROGNAME.COM without the whole line having to be re-typed, although, personally, I found the sequence of commands to do this just a little tedious. The sequence ESC U copies the entire template into the command line, allowing you to repeat a command with just two keystrokes. A rather pointless limitation with the template facility is that the letter following the ESC must be typed in upper case; this is particularly silly as MS-DOS accepts commands in either upper or lower case and is annoying on the Sirius as its keyboard is always in lower case when the system is first fired up.

Both systems allow you to 'edit' the command line itself, although, frankly, neither are particularly easy to use and I generally find myself using only the CTRL-X feature, found on both, which simply deletes the entire line and allows you to try again. Typing a non-existent program name produces a 'Bad command or file name' error message from MS-DOS, while CP/M-86 merely repeats what you typed (translated into upper case if you had typed in lower) followed by a '?' and the prompt.

A major source of irritation (to me, at least) with CP/M-80 is the requirement to type CTRL-C whenever a new disk is inserted. This is done because the operating system maintains a 'map' of the disk in memory and, if a new disk is inserted without CTRL-C being typed to tell it what's happened, the system gets horribly confused when it tries to access the new disk and finds

|                               |   |
|-------------------------------|---|
| Copy fs                       | Copy file onto default drive  |
| copy fs1 fs2                  | Copy first file onto second file  |
| copy fs1+fs2 fs3              | Copy first and second files onto third file                                     |
| copy/b fs1+fs2                | Copy first and second binary files onto first file                              |
| copy fs1/b+fs2/a fs3/b        | Copy first binary and second ASCII files onto third binary file                 |
| copy fs1/a fs2                | Copy first file up to first embedded CTRL-Z onto second file                    |
| copy *.ext fs                 | Copy first file group onto second file  |
| copy *.ext1 *.ext2            | Copy files with extensions matching first onto second file group                |
| date                          | Display date  |
| date mm-dd-yy                 | Set new date  |
| del fs                        | Delete named file   |
| del *.ext                     | Delete all files with matching extensions                                       |
| del d:filename.*              | Delete all files on named drive with matching name regardless of extension      |
| dir                           | Display directory of disk in default drive                                      |
| dir d:                        | Display directory of disk in named drive  |
| dir fs                        | Display directory entry for named file  |
| dir x??????.*                 | Display directory entries for all files starting with x regardless of extension |
| pause                         | Suspend execution of batch file   |
| pause (comment)               | Suspend batch file execution and display comment                                |
| rem (comment)                 | Display comment during batch file execution                                     |
| ren oldname.ext newname.ext   | Rename file on default drive  |
| ren d:oldname.ext newname.ext | Rename file on named drive  |
| ren d:*.ext1 *.ext 2          | Change extensions of all the files with ext1 on named drive to ext2             |
| time                          | Display time  |
| time hh:mm                    | Set time — hour and minute  |
| time hh:mm:ss                 | Set time — hour, minute and second  |
| type fs                       | Display named file  |

Note: fs = file specifier, made up of optional drive name, a file name of up to eight characters and an optional extension

Fig 5 MS-DOS intrinsic commands

|        |   |
|--------|---|
| chkdsk | Gives details of disk and system memory status — how much used, how much remaining  |
| dcopy  | Copies entire disk onto another, formatting second disk if necessary  |
| format | Formats a disk, with option soft error reporting and optional automatic creation of system on second disk   |
| rdcpm  | Transfer a CP/M file from a CP/M disk onto an MS-DOS disk. Of course this is for data files only — it doesn't automatically translate a CP/M-86 program into an MS-DOS program! |

Fig 6 MS-DOS utilities

its contents don't match the 'map'. Very regrettably, CP/M-86 also demands new disks to be logged in with CTRL-C. MS-DOS, on the other hand, is rather more clever: it detects the opening of a disk drive door and automatically logs on the new disk, so there's no need for the user to bother about telling the system what he's done.

It's of paramount importance to make back-up copies of everything you keep on a disk and an operating system should provide a quick and easy way to do this. These two go about it in different ways. CP/M-86 adheres to CP/M-80 practice by providing a utility program called PIP (Peripheral Interchange Program). Calling this program with a command such as PIP A:filename=B:filename will copy a file from the disk in drive B to the one in drive A. Wildcard characters can be introduced, as described in the DIR command above, so that PIP B:=A:\*.BAS will copy all files with the '.BAS' extension from drive A to drive B. Files can also be renamed as they are transferred: PIP B:newname=A:oldname.

PIP is in fact much more than just a file-copying utility, for files can be transferred to other devices, such as the screen or printer, by inserting the appropriate device names instead of destina-

tion files, such as PIP LST:=B:filename, which would send the file to the printer. Additionally, there's a whole host of parameters which can be tagged onto the end of the command line to do things such as verifying after transfer (for disk transfers only), converting ASCII files from lower to upper case, stripping out form feeds and inserting them after a specified number of lines have been sent.

MS-DOS has no direct equivalent of PIP and approaches the back-up facility in a different way. A command called COPY is built into MS-DOS (rather than being a separate program, as is PIP) but is far less versatile than PIP, although its syntax is rather friendlier. COPY A:filename B:filename transfers the file from the A drive to the B drive — note that the syntax is exactly the opposite to that of PIP! Files can be renamed and concatenated and Cromemco's similar XFER function, for a renamed and concatenated as they are transferred. Having used PIP on CP/M-80 machines, and Cromemco's similar XFER function, for a long time, I found COPY a little awkward to get used to, mainly because of the source-destination reversal in its syntax; other users with no previous CP/M convictions have found it far

# MS-DOS v CP/M-86

easier to use than PIP and certainly the word 'copy' makes a lot more sense to the naive user than 'PIP'.

Syntax reversal also takes place with the command to rename (without transferring) files: REN B:oldname newname for MS-DOS, REN B:newname=oldname for CP/M-86 to change the name of a file on drive B. File deletion is carried out with DEL filename for MS-DOS and ERA filename with CP/M-86; both renaming and deletion can be used with wildcards on both systems. Wildcards can be rather dangerous when deleting files so both operating systems trap any attempt to delete everything on a file using DEL \*.\* or ERA \*.\*. CP/M-86 rather tersely asks 'ALL (Y/N?)' while MS-DOS produces a genteel 'Are you sure (Y/N)?' In both cases, typing 'n' aborts the command, leaving your files intact.

While on the subject of messages, I should mention what happens when you try to write to a write-protected disk. True to its ancestry, CP/M-86 gives an expanded — but just as useless — version of the now-infamous 'BDOS err on B: Bad sector' message. MS-DOS is slightly better, with 'Disk error writing drive B Abort, retry ignore'. Neither matches my Cromemco's 'Diskette in drive B is write-protected' message under the same circumstances.

Both operating systems have a TYPE filename command which simply throws the contents of an ASCII file onto the screen and, optionally, to the printer too.

MS-DOS has two additional built-in commands for which there are no CP/M-86 equivalents, TIME and DATE. These display the time and date respectively and offer you the chance to update them if required. You can set both as part of the command line by typing, for example, DATE MM-DD-YY; note the American date format which, irritatingly, is compulsory.

## Other utilities

Both operating systems come with very comprehensive utilities to configure the operating system to your particular needs, such as catering for parallel or serial printers and — for the Sirius — defining character sets and keyboard layouts. Additionally, both systems have a number of other utility programs for performing various 'house-keeping' functions.

Both have a FORMAT program to format new disks and in both cases this can optionally display a report of any faults encountered during the formatting process. The MS-DOS FORMAT program will also, if the option is selected, place a copy of the operating system on the newly-formatted disk. CP/M-86 has a separate program called BOOTCOPY to do this.

Both also have a program called DCOPY which will copy the entire contents of a disk from one drive to another, including the systems tracks, and both will format the destination disk automatically if necessary. This provides a very hand and quick method of taking a backup copy and in both cases you have the choice of

typing DCOPY A: to B: to do it automatically or just DCOPY, which will load the program and prompt you for source and destination drives, giving you the chance to insert a fresh source disk to be copied if required.

The powerful STAT program has been transferred from CP/M-80 to CP/M-86. This allows you to check the amount of space left on a disk, to list the files on a disk alphabetically with a report on their lengths and to change certain features of the operating system; the latter facility allows you to, for example, change the default system printer from a parallel to a serial unit with STAT LST:=LPT:. STAT is a little like PIP in terms of its power and extent and once again there isn't a direct equivalent in MS-DOS. There is a CHKDSK command to give a summary of a disk's space allocation and, of course, file sizes are shown in the DIRectory listing.

Both systems allow you to set up batches of jobs to be done. A text file is written with a word processor or line editor, containing a list of programs to be executed in the order in which they are to be run. To be recognised as a batch file, this must have the extension '.BAT' for MS-DOS and '.SUB' for CP/M-86.

CP/M-86 requires a special program called SUBMIT to run a batch file; you simply type 'SUBMITfilename' and the commands are executed in sequence. However, the disk containing SUBMIT must not be write-protected as SUBMIT creates a temporary file on disk while it's working. Batch processing is much simpler under MS-DOS: the batch processing software is built into the operating system and one merely types the name of the batch file for it to be executed. If the disk contains a file called AUTOEXEC.BAT, this will be executed automatically on boot-up, over-riding the automatic requests for time and date.

## Performance

As both operating systems are single-user, single-tasking systems, there isn't a great deal to say about their performance, except in the area of disk handling. Here, MS-DOS seems to be noticeably quicker than CP/M-86 although lack of time has prevented my running a series of benchmark programs to show just how much faster it is. I did, however, time the loading of Microsoft's Basic 5 interpreter under both systems, in each case from a disk which was otherwise empty. Under CP/M-86 this took an average 4.8 seconds while MS-DOS took 2.1 seconds. Using a variety of other packages, such as Wordstar under CP/M-86 and Multiplan under MS-DOS, I certainly seemed to spend less time waiting around for disk access with MS-DOS than with '86, although until Wordstar becomes available under MS-DOS, I won't be able to quantify this different, either.

## Documentation

As I was using both systems on a Sirius, I had the Sirius manuals to both systems.

These were user's guides and explained all the facilities of each system thoroughly, with examples, and with excellent use of typography to clarify things.

I have seen very early versions of the CP/M-86 programming guide and these seemed slightly better than Digital Research's previous attempts at documentation. Despite a couple of letters and phone calls to Microsoft, I have not yet managed to get my hands on any 'official' MS-DOS documentation and therefore cannot comment on it.

Programmers will certainly need further information on both systems before they can get to grips with them. I understand the documentation is now ready in its final form for CP/M-86 and full programming aids including an assembler and debugger — in fact precisely the same tools as are provided with CP/M-80 — are now available for CP/M-86. Curiously, Microsoft seems to have taken its time to produce an MS-DOS assembler but I'm told this has now been done and will be available very shortly. Several companies are already offering high-level language compilers for both systems — Microsoft has produced a Basic compiler for MS-DOS and there are Pascal, Cobol and C compilers out now for both systems.

## Conclusions

My main aim in investigating these two operating systems has been to see how closely or otherwise they approach the 'perfect' operating system outlined earlier. I must state now that neither come anywhere near this standard but that's not too surprising, given their ancestry and the current newness of 16-bit microcomputers. It will take a while for somebody to develop the 'perfect' system and even longer for it to become recognised as such and adopted as a standard, by which time of course we'll be ankle-deep in 32-bit machines and gigabytes of RAM!

For users graduating from CP/M-80 micros, CP/M-86 will of course be the more familiar of the two. This means that the simplicity of CP/M-80 has been retained but so also have its bad points, especially its very unhelpful user interface. A 'Help' facility is supposed to be on its way to supplement CP/M-86 in some way, but I'm not sure at the moment whether this will be integrated into a new version of the system or supplied as a separated, but linked, text file; I suspect the latter.

MS-DOS is certainly friendlier than CP/M-86 and definitely gives faster disk handling. It incorporates sensible error messages (well, much more sensible than CP/M-86) and generally feels a lot more robust and easier to use.

Of the two, then, I found MS-DOS the nicer to use. At present there seems to be less in the way of applications software available to run under it than is currently up and running under CP/M-86 — but I expect this situation to change pretty quickly as more and more software for the IBM Personal Computer becomes available on this side of the Atlantic and, of course, as more machines running MS-DOS appear.

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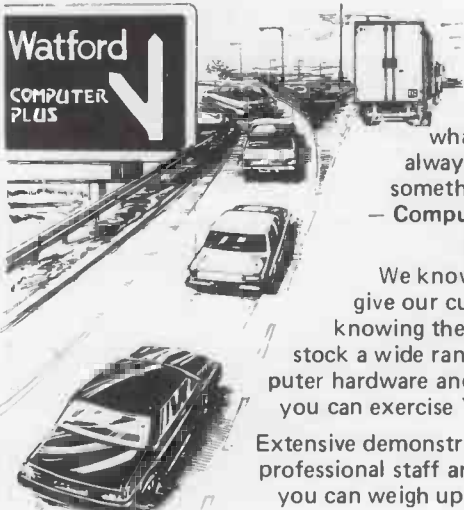
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# PCW SUBSET

```

VECT: EQU X ;Location of interrupt vector in
; RAM (2 bytes)
RTIM: EQU X ;Location of 4-byte time storage
CTCO: EQU X ;CTC port on channel 0
CTCN: EQU X ;CTC port free
ON: PUSH HL ;Save registers E5
PUSH AF ; F5
IM 2 ;280 vector mode ED 5E
LD A,VECT/256 ;Initialise I with 3E XX
LD I,A ; top byte of vector ED 47
LD HL,ISR ;Initialise vector with 21 YY YY
LD (VECT),HL ; address of ISR 22 XX XX
LD A,VECT ;Send low byte of 3E XX
OUT (CTCO),A ; vector to CTC D3 XX
LD A,85H ;Initialise CTC 3E 85
OUT (CTCN),A ; in timer mode D3 XX
LD A,250 ;For 4 MHz sys or 125 3E FA
; for 2 MHz sys
OUT (CTCN),A ; D3 XX
POP AF ;Restore registers
POP HL ;
RET ; C9
;
ISR: EI ;Re-enable interrupts FB
; interrupt response
PUSH HL ;Save registers E5
PUSH AF ; F5
LD HL,RTIM ;Start (LSD) of time 21 XX XX
INC (HL) ;Incr time 34
INC HL ;Point to next digit 23
JR Z,LOOP ;Incr next digit if carry 28 FC
POP AF ;Restore registers F1
POP HL ; E1
RETI ;Return from interrupt ED 4D
;
OFF: PUSH AF ;Save AF F5
LD A,+3 ;To internally reset CTC 3E 03
DI ;Prevent spurious ints F3
OUT (CTCN),A ; D3 XX
EI ;Re-enable interrupts FB
POP AF ; F1
RET ; C9
;
CLEAR: PUSH HL ; E5
LD HL,+0 ;Zero RAM 21 00 00
LD (RTIM),HL ; 22 XX XX
LD (RTIM+2),HL ; 22 XX XX
POP HL ; E1
RET ; C9
;
READ: DI ;Prevent time changing F3
; while being read
LD HL,(RTIM) ;Get low word 2A XX XX
LD DE,(RTIM+2) ;Get high word ED 5B XX XX
EI ;Re-enable FB
RET ; C9

```

## 6502 arithmetic

Continuing Vincent Fojut's improvements to the 6502 arithmetic routines, we have ABS4, to get the absolute values for 32-bit numbers and SMUL46, the 32-bit multiplication.

Before looking at these, I remind you that, for 6502 code, Sub Set routines have 16 bytes of zero-page RAM reserved for them, designated M0 - MF in the mnemonics and ZZ in the machine code. For this suite of routines, the first accumulator is in M0 - M3, the second in M4 - M7 and the third in M8 - MB. MC - MD points to ASCII strings, ME holds the sign of the product of the second and third accumulators and MF is available as a temporary store.

The original ABS4 (April '82) got the absolute values

of the second and third accumulators, after moving them into the first accumulator. Vincent restructures this into two subroutines; a lower level one, ABSNEG, to deal with a 32-bit value without moving it, and the controlling one, ABS4. While functionally the same as the original, the new routines save 20 bytes and 242 T-states as well as a zero page storage location but make use of the Y register, which the original left untouched.

To save space, I have put ABS4 and ABSNEG together but, outside the magazine publishing world, they should be held and documented separately, since ABSNEG has wider application than its use by ABS4.

```

;/INTERFACES: None
;/INPUT: Multiplicand in M8-MB, multiplier in M4-M7 with the
;/ mostly significant bytes in MB & M7
;/OUTPUT: No error: product in M0-M3; M4-M7=zero; M8-MB
;/ contains the absolute multiplicand; carry is reset
;/ Overflow: carry set; all 3 accs indeterminate
;/REGS USED: A,X,Y,P,M0-MB,ME
;/STACK USE: 4
;/LENGTH: 63
;/T-STATES: Min 1756, max 4134
;/PROCESSOR: 6502
;
SMUL46:JSR ABS4 ;Get abs values & product 20 XX XX
STX M0 ; sign, zeroise 86 ZZ
STX M1 ; accumulator 86 ZZ
STX M2 ; withX 86 ZZ
STX M3 ; = 0 86 ZZ
LDY £+32 ;Bit count A0 20
SML1: ASL M0 ;Shift 06 ZZ
ROL M1 ; left 26 ZZ
ROL M2 ; accumulator 26 ZZ
ROL M3 ; 26 ZZ
BMI OVFW3 ;Jump if 30 26
BCS OVFW3 ; overflow 80 24
ASL M4 ;Get next 06 ZZ
ROL M5 ; bit of 26 ZZ
ROL M6 ; multiplier 26 ZZ
ROL M7 ; into carry 26 ZZ
BCC SML3 ;Skip if bit is a 0 90 0E
LDX £-4 ;Using negative A2 FC
CLC ; indexing 18
SML2: LDA M0+4,X ; add byte in acc B5 ZZ
ADC M8+4,X ; to multiplicand 75 ZZ
STA M0+4,X ; & store in acc 95 ZZ
INX ; E8
BMI SML2 ;Continue if X = 0 30 F7
BVS OVFW3 ;Jump if overflow 70 0C
SML3: DEY ;Repeat 88
BNE SML1 ; 32 times 00 09
BIT ME ;Test product sign 24 ZZ
BPL SML4 ;Skip if positive 10 03
JSR SNEG46 ; else negate 20 XX XX
SML4: CLC ;Clear carry to show OK 18
RTS ; 60
OVFW3: SEC ;Set carry to show error 38
RTS ; 60

```

In the multiplication, storage location and, in the negative indexing at SML2, worst possible case, 1013 T-states saves eight bytes, a zero page

## Datasheet

```

;=ABS4 - Get absolute values of two 4-byte numbers
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Gets abs value of two 32-bit accumulators
;/ in page zero of RAM, leaving X=0 & the sign of
;/ product of the accumulators in ME
;/ACTION: Exclusive OR the most sig bytes of the accs & store
;/ in ME. Point to each acc in turn & call ABSNEG to
;/ negate if necessary
;/SUBR DEPENDENCE: Local ABSNEG
;/INTERFACES: None
;/INPUT: 2nd (M4-M7) & 3rd accs, which are 32-bit signed numbers
;/ with their most sig bytes in M7 & MB
;/OUTPUT: 2nd & 3rd accs contain their absolute values; X=0;
;/ ME has sign of the product of the 2nd & 3rd accs
;/REGS USED: A,X,Y,P,M4-M7,M8-MB,ME
;/STACK USE: 2
;/LENGTH: 37
;/TIME STATES: 33+2*ABSNEG t-states (83 when a number neg,
;/ 13 when positive
;/PROCESSOR: 6502
;
ABS4: LDA M7 ;Get 2nd acc sign & A5 ZZ
EOR MB ; XOR with 3rd acc sign 45 ZZ
STA ME ;Store in ME 85 ZZ
LDX £M4 ;Set pointer to 2nd acc & A2 ZZ
JSR ABSNEG ; negate if necc 20 YY YY
LDX £M8 ;Set up pointer to 3rd acc A2 ZZ
JSR ABSNEG ; & negate if necc 20 YY YY
LDX £+0 ;Zeroise X A2 00
RTS ; 60
;
ABSNEG: LDA O3,X ;Get msb of acc B5 03
BPL EXIT ;Exit if positive 10 00
LDY £+4 ;Initialise counter A0 04
SEC ;Prepare to subtract with no 38
ABNG1: LDA £+0 ; borrow. Subtract A9 00
SBC O0,X ; accumulator F5 00
STA O0,X ; from 95 00
INX ; zero E8
DEY ;Decr counter 88
BNE ABNG1 ;Continue if not = 0 00 F6
EXIT: RTS ; 60

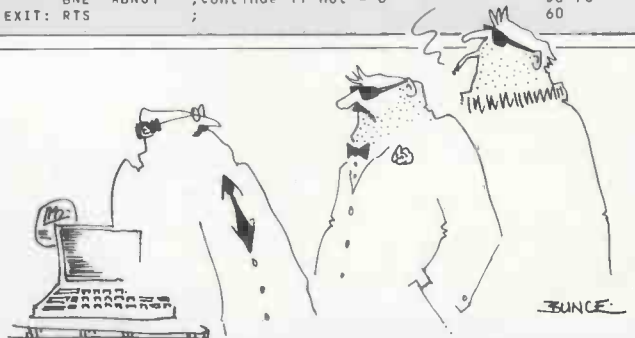
```

## Datasheet

```

;=SMUL46 - 32-bit signed integer multiply
;/CLASS: 2
;/TIME CRITICAL? No
;/DESCRIPTION: Multiplies two 32-bit signed integers in M4-M7
;/ & MB-MB
;/ACTION: Get product sign & absolute values of arguments
;/ Clear accumulator
;/ Multiply accumulator by 2 & check for overflow
;/ Get next bit & if it's 1 add multiplicand to acc &
;/ check for overflow
;/ Repeat 32 times
;/ Negate if product sign minus

```



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# CLOCK IT TO ME

In the first instalment of a two-part article, Bruce Marriott describes a real-time clock/calendar card for the Apple II

Many programs require time and date information: either directly, as in tagging output for later identification, or for generating or measuring accurate intervals of time — as, for instance, in scientific data logging.

In the former case, the user can be asked to input the time and date but this is irksome and error-prone since it has to be done at least once for every program run. For generating or measuring time intervals, recourse is often made to assembler or Basic timing loops, the programming of which is complex and hard to modify. Since computers are used to increase efficiency, an automatic (and cheap!) solution to such routine requirements would be particularly useful: this is what led to this design for a clock/calendar card.

This month I shall cover the hardware design of the real-time card; next month I shall go on to describe suitable driving software. Depending on which system is being used, and the chosen construction method, the cost of the card varies between £15 and £35. As usual with such articles, complete details are only given for one machine, in this case the Apple II. Don't let this dissuade you from reading on if you own another micro — the hardware itself is not complex and some information on implementing the design for other machines is given.

The Apple II uses the 6502 processor, so the design will be easiest to adapt to other 6502-based machines; owners of 8080/Z80 machines will have to work a little harder — but again, the comparative simplicity of the hardware cannot be overemphasised.

## Background

There are several methods for implementing a real-time clock on a micro. The easiest is to generate regular interrupts (at least once a second) and have an operating system which counts the interrupts into time (and possibly date) registers in a reserved area of memory. This system — used in several micros — is fine until the power is turned off; the clock has to be reset every time you turn the machine on.

Until two or three years ago the only other practical method was to implement a design totally in discrete hardware using a crystal timebase and a host of TTL chips, with power supplied by rechargeable batteries. This method is used in the Mountain Computer clock/calendar card for the Apple II and suffers from two drawbacks: cost (£149) and excessive power consumption, requiring an AC charger which has to be left permanently on, more or less.

The most satisfactory solution came with low-power CMOS clock/calendar chips specifically designed to interface to micro buses. These chips typically use a 32768 Hz crystal as a timebase and will continue to operate on about

20 microAmps at 2.2 volts, supplied by battery backup which should last for months. Access to the time and date registers is usually through 4-bit address and data lines.

One of the first of these chips was the National Semiconductor MM58174A, which has been described for use in a number of articles. Unfortunately it suffers from a serious flaw: it has no year register, which seems ludicrous. You either have to design a circuit with CMOS RAM to hold the year, or modify the disk operating system to store the year on all disks. Otherwise the user of an applications program is, rather perplexingly, asked to enter just the year instead of the full date. NatSemi has recently produced a rather more sophisticated chip, the MM58167A, but this too lacks a year register!

Casting around for a better device to use for this design produced the Oki MSM5832RS. This chip has no serious drawbacks and, surprisingly, has been available for two years, though it would seem to be used only in professional circles. After opting for the Oki chip, I have heard of a Motorola device, the MC146818, and this might be worth checking out as it has a very advanced specification. It is, however, rather expensive — about £15 one-off.

## MSM5832 anatomy

Figure 1 shows the functional block diagram and pin-out of the 5832. The chip interface breaks down into three broad areas: supply requirements, control systems, and data and address lines.

The supply requirements are a 3276 Hz crystal across XT and XT and +5 volts at Vcc when being accessed, or a minimum of 2.2 volts when on standby (ie, when supplied from a battery).

The major control signals are HOLD, READ, WRITE and CS (chip select). The CS input is rather unusual in that it is not normally connected to the micro bus or tied to a power rail through a resistor but is connected directly to the +5 V supply. With +5 V applied, CS enables all inputs and outputs but when the power is removed (but battery backup is working) CS goes low, disables all the control lines and effectively isolates the chip. The HOLD line is effectively the chip enable (or select) signal and while high suspends updating of registers so that stable conditions exist for reading from or writing to the chip. The READ line goes high to enable reading data from the chip and WRITE goes high to enable writing data.

Two other control signals exist, neither of which is normally used. The ±30 ADJ input, when briefly taken high, resets the seconds register to zero and if there were more than 30 seconds, the number of minutes is increased by one, otherwise the minutes are left unchanged. The TEST input, as its name implies, is used for testing; with CS high, pulsing high signals on this pin will directly clock certain registers depending on the addressing used.

The last group of signals comprises the address and data lines, which follow normal practice with the address lines selecting a specific register within the 5832 and the data lines actually passing the contents. Figure 2 shows the register

| HEX | ADDRESS INPUTS |    |    |    | INTERNAL COUNTER | DATA I/O |    |    |    | DATA LIMITS | NOTES   |
|-----|----------------|----|----|----|------------------|----------|----|----|----|-------------|---|
|     | A3             | A2 | A1 | A0 |                  | D0       | D1 | D2 | D3 |             |   |
| 0   | 0              | 0  | 0  | 0  | S                | *        | *  | *  | *  | 0~9         | S1 or S10 are reset to zero irrespective of input data D0~D3 when write instruction is executed with address selection. |
| 1   | 0              | 0  | 0  | 1  | S 10             | *        | *  | *  | *  | 0~5         |   |
| 2   | 0              | 0  | 1  | 0  | MI 1             | *        | *  | *  | *  | 0~9         |   |
| 3   | 0              | 0  | 1  | 1  | MI 10            | *        | *  | *  | *  | 0~5         |   |
| 4   | 0              | 1  | 0  | 0  | H 1              | *        | *  | *  | *  | 0~9         | D2 = "1" for PM<br>D2 = "0" for AM<br>D3 = "1" for 24 hour format<br>D3 = "0" for 12 hour format<br>(Day of the week)   |
| 5   | 0              | 1  | 0  | 1  | H 10             | *        | *  | †  | †  | 0~1<br>0~2  |   |
| 6   | 0              | 1  | 1  | 0  | W                | *        | *  | *  | *  | 0~6         |   |
| 7   | 0              | 1  | 1  | 1  | D 1              | *        | *  | *  | *  | 0~9         |   |
| 8   | 1              | 0  | 0  | 0  | D 10             | *        | *  | †  | †  | 0~3         |   |
| 9   | 1              | 0  | 0  | 1  | MO 1             | *        | *  | *  | *  | 0~9         |   |
| A   | 1              | 0  | 1  | 0  | MO 10            | *        | *  | *  | *  | 0 1         |   |
| B   | 1              | 0  | 1  | 1  | Y 1              | *        | *  | *  | *  | 0~9         |   |
| C   | 1              | 1  | 0  | 0  | Y 10             | *        | *  | *  | *  | 0~9         |   |

- (1) \*data valid as "0" or "1".  
Blank does not exist (unrecognized during a write and held at "0" during a read)  
† databits used for AM/PM, 12/24 HOUR and leap year.
- (2) If D2 previously set to "1" upon completion of month 2 day 29, D2 will be internally reset to "0".

Fig 2 MSM5832 register addressing



addresses; note that two registers (tens of hours and tens of days) not only hold time and date digits but also use some bits for control of time format and leap years.

One facility of the 5832 which is not apparent from the pinout is the chip's ability to generate interrupts. These appear on the data lines under specific

control and address line conditions, as shown in Figure 3.

## Interfacing

The easiest way to interface the 5832 to most popular systems is to use a 6821 PIA (Peripheral Interface Adaptor) for 6800/6502 systems or the equivalent

8255 PPI (Programmable Peripheral Interface) for 8080/Z80 based systems. The Oki data sheet shows the way with a 'typical application' based on the 8255.

An advantage with using a PIA/PPI is that the normally critical timing constraints involved with discrete logic interfacing are no longer a problem as timing moves from the microsecond

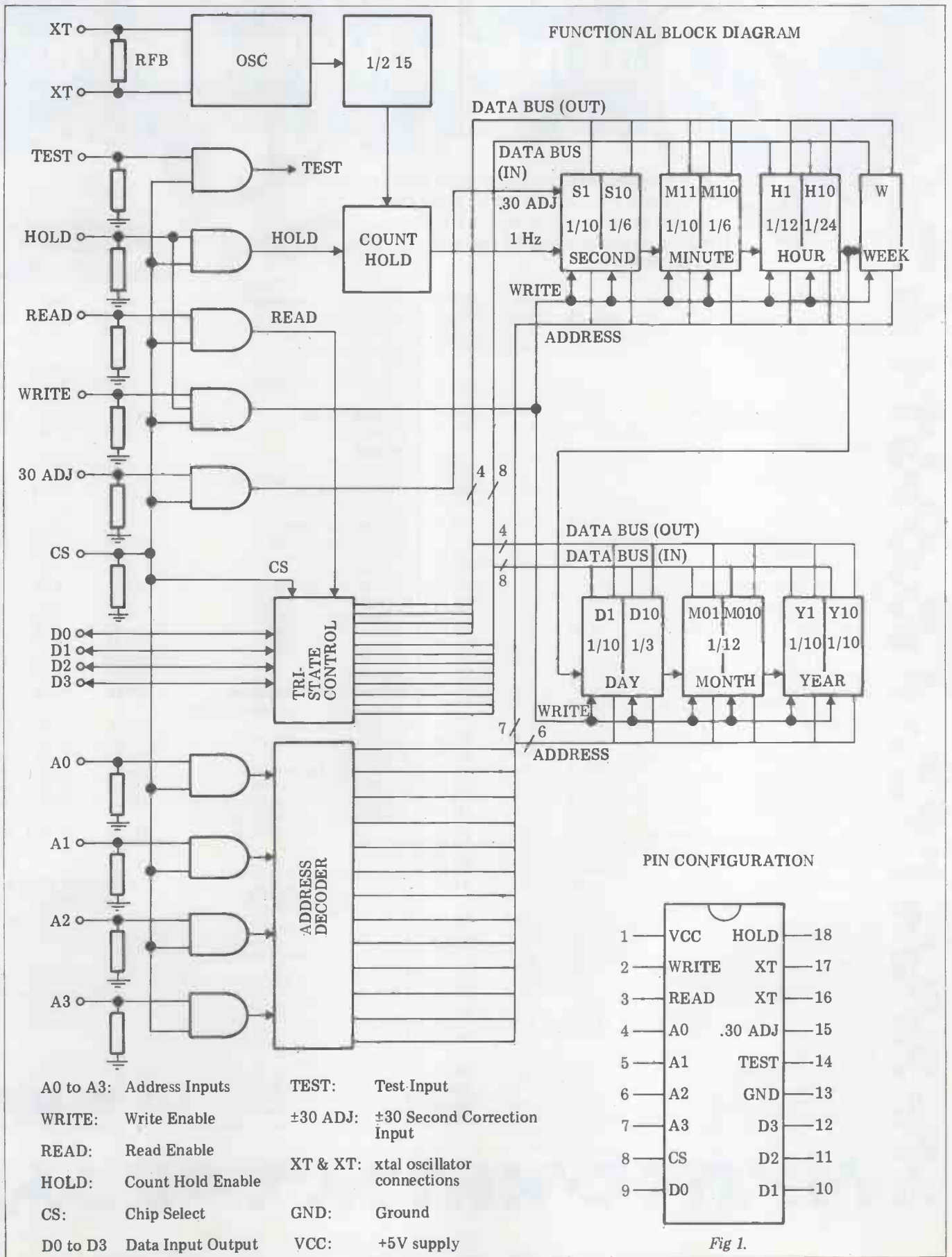


Fig 1.



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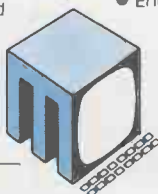
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domain to the processor's clock and instruction times, which are much longer. For instance, to write to the 5832 using a direct design would need HOLD to go high for 150 microseconds before the address and data with the actual WRITE pulse following within a minimum of 0.5 microseconds and lasting at least 1 microsecond. With a PIA/PPI, everything is slowed down to the speed that instructions can be given and these in all cases will be longer than the minimum times given.

Another advantage of a PIA/PPI is that this is the most popular addition to a system (with the exception of memory chips) and hence for most readers will be a known entity. With a 6821 device, as used here, the interrupt inputs are available, allowing the 5832's interrupt capabilities to be exploited under software control rather than by jumper leads.

Figure 4 shows the 'typical application' design from the 5832 data sheet. I haven't tried this so I can't guarantee its correct operation, but it should give a good start for 8080/Z80 users.

## PIA design

For 6800/6502 systems, the 6821 PIA is the easiest chip to use. Figure 5 shows the complete circuit diagram for the Apple II. The heart of the system has been heavily outlined and is usable on any system, so I'll talk about this first. I assume that you know how to interface a 6821 to your particular system; if not, then get a book on your processor or, even better, one on interfacing to your particular computer system.

Connection between the two 8-bit PIA ports and the 5832 requires some consideration because the ports are not identical and this can affect the 5832 when the 6831 PIA is reset. The critical line is HOLD which, when taken high, stops the 5832 updating its registers. When a 6821 PIA is reset, both A and B ports become inputs but the A port has internal pullup resistors while the B side doesn't. The net effect of this is that should the HOLD line be connected to the A side of the PIA resetting the system will take HOLD high and stop the clock. Hence the control lines shown in Figure 5 have been connected to the PIA's B side.

As discussed earlier, the four data lines have a dual function: moving actual register contents and acting as constant interrupt sources (Figure 3). For data flow handling they are connected to port B but, in addition, the lines are also connected to the four interrupt ports (CA1, CA2, CB1, CB2) through which their interrupt signals can be software controlled.

Power-off operation comes from a 3.5 V 100 mAh Nicad battery which is automatically trickle-charged during normal use. Precise setting of the required clock frequency is achieved with a variable capacitor. Two switches are used in this design: one allows the use of the  $\pm 30$  second adjust mentioned earlier while the other write-protects the 5832.

## Apple extension

The ports outside the heavily lined area in Figure 5 are specific to the Apple II.

The Apple has a unique I/O structure which, considering the age of the design, is quite exemplary. At the back of the Apple are eight slots for peripheral cards. Slots 0 and 7 are unique and have specialist uses but the other six can generally be used by any Apple-compatible card. Each slot has 16 locations for general I/O and a 256-byte page of memory which is normally used to hold the card's driving program. The 256-byte page is corrected to Basic via the IN# (slot number) command which, when processed, means that the peripheral card in that slot will respond to subsequent INPUT statements instead of the keyboard. It's clearly much neater to use INPUT TIME\$, DATE\$ rather than resorting to the usual PEEKs and POKEs, so the circuitry to do this has been included.

The driving program is housed in a single rail 2716 EPROM which is both cheap and relatively easy to program. This is a 2k device, so eight 256-byte driving programs could be contained within it. As I don't think anyone will need that many, the highest 2716

address line (A10) has been permanently connected to ground, so only four spaces are available, and are conveniently decoded by switches 1 and 2.

Output enable for the EPROM comes from the Apple-supplied I/O SEL line which is fully decoded for each of the slots. The 6821 PIA is mapped into four of the 16 general I/O locations which have an equivalent chip select signal called DEVSEL.

Most signals available at each slot in the Apple are capable of driving several LSTTL loads with the exception of the data lines which can drive only one such load. Although the design would probably work without buffering, I decided to play safe and an LS245 tri-state buffer has been incorporated. Chip select for this device (G) is derived from an LS08 (AND gate) and the two Apple lines DEVSEL and I/O SEL. All other connections are standard.

## Construction

The circuit can either be constructed on an Apple-compatible prototyping board

| CONDITIONS  | OUTPUT | FREQUENCY | PULSE WIDTH   |
|-------------|--------|-----------|---------------|
| HOLD = L    | D0 (1) | 1024 Hz   | duty 50%      |
| READ = H    | D1     | 1 Hz      | 122.1 $\mu$ S |
| C.S. = H    | D2     | 1/60 Hz   | 122.1 $\mu$ S |
| A0 ~ A3 = H | D3     | 1/3600 Hz | 122.1 $\mu$ S |

(1) 1024 Hz signal at D0 not dependent on HOLD input level

Fig 3 Control of MSM5832 interrupt facility.

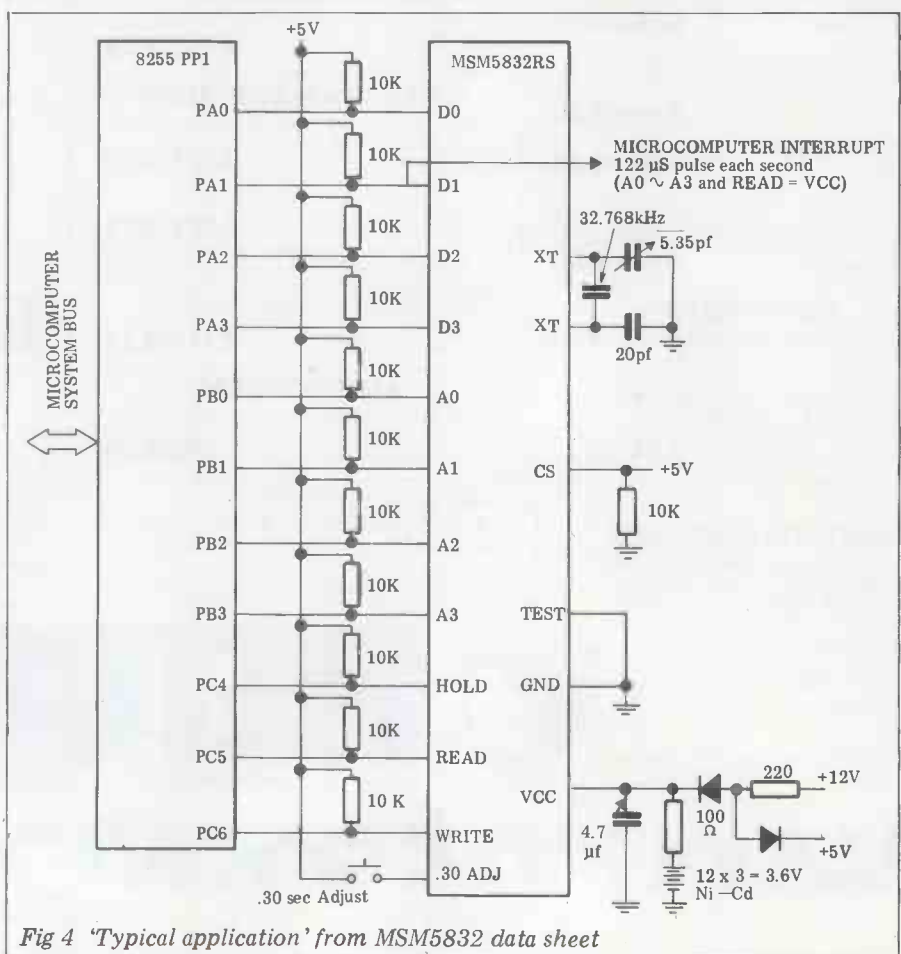


Fig 4 'Typical application' from MSM5832 data sheet



# TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: 'TJ's Workshop', PCW, 62, Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.

## PET CAMERA TESTER

A microcomputer system is ideal for testing the shutter speed of a camera, the main requirement of which is to measure short periods of time, down to 1/2000 second, with a high degree of accuracy.

First, some sort of sensor is necessary to detect the shutter's opening. The obvious way to do this is by light, with a fairly powerful lamp shining into the open lens mount (it's better to remove the lens, if possible) and the sensor held as closely as is safely possible behind the rear of the shutter blind.

The sensor must be a photo-transistor with no connection to its base. A photoresistor will definitely not do as its response times are far too slow. I used an old OC45 from my junk box. Other photo-transistors may be used, but the value of R1 in the circuit diagram may need altering. If you use an NPN photo-transistor you must of course connect the emitter and collector the opposite way round.

A word about the lamp: don't make it too powerful and don't put it too close to

the camera. When I put a photoflood right up next to my Yashica, I was horrified to see the plastic nameplate partially melting! That cost me £5 to fix.

The software consists of a machine-level program resident in the second cassette buffer (which would need re-locating on machines other than the PET) and a Basic program to control it and tabulate the results.

The machine code timer program is shown in Listing 1. The loop at \$033B - \$033E waits until the phototransistor is exposed to light. Once the phototransistor registers, the BC108 turns on and PA0 is grounded so the micro drops through this loop and starts counting. The counter is a simple two-byte counter, clocking continuously until the shutter closes. The complication is to make the routine take exactly the same time and exactly the same number of instruction cycles per loop whether or not the branch to increment the high order byte, \$02, is taken. A bit of roundabout program-

ming has neatly overcome this problem: 25 cycles (25 us with a 1 MHz 6502, 12.5 us with a 2 MHz chip) are taken in each case.

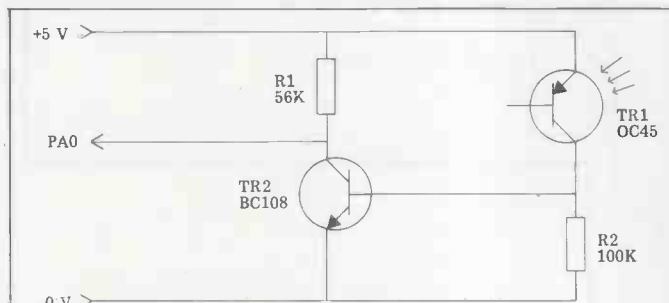
The number of loops made will be given by the Basic code  $PEEK(1)+256*PEEK(2)$ . With only two bytes to hold the count, the system will clock round to 0 after 1.6384 seconds (half this with a 2 MHz clock) so times longer than that will read low by the same amount.

The rest of the Basic program should be self-explanatory. Dividing the figure obtained by the above expression by 40 (because each cycle takes 1/40000 second) gives a reading in milliseconds, and inverting that gives the nearest practical fraction.

I have used the system to measure speeds of both a Yashica FR and a Leica M3. I took 10 successive measurements and averaged them out, as is done by a leading photographic weekly. The results, although too long to publish in full here, make interesting reading. The Leica, the 'Rolls-Royce' of cameras, was less accurate by a factor of 2½ than the electronically timed Yashica. What is more surprising is that a camera a quarter of a century old should hold its own so well against a camera with technology so much newer and still provide a highly commendable set of figures, only 10 per cent out on average, even though it has never been serviced. That's why a Leica costs three times as much as a 'comparable' Japanese product!

The circuit and timer program should be easily adaptable to any other 6502-based machine; other processors will require a simple rewrite. And with different circuitry attached, the timer program must have a thousand other applications.

Kevin Jones



NB: PA1-7 inclusive must also be grounded, as the program will only count when all lines are grounded.

Fig 1 The Circuit

|     |      |     |        |          |                                |
|-----|------|-----|--------|----------|--------------------------------|
|     | 033A | SEI |        | 78       |                                |
|     | 033B | LDA | \$E84F | AD 4F E8 |                                |
|     | 033E | BNE | \$033B | DO FB    | ; Wait for shutter to open     |
| 4   | 0340 | LDA | \$E84F | AD 4F E8 |                                |
| 3   | 0343 | BEQ | \$0347 | FO 02    |                                |
|     | 0345 | CLI |        | 58       |                                |
|     | 0346 | RTS |        | 60       |                                |
| 5   | 0347 | INC | \$01   | E6 01    | ; Increment low order byte     |
| 2/3 | 0349 | BEQ | \$0351 | FO 06    | ; Branch through if low byte   |
| 3   | 034B | JMP | \$034E | 4C 4E 03 | ; clocked round                |
| 3   | 034E | JMP | \$0353 | 4C 53 03 | ; These jumps are a time delay |
| 5   | 0351 | INC | \$02   | E6 02    | ; and must not be delayed      |
| 2   | 0353 | NOP |        | EA       | ; Time delay - must be kept    |
| 3   | 0354 | JMP | \$0340 | 4C 40 03 | ; Back to beginning of loop    |

Fig 2 The machine code program

```

10 POKE 49459,0 : REM Set user port to all inputs
20 POKE 1,0 : POKE 2,0 : REM Set counters to zero
30 PRINT "Ready to start"
40 SYS 826
50 T=(PEEK(1)+256*PEEK(2))/40 : REM Div by 80 if 2 MHz clk
60 PRINT "Time taken = ";T;" milliseconds"
70 PRINT "= 1/";INT(1000/T+.5);" second"
80 GOTO 20

```

Fig 3 Basic program

## UK101 QUIRKS

Has anyone else noticed these quirks on the UK101's new monitor (UK02)?

Clear the screen so that the cursor is in the top right-hand corner. Press Cursor Up (Ctrl-K) a number of times and the machine will allow you to backspace for that same number, wrapping around the bottom of the screen (up to a maximum of 72). With the cursor in this position, press Cursor Up again and a ' ' will appear, replacing the Cursor Up character. This will also cursor up, resulting in a diagonal line of these characters wrapping round the top of the screen. After 72 of these the 'Maximum Line Length' character will appear. After 48 of these characters the whole screen will start moving upwards. When this is done the computer will do some processing and the cursor will appear on the top line of the

screen. Press any key and the machine will perform many carriage returns, leaving the cursor on the top line again in the left-hand corner. If Return is pressed there is a noticeable delay while the computer processes the lines.

Some variations on the theme are to press Return while in the diagonal line stage. Doing this many times will result in the cursor wrapping round the bottom of the screen. Try pressing Return, then enter a program line with Cursor Ups at the end of it. Now try listing it. If keys are pressed while the screen is moving upwards, when the cursor reaches the bottom of the screen Ctrl-K will make the cursor move upwards and wrap over the screen.

Matthew Phillips

## REDUNDANT RESET

Here is a method for ascertaining filenames of Tangerine Microtan programs without having to use RESET.

If the program is saved at fast speed, type

```
0 POKE 14,0 : POKE 22,2 :
  INPUT F$: PRINT F$
RUN
```

and press PLAY on the tape recorder. The computer will display the filename followed by the suffix .B and some garbage.

If the program is saved at slow speed, then alter the line to read

```
0 POKE 14,1 : . . . . .
and proceed as above.
```

This cannot be done in command mode, as this will produce a 'syntax error' message for some reason.

On very short programs the filename will not be given first time around; in this case do not press BREAK, but rewind the tape and press PLAY again.

Jon Strutt

## BEEB CHARACTERS

I read Malcolm Howlett's BBC Character Generator program (July '82) with interest and, I must admit, a little irritation as he had beaten me to getting a similar program published. I typed in the program and ran it, finding it to be a very use-

ful addition.

I suggest that to make it easier to operate the cursor the following modifications could be made:

- 1) Add line 22960 to read 22960\*FX 4,1
- 2) Change lines 23100 to 23400 to read  
23100 IF ASC(C\$)=139  
THEN Y=Y-1  
23200 IF ASC(C\$)=138  
THEN Y=Y+1  
23300 IF ASC(C\$)=136  
THEN X=X-1  
23400 IF ASC(C\$)=137  
THEN X=X+1
- 3) Add line 23405 to read 23405\*FX 4,0
- 4) Delete lines 31120 and 31125.
- 5) Delete the A and D characters from line 31122.

These modifications disable the editing cursor keys and make them return an ASCII code. Line 23405 restores them to normal operation.

P Clayton

## TRS-80 COMPUTED RESTORE

It is often useful to start READING data from a particular point rather than from the start of the DATA lists. This can be done by using RESTORE and then skipping over the unwanted data with a FOR-NEXT loop, but this is slow; if more data is added the numbers need to be changed.

This program allows you to specify a line number and, next time the READ command is used, the data assigned will be from that line (or the first line after it that has DATA). It is in machine code: to enter it simply type the three-line Basic subroutine shown in Listing 1 at the end of your program, and GOSUB 65520 at the start.

Then, to RESTORE at a line number, use the command DU=USR(X) where X is a line number and DU a dummy variable. X can, of course, be a constant, a variable or an expression, allowing the user to RESTORE at different line numbers depending on the value of the expression.

There are two limitations:  
1) The line number cannot be greater than 32767; if it is this

will result in an OV error.  
2) If text entered in response to an INPUT command is over 205 characters long it will destroy part of the machine code program. It is very rare that such long inputs are needed: if they are simply add GOSUB 65520 after the INPUT command in your Basic program.

Briefly, the Basic program is scanned until:

- a) the correct line is found;
- b) the correct line is not

found, so the next line after it is used;  
c) the end of the Basic program is reached.

The data pointer (locations 16639 LSB/16640 MSB) is then set to the end of the previous line.

An assembly listing is provided which shows how it works in detail.

Steve Goldman

```

RESTOR  ORG 17080 ;End of direct command RAM
        CALL 2687 ;Get argument (line no)...
        EX DE,HL ;...into DE
        LD BC,17129 ;Start of Basic program
LINE    PUSH BC ;Store program pointer
        POP IX ; in IX
        LD L,(IX+2) ;Get current
        LD H,(IX+3) ; line number
        OR A ;Reset carry
        SBC HL,DE ;Comp current line no to
        ; that wanted
        JP P,COMP ;If correct, go to adjust
        ; routine
        LD C,(IX) ;Get next
        LD B,(IX+1) ; line pointer
        LD A,B ;If it isn't zero
        OR C ; Loop to check
        JR NZ,LINE ; next line
COMP    DEC IX ;Point to end of last line
        LD (16639),IX ;Adjust data pointer
        RET ;Back to Basic
        END

```

Listing 2 Assembler listing

```

65520 DATA 205,127,10,235,1,233,66,197,221,225,221,110,2,221,
        102,3,183,237,82,242,216,66,221,78,0,221,70,1,120,177,
        32,231,221,43,221,34,255,64,201
65521 FOR L=0 TO 38:READ DA:POKE 17080+L,DA:NEXT
65522 POKE 16526,184:POKE 16527,66:RETURN

```

Listing 1 Basic subroutine to load machine code

## POKE SUBSTITUTE

To anyone mourning the lack of a standard PEEK and POKE on the BBC Computer, I suggest they include the following declarations in their programs:

```
DEFPROCPOKE(A,B)?A=B:
  ENDPROC
DEFNPEEK(A)=?A
```

One can POKE by saying PROCPOKE (address, data) and PEEK by saying data = FNPEEK (address).

At least these look vaguely like the familiar forms. Naturally, getting the hang of the ! and ? operators is better in the long term.

Andrew Civil

## BBC ASSEMBLER AIDS

The assembler built in to BBC Basic does not appear to offer the pseudo operations used in stand-alone assemblers for declaring strings or byte data without the assembled within the assembled code. Although bytes can be initialised, it is necessary to leave the assembler and POKE the values, using the assembly pointer P%, and then correctly adjust the pointer before resuming assembly. This can make construction of large assembler programs rather cumbersome.

The two functions presented here can be used as rough equivalents of pseudo operations, to initialise strings and sequences of data bytes simply.

Function "defstring" initialises a section of memory to hold a string. The function has two parameters: the first is the string itself, and the second is a number specifying the format in which it is to be stored. The routine provides four possibilities:

format=0 stores the string and adds a RETURN (&0D) byte at the end.

format=1 stores the string and adds a zero byte at the end.

format=2 stores the string after a byte containing the length of the string.

format=3 stores the string without embellishment.

The value returned by the function is the address of the first byte it plants, so that text = FNdefstring("Here is a message",0) will store the text, followed by an &0D

byte, and adjust P% to point to the next byte to be used by the assembler. The variable "text" will contain the address of the leading "H" character.

Function "defbytes" initialises one or more bytes to numeric values. The caller passes a list of the values as a string (Basic does not permit a function to have a variable number of parameters, so the numbers have to be set as a string and unpacked by the routine). Each element can be any numeric expression: the 1s byte will be stored. Assembler labels (which are Basic variables) can be used, but forward references can't be handled, so labels thus used should be given (arbitrary) values before the assembly begins. After pass one they will have their correct values. Again, the value returned by the routine is the address of the first byte planted. So numbers = FNdefbytes

("3,&27,&FF,1") will initialise four consecutive bytes, and the variable "numbers" will contain the address of the first of them.

The example program presents the listing of the two functions and an example of their use. The program will clear the screen and move the text cursor to (10,15) by the equivalent of the Basic statements

```
VDU 12
VDU 31,10,15
which involves writing the successive bytes to the OSWRCH routine at &FFEE.
```

The program then prints 'Assembler Rules OK' and stops.

The functions themselves are quite simple and need little explanation. In defstring, the work is done in one IF statement at line 10030. The caller's string is copied to a 'fixed string' starting at the byte pointed by P% (specified by the \$P% construction). This adds a &0D to the string and so no more is done for format 0. For format 1, the string has a CHR\$0 concatenated with it before it is assigned to a fixed string,

and the &0D is subsequently removed. The value of P% is adjusted to point to the byte after the string, allowing for any byte following.

Function defbytes consists of two nested REPEAT loops. The inner loop slices the string into the numeric elements, and the outer pokes the values obtained and increments P% each time.

Alan Phillips

```
100 DIM code 100
120 FOR IZ = 0 TO 3 STEP 3
140 PZ=code ; REM set assembler ptr
160 [OPT IZ
180 .doit
200 LDY #0 \ ptr to list of bytes
220 .nextvdu
240 LDA vdubbytes,Y \ set next byte
260 JSR &FFEE \ send it to vdu driver
280 INY \ step the pointer
300 CPY #4 \ stop when Y=4
320 BNE nextvdu
340 LDY #0 \ now set text ptr
360 .nextchar
370 LDA text,Y
380 JSR &FFEE3 \ output it with osascii
400 CMP #&0D \ was it RETURN?
420 BEQ end \ finish if it was
440 INY \ else move pointer on
460 JMP nextchar \ and carry on
480 .end
500 RTS \ finished
520 ]
540 REM
560 REM DEFINE BYTES AND TEXT - INSIDE
580 REM THE TWO PASS LOOP SO THE ADDRESSES
600 REM ARE KNOWN BY PASS 2 TIME
620 REM
640 vdubbytes=FNdefbytes("12,31,10,15")
660 text=FNdefstrings("Assembler Rules OK",0)
680 REM
700 REM AND DO PASS 2
720 REM
740 NEXT
800 REM
810 REM NOW CALL THE M/C CODE ROUTINE
820 REM
830 CALL doit
840 REM
850 REM AND FINISH
860 REM
870 END
9000 REM
9010 REM FUNCTION defstrings
9020 REM =====
9030 REM
10000 DEF FNdefstrings(string$,format%)
10010 LOCAL address%
10020 address%=P% ; REM note start address of string
10030 IF format%=0 THEN $P%=string$ ELSE IF format%=1 THEN
$P%=string$+CHR$0 ELSE I
F format%=2 THEN $P%=CHR$(LEN(string$))+string$
ELSE $P%=string$:PZ=PZ-1
10040 PZ=PZ+LEN(string$)+1
10050 =address%
11000 REM
11010 REM FUNCTION defbytes
11020 REM =====
11030 REM
12000 DEF FNdefbytes(list$)
12010 LOCAL AZ,BZ,address%
12020 address%=P% ; REM note address of first byte
12030 AZ=1
12040 BZ=1
12050 REPEAT
12060 REPEAT
12070 BZ=BZ+1
12080 UNTIL MID$(list$,BZ,1)="" OR BZ>LEN(list$)
12090 ?PZ=EVAL(MID$(list$,AZ,BZ-AZ))
12100 PZ=PZ+1
12110 AZ=BZ+1
12120 UNTIL BZ>=LEN(list$)
12130 =address%
```

## BBC HAND RESET

Pressing the BREAK key on the BBC Computer returns the system to Mode 7, and deletes any program from memory. The message BBC Computer BASIC

> appears on the screen. However, this does not reset the clock or clear the definitions of the user-defined keys. This is what the User Guide calls a 'soft reset'.

According to the User Guide a 'hard reset' (clock reset and user-defined keys reset) can be obtained in operating system version 1.0 by pressing BREAK and CTRL keys together. However, my Model B machine does not do this, neither has it anything in the hole marked 'reset' at the rear of the case.

Users with similar machines may like to know that it is possible to obtain a hard reset by pressing the BREAK key twice in quick succession. This causes the CHR\$(7) 'bell' to be printed and the message

BBC Computer 32K BASIC

> to appear. The variable TIME will be set to 0 and the ten user-defined keys will be cleared.

Ian Simpson



## NEW ATOM COMMANDS

This assembler routine enables you to create new Basic commands for your Atom. The program sets the error-handling routine pointers (in #202, #203) to the start of an assembler routine. When the new command is encountered, an error occurs and control is passed to this routine.

The routine is illustrated using a simple command ' ' which clears the screen (ie, it issues a CTRL-L). Any new Basic command(s) could be entered between lines 100 and 150.

The assembler routine is essentially in two parts. The

first, lines 55 to 180, checks the error to see if it is the new command (in this case ' '); if it isn't control is passed to the usual error-handling routine. If it is the new command, the command is executed by lines 130-140 and control is passed to the second half of the routine. This part searches for the start of the next statement or line to be interpreted; when located, the statement pointers are updated by lines 260-310 and Basic execution is resumed.

John Hearn

```

10 DIM LL(5)
20 P.$21
30 FOR I=1 TO 2
40 DIMP(-1);A=P;REM Starting address=A
50 I
55 LDY @#1
60 :LL0 LDA (#5),Y #5,#6 point to statement being interp'd
70 CMP @#3B #3B=;
80 BEQ LL2
90 CMP @#0D #0D=return
100 BEQ LL2
110 CMP @#5E #5E=^ (new command)
120 BNE LL1
130 LDA @#0C Print $12, clear screen
140 JSR #FFF4 Print routine
150 JMP LL3 Return to Basic
160 :LL1 INY
170 JMP LL0
180 :LL2 JMP #C9DB Normal error routine
190 :LL3 LDA (#5),Y Look for next statement
200 CMP @#3B
210 BEQ LL4
220 CMP @#0D
230 BEQ LL4
240 INY Continue search for ; or return
250 JMP LL3
260 :LL4 CLC
270 TYA Update statement pointer in #5,#6
280 ADC #5
290 STA #5
300 BCC LL5
310 INC #6
320 :LL5 JMP #C2F2 Return to Basic
330 I
350 N.;P.$6
360 ?#202=AZ256;?#203=A/256;REM#202, #203 point to brk routine
370 ^;REM New command to clear screen
380 E.

```

## BETTER RANDOMISATION

Here is a means of avoiding the prompt RANDOMIZE and its input response required by Microsoft Basic and some other Basics, while still providing fresh randomisation each time the game is run.

A sequential file is opened at the beginning of the program, from which an integer is retrieved, incremented and used as the seed before being rewritten to file. In Microsoft Basic-80 a suitable routine would be

```

10 OPEN "I", #1, "SEED"
20 INPUT #1, N
30 CLOSE #1
40 N=N+1
50 M=N
60 RANDOMIZE M
70 OPEN "O", #1, "SEED"
80 PRINT #1, N
90 CLOSE #1

```

...rest of program  
The file "SEED" is initialised with the largest negative number that the system will support; in my case, -32767.

Theoretically, one should perhaps provide for re-initialisation when N overflows at +32768, but I doubt whether the average punter will live to see it.

If a disk contains more than one game you can incorporate this routine into the menu, so that all games share a common series of randomisation seeds and disk activity is reduced.

Simon Holmes

## ATOM AUTO REPEAT

One of the disadvantages of the Atom keyboard is that the keys do not automatically repeat when they are held down.

This short routine replaces the normal character input routine to provide auto-repeat on all of the keys that are available to Basic programs.

The delay between the time that the key is pressed and the start of the repeat sequence is set on line 150. The number 35 gives a delay of just over half a second.

The subroutine call at line 270 causes a delay of 0.1 seconds. This could be replaced by a delay loop in order to change the repeat speed.

To use the auto-repeat routine the character input vector must be changed to point to the new routine. This can be done in Basic as follows:  
?522=0; ?523=40.

This must also be done if the break key is pressed.  
N P Capper

```

10REM ATOM AUTO-REPEAT ROUTINE
20REM BY N.P. CAPPER
30 DIM LL(3)
40 P.$21 ;REM turn display off
50 F.I=0 TO 1 ;REM do two passes
60 P=#2800 ;REM store at #2800
70I
80:LL0 PHP save flag reg
90 CLD set binary mode
100 STX #E4 save x
110 STY #E5 save y
120 JSR #FE71 scan keyboard
130 BCC LL2 key pressed
140
150:LL1 LDX @35 put repeat delay
160 STX #80 into #80 and get
170 JMP #FEA4 ascii code
180
190:LL2 DEC #80 delay loop
200 BEQ LL3
210 JSR #FE66 wait 1/60 sec
220 JSR #FE71 scan keyboard
230 BCS LL1 key released
240 BCC LL2 key still pressed
250
260:LL3 INC #80 set delay to 1
270 JSR #FB8A wait 1/10 sec
280 JMP #FEB1 get ascii code
290
300I
310 N. ;REM do next pass
320 P.$6 :REM turn display on
330 END

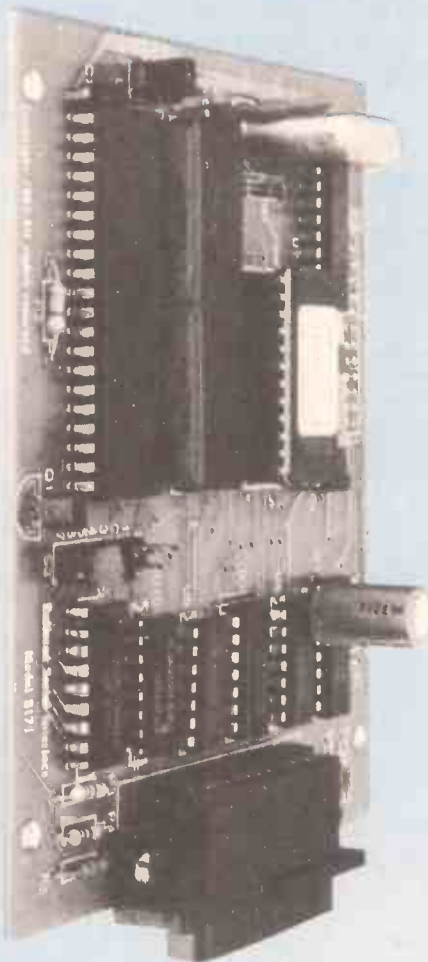
```

# WARNING!

In last month's TJ's we published a method to speed up the display on the PET ('Faster PET Screen', page 174). We have since been advised that on certain models this can cause serious damage to the video circuitry. Unfortunately there is no easy

way to tell whether your PET is one of these models other than by trying the POKEs mentioned and switching off immediately if the screen display collapses. To be safe, we advise readers not to use this method of speeding up the display.

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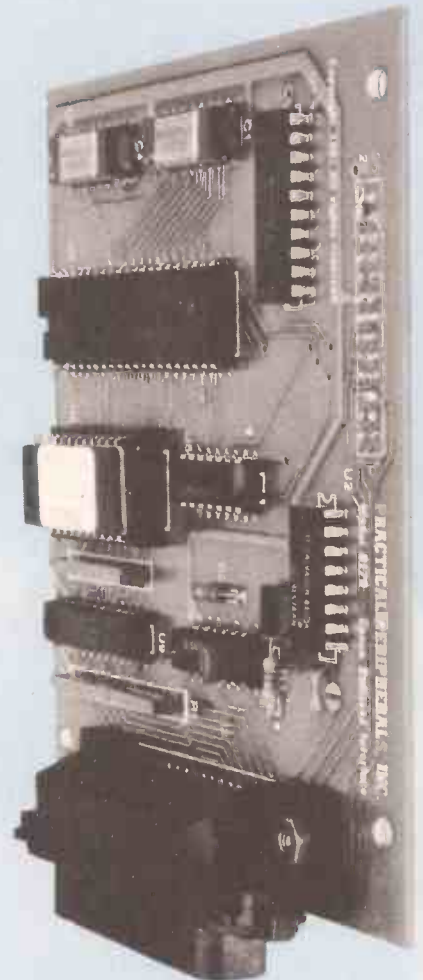
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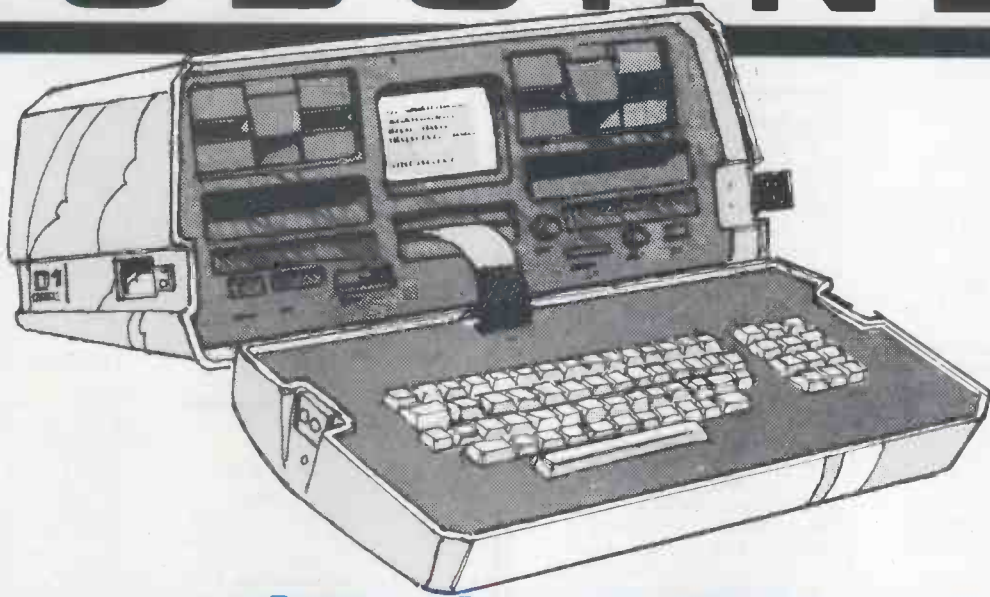
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## TRS-80 troubles

Could you please tell me where I could get some advice about my TRS-80 micro-computer?

*Martin Pearce, Castleford*

I own a TRS-80 which I have attempted to upgrade myself. Unfortunately I cannot get the upgrade to work, so where can I get advice?

*J Harrison, Burton-on-Trent*

I believe very strongly in self-help. This can be achieved by joining a local club, or user group. There you will find others who have surmounted similar problems. This applies to any computer system, not just to the TRS-80. Look through PCW's user group index and join one straight away.

SW

## VIC follow-up

The following letter from I Wright of Sheffield refers to the query 'VIC Interface' in the June issue of PCW. The original question was: 'Here in Athens the VIC cassette is £90 — is there a way of using an ordinary cassette recorder on the VIC?'

Mr Wright has the following advice:

The solution is a single pole, single throw switch used to ground the 'switch' connection on the cassette output port. Precise details are:

- 1) Ignore the 5V and 9V lines on the output port.
- 2) Connect the 'data out' and 'data in' lines to the centre conductors of two lengths of microphone cable, the screens of which go to the 'ground' (0V) line.
- 3) Connect the other ends of these to 3.5mm jack plugs as normal and insert these into the mic and earphone sockets of the recorder (beware of DIN sockets as there are often unwanted resistors lurking behind these). Remember that the IN and OUT designations of these lines refer to the computer and *not* the recorder.
- 4) Finally, wire a switch between the 'switch' line and 'ground'. If you're not unduly worried about guarantees, etc, the best place to secure this is probably the main computer case.

To operate, type SAVE"" and press RETURN as normal. The VIC will reply with

'PRESS RECORD AND PLAY BUTTONS'; turn on the tape recorder, wait for the leader to pass, then turn on the 'magic switch' and the program will be saved as normal. When complete, turn off the switch, followed by the recorder. Loading is just as simple.

SW

## Space problem

I have an RML 380Z with 5¼in disks and want to store data on 10,000 stock items. I want to know the most efficient (least storage), fastest access method of doing this. I need to be able to access any item by part number, description or drawing number.

*J F Cain, Redhill, Surrey*

The 380Z is far from being the ideal machine for the purpose on three counts: disk access speed, disk capacity and systems software. The 5¼in disks are only single density (70k per side) and have a very slow transfer rate. You are also hampered by the lack of direct access file handling capability in RML Basic, though you can obtain this from a company called Software Production Associates. I suggest that you use Cobol as this supports index sequential files. You will have to code your data substantially as with 10,000 items each needs only to be seven characters in length and your 70k is gone. In fact you will certainly need to split the file across several disks and sides.

You really need a system with large-capacity disks — 8in or even a hard disk.

SW

## Musical micro

I have heard that there is available a micro that can not only play a tune but can also print out the music onto manuscript paper. Can you please tell me more about it?

*A P Hawkins, Camberley, Surrey*

The system you have heard about might well be the Apple II computer fitted with an Alf Products MC16 or MC1 Music Synthesizer board. This provides facilities for composing music on the screen and displaying it in full musical notation. The resultant music can then be played through the user's external audio system. By using a high-resolution graphics printer like the Epson MX100 it should also be possible to print out the music score, screen by screen. Details of the Alf

synthesiser boards are in PCW vol 4, number 5, May 1981.

*P L McIlmoyle*

## Stop it!

How can I stop the computer responding to control characters when using Basic's INPUT\$(1) command?

*D Salkeid, Weymouth*

Simply test after the input — for example:

```
100 CH$=INPUT$(1):
    CH=ASC(CH$)
110 IF CH<32 OR CH>122
    THEN 100
120 PRINT CH$;
```

Using this technique you can restrict the input to only the numeric keys, for instance.

SW

## '81 RAM

I own a ZX81 and wish to extend the memory. My theory of computer internals is low, so I do not understand how you could add 16, 32 or 64k RAM. How does the CPU know how much memory it has?

Also, can you recommend Audio Computers of Southend and its 32k RAM pack?

Finally, how easy would it be to assemble from kit?

*David Pye*

The Z80 is capable of directly addressing up to 64k RAM. So if you subtract 8k for the Sinclair ROM, then the ZX81 is capable of having 56k RAM.

The simplest way for the Z80 to check how much memory it has is by loading each location with 02 (or any other number) and then reading them back — if the result is 02 then there is RAM there; if the answer is 00 then there isn't.

The Audio Computers RAM pack looks very good value. I myself tried to obtain one a few months ago. After sending the money I was repeatedly told that it would arrive within the week. After two months I gave up and asked for my money back, which I got.

If you decide to build any kit involving ICs, it's important to have a good fine soldering iron, which isn't too powerful, and some experience of soldering.

*James Walsh*

I should be grateful for your answers on three ZX81 questions:

- 1) Is there a larger RAM than 16k?
- 2) Is it possible to determine what portion of memory space remains at any stage of program development?

3) Is there any programmable way of deleting 50 or 60 program instructions?

*C Payne*

Starting with the first question first:

1) Yes, it is possible to expand the ZX81 up to 56k RAM. These types of memory expansion are available from JRS Software and Hewson Consultants, to name but two.

2) Yes, by implementing this short machine code routine:  
LD HL,0000  
ADD HL,SP  
LD DE,(16412)  
AND A  
SBC HL,DE  
LD B,H  
LD C,L  
RET

The simplest way of doing this is:

```
10 REM 123456789012
20 FOR X=16514 TO 16526
30 INPUT A
40 POKE X,A
50 NEXT A
60 PRINT USR 16514
```

Then enter these numbers on input prompt:  
33,0,0,57,237,91,28,64,107,  
238,66,68,77,201.

You can now delete lines 20-60.

Any time you want to know the remaining memory, just type PRINT USR 16514.

3) Again the answer is yes. This function is available on the Picturesque ScreenKit.

*James Walsh*

I own a ZX81 and have read many adverts on books to explain how to use the ZX81 'monitor'. What is the monitor and what can I do with it?

Also, I am on my seventh 16k RAM Pack and it works all the time but now and then when I press SHIFT plus another character the memory wipes itself. I have sent away so many times to Sinclair and waited so long that I don't know whether to send away for a replacement or my money back.

*John Hogg*

The monitor is a set of routines within the ZX81 ROM which deals with the operations which the CPU cannot handle on its own. For example, printing on the screen and expanding the display file at the same time and doing the mathematical functions. The best way to find out about the monitor and what you can do with it is to read Ian Logan's book

*Understanding Your ZX81 ROM.*

If I had as much trouble with my Sinclair RAM Pack then I would be inclined to ask for a refund and buy one of the independently manufactured RAM Packs which are on the market. These

don't suffer from most of the problems of the Sinclair model.

James Walsh

I have recently bought one of the machine code programming books advised in the ZX81 Basic Manual. The book doesn't tell you how to get into machine code but just what to do when you are there. I've tried USR routines but they don't seem to work, it's probably that I am doing something wrong. Please can you help?

Jonathan Menmuir

The simplest way of entering machine code on the ZX81 is to put a large REM statement as the first line of the program, and POKE the decimal value of the desired instruction into address 16514 onwards. For example:

```
10 REM 1234567890
20 LET X=16514
30 INPUT A
40 IF A=999 THEN STOP
50 POKE X, A
60 PRINT A; " ";
70 GOTO 20
```

The REM statement must be able to hold the same number of characters as your machine code routine is long. If you type '999' (there is no such m/c instruction) then the program will stop, so that you can execute your routine. To execute type RAND USR 16514.

James Walsh

## The sole of a new machine

I read your Benchtest of the ZX Spectrum and am very interested to see such a cheap and efficient personal computer.

Would you tell me if the Spectrum would serve me in the following area: I sell shoes in a large boutique and want to check my stocks, thus enabling me to serve customers faster. I keep 40 types of shoe in each of four colours and five sizes. I sell 15 pairs a day and serve about 20 customers.

Mehmet Muderrisoglu,  
Istanbul

You should remember that computers need to be fed with information in order to be kept up to date. This will entail entering the transactions as they take place, or in batches at the end of the day, say. If your requirement is really as simple as you state, then the Spectrum would cope, because you could code the model, colour and size as single characters; this would need only around 800 bytes of data storage. This could be loaded from cassette at the start of the day and dumped out at the end (barring power failures, etc). My advice would be to go for a system with a proper keyboard which also has good dealer backup in Istanbul. Once you require the system to handle accounts, sales statistics, etc,

you should certainly look for a more up-market business system.

SW

## Newbrain v Spectrum

I am considering a computer in the £200 range for some medical and financial applications. So far I have narrowed the choice down to the Newbrain Model A and the Sinclair Spectrum (48k).

The Newbrain offers greater memory expansion (to 512k), higher resolution graphics with an 80-column display option (for word processing) and interfaces which would allow disks and CP/M to be used. The Spectrum offers colour and sound and the likelihood of cheaper disks but seems to have limited expansion potential. How would you compare these for my application? Also, how does the Newbrain ANSI compare with the Sinclair Basic?

A Wetter, London N1

As with so many questions it is, as you imply, very much a matter of selecting the right machine for your particular application, rather than one being 'better' than another in some general way. In your case the Newbrain seems to me to have a number of attractions.

Firstly, it is generally about twice as fast as the ZX Spectrum in most benchmarks. Assuming that your medical work calls for searching databases of some type, this could be quite significant. Secondly, the Newbrain has what is essentially a standard typewriter keyboard. If you, or anyone entering data on your behalf, can touch-type, this is a very great advantage over the Spectrum, which does not have such a good keyboard. If you are a novice programmer the Spectrum's multi-function keys can be a great help, but with more experience they can become rather frustrating (which is only to say that the Spectrum is just right for its intended market!).

Again, if you want to use commonly available professional software, the ability of the Newbrain to support standard size disk drives and to run the 'industry standard' CP/M operating system is of great advantage.

On the other hand, the Spectrum offers a cheaper route to a system complete with disk drives and a printer (once the special micro floppy drives become available) and does provide colour graphics, if that is significant for your applications. Doubtless somebody will put CP/M onto the Spectrum soon, too!

As regards the two versions of Basic, both strike me as being above average. The I/O handling on the New-

brain is a little complex, but very powerful, while the Sinclair Basic offers a much better method of handling sub-strings than does the more usual Microsoft Basic.

P L McIlmoyle

## Mono Dragon

In the August issue of PCW Mike Curtis reviewed the Dragon 32, saying that the computer plugs into the back of a colour television. I only have black and white, so will I be able to use the Dragon? T Caddies, Newcastle-on-Tyne

Any colour computer that sends out a colour signal can be used on a b&w set. However, you will have difficulties seeing some of the colours: light blue, for instance, can often only be seen on a b&w set if the brightness is turned right up.

SW

## X-ray vision

I have a question for my own 'Answers' page. I hope some readers may be able to answer it.

Colour TV sets give off X-rays. It has been assumed that this causes no problems when watching at home because of the usual viewing distance from the set. However, it worries me to think that I am being saturated by X-rays when using the colour TV attached to a computer, because I sit less than one metre from the screen. I have no desire to die of these effects on PCW's behalf, so could someone reassure me and readers that the effect is not worth worrying about?

Sheridan Williams

## Which monitor?

I am interested in the Microvitec LCCD colour monitor and intend to use it with my BBC Computer. I notice that it has a bandwidth of 7 MHz and a resolution of 452(H) by 585(V) elements. Can it be used with 80-column text? W H Kwan, Durham

We have reviewed b&w and colour TVs and monitors in the June issue of the Beebug magazine. It was apparent that no colour set (not even RGB) gave a picture quality on 80 columns that was comfortable to read for long periods.

The Microvitec is available in three models — Standard, 1V Linear and high resolution. The bandwidths are 6, 7 and 12 MHz respectively and the horizontal resolutions are 452, 452 and 895 elements respectively. They all have the same (585 elements) vertically. For serious word processing use it is essential to use a black and white monitor

and even the cheapest of these seem adequate. Prices of the three Microvitec sets (14in) are £274, £295 and £499 respectively. For more details write to Microvitec Ltd, PO Box 188, Futures Way, Bradford, BD4 7TU (tel 0274 390011).

SW

## Osborne rub-out

I have recently started to use an Osborne 1 and am generally impressed by it. The keyboard is not as solid-feeling as I would like, but must obviously be light for portability. However, there is one curious and awkward omission, which is the lack of a DEL (or RUBOut) key. This is particularly frustrating when using Wordstar, as deleting the character just typed then needs Control-S to backspace, followed by Control-G to delete the character the cursor is then on, rather than just pressing DEL. Is there any way to provide a DEL function on this machine?

(Name and address withheld by request)

There are in fact at least two ways to overcome this problem. The first is to make use of the ability to program the numeric pad keys to generate the ASCII code for DEL (127 decimal).

Alternatively, and much simpler, pressing Control together with the minus sign key will generate DEL.

P L McIlmoyle

## C sought

I wish to download software I have developed on the Onyx C8002 to a Superbrain for testing under CP/M. I am a little unsure of how to write the driver software in C to handle the communication between the two machines' IEEE ports. I would be grateful if you could recommend any books I could read to help me solve the problem.

H Frost, Shepperton, Middx

For the C language used for the driver program I would recommend *C Programming Language* by Brian Kernighan and Dennis Ritchie, obtainable from Lifeboat Associates, PO Box 105, London WC2H 9LU. One of the best books on CP/M that I know is the *CP/M User's Guide*, published by McGraw-Hill/Osborne. *The CP/M Handbook* by Rodney Zaks (published by Sybex) is also excellent, although it does not go into the inner workings of CP/M to the same extent. The Digital Research CP/M handbooks are also essential for your project, but I expect you are familiar with these.

P L McIlmoyle

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|                           |           |
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|-----------------------------|-----------|
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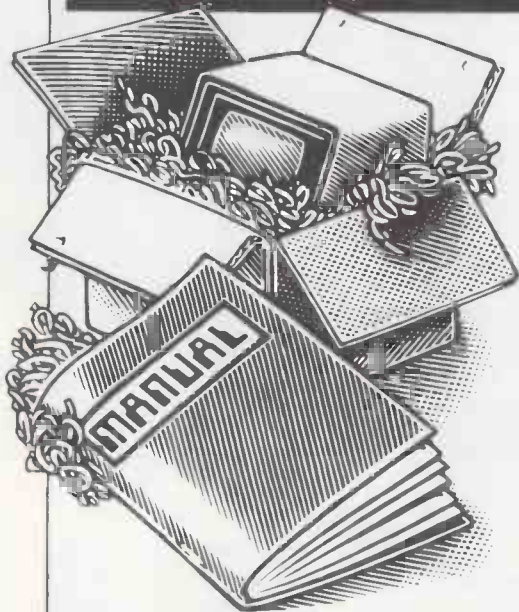
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# NEWCOMERS START HERE



*This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering 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** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultraviolet 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.

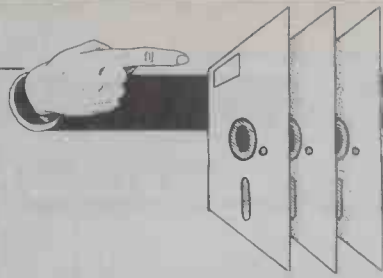
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information 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 system allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



# PACKAGES

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: Dick Olney, PCW, 14 Rathbone Place, London W1P 1DE.

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below. All details published are the latest made available — some may have changed since this issue went to press.

| Code | Company                            | Telephone       |
|------|------------------------------------|-----------------|
| A1   | ACT/Petsoft                        | 021-454 8585    |
| A2   | Arden Data Processing              | 0533 22255      |
| A3   | ADP Network services               | 01 388 1912     |
| A4   | Alamo Comp. Serv.                  | 0642-310381     |
| B1   | B + B Computer Ltd.                | 0204 26644      |
| B2   | Beam Business Centre               | 061-831-7292    |
| B3   | Benchmark Computer Systems         | 0726 61000      |
| B4   | Bristol Software Factory           | 0272.23430      |
| B5   | Byte Soft Systems Ltd              | 0533 531441     |
| B6   | Business Solutions Ltd             | 01-554-5985     |
| B7   | Bromley Computer Consultancy       | 01 464 8080     |
| C1   | CAP-CPP Products Ltd.              | 01-404 0911     |
| C2   | Commodore                          | 01-388 5702     |
| C3   | Comsoft                            | 0483 39665      |
| C4   | Comput-a-crop                      | 0507-604271     |
| C5   | Computastore Ltd.                  | 061-832-4761    |
| C6   | Computech                          | 01-794 0202     |
| C7   | Compass                            | Standish 426252 |
| C8   | CWP Computers                      | 01-828 3127     |
| C9   | C4 Computer Services               | 0632-664313     |
| C10  | Caxton Software                    | 01 379 6502     |
| C11  | CBS Consultants                    | 021-722-8181    |
| C12  | Comp Prog & Systems Serv           | 0942-38831      |
| E1   | Engineering Sciences               | 01-437-4894     |
| G1   | Graffcom Systems Ltd.              | 01-727 5561     |
| G2   | Grama (Winter) Ltd.                | 01-636 8210     |
| G3   | Great Northern                     | 0532 589980     |
| G4   | Alan Greenhalgh Ltd                | 01-520-0218     |
| G5   | Grade One                          | Glossop 63819   |
| H1   | A. J. Harding                      | 0424 220391     |
| H2   | Hartford Software                  | 0606 76265      |
| H3   | H. B. Computers                    | 0536 83922      |
| H4   | Wordcraft Systems                  | 0332 760127     |
| I1   | Intereurope Software Design        | 0734 786644     |
| I2   | Intex Datalog Ltd                  | 0642 781193     |
| J1   | T. V. Johnson                      | 0276 20446      |
| K2   | Keen Computers                     | 0602 412777     |
| L1   | Lifeboat Associates                | 01-836 9028     |
| L2   | Liveport (Exidy Sorcerer Firmware) | 0736 798157     |
| L3   | Ludhouse (Computing) Ltd.          | 01-679 4321     |
| L4   | Logic Comp Systems                 | 01-222-1122     |
| M1   | Micro Computer Applications Ltd.   | 0734 470425     |
| M2   | Microtech.                         | Orpington 26803 |
| M3   | Microsys Ltd                       | 051 426 7271    |
| M4   | Microsave                          | 0272 737555     |
| M5   | M. A. P. Comp Systems              | 061-624-5662    |
| P1   | Padmede Computer Services          | 02514 21892     |
| P2   | Personal Computers Ltd.            | 01-377 1200     |
| P3   | Professional Computer Services     | 061 624 4065    |
| Q1   | Quill Computer Systems.            | 061 477 4960    |
| R1   | Rockliff                           | 051-521 5830    |
| S1   | SMG Micro Computers                | 0474 55813      |
| S2   | The Softwarehouse                  | 01-637 2108     |
| S3   | Stage One Software                 | 0202 735656     |
| S4   | Systematics International          | 0440 61121      |
| S5   | Sumlock Bondain                    | 01-250 0505     |
| S6   | Stemmos                            | 01 602 6242     |
| S7   | Software Aids Int                  | 01-904 8139     |
| T1   | Tridata Micros Ltd.                | 021 622 6085    |
| T2   | Templeman Software                 | 0789 66237      |
| T3   | The Micro Solution                 | 0608 3256       |
| T4   | Terodec Ltd                        | 0734-664343     |
| T5   | TABS Ltd                           | 0264-58933      |
| T6   | Tip Data Ltd                       | 0375-33910      |
| V1   | Vlasak Electronics Ltd.            | 0494-448633     |
| W1   | Wisbech Computer Services          | 0945 64146      |
| W2   | Westfarthing Comp Services         | 03265-4098      |
| X1   | Xetal                              | 061 682 7555    |

## Applications

|                    |              |      |    |
|--------------------|--------------|------|----|
| Appointments       | Act Sirius 1 | £115 | C7 |
| planner            | Challenger   | £25  | C7 |
| Assembler dev      | PET/CBM      | £50  | L2 |
| Bill of materials  | Apple II     | £199 | T5 |
|                    | CP/M         | £850 | B5 |
|                    | CP/M         | £199 | T5 |
|                    | Cromemco     | £850 | B5 |
|                    | PET/CBM      | £199 | T5 |
|                    | Superbrain   | £450 | T3 |
| Bookmakers package | CP/M         | POR  | B7 |
| Budgeting package  | Apple II     | £125 | P2 |
|                    | Apple II     | £125 | T2 |
|                    | CP/M         | £95  | B5 |
|                    | Cromemco     | £95  | B5 |
|                    | North Star   |      |    |
|                    | Horizon      | £95  | B5 |
| Bureau de change   | PET/CBM      | £8   | H3 |
| Cash flow          | Apple II     | £125 | P2 |
|                    | Apple II     | £80  | V1 |
|                    | Apple II     | £100 | C8 |
|                    | CP/M         | £250 | L3 |

|   |                  |          |     |
|---|------------------|----------|-----|
|   | CP/M             | £95      | B5  |
|   | Cromemco         | £95      | B5  |
|   | North Star       |          |     |
|   | Horizon          | £95      | B5  |
|   | PET/CBM          | £8       | A1  |
| Cash register                             | CP/M             | £300     | T4  |
| Cheque writer                             | CBM/8032         | £90      | P3  |
|   | PET/CBM          | £90      | P3  |
| Company secretary                         | CP/M             | £450     | C4  |
| Container accounting                      | CP/M             | £750     | M5  |
| Contract costing                          | Apple II         | £500     | P1  |
|   | CP/M             | £2000    | L3  |
| CP/M & utilities                          | Tandy Model II   | £150     | M1  |
| Credit control                            | Apple II         | £98      | P2  |
|   | PET/CBM          | £650     | B4  |
| Customer file                             | Famos            | £1000    | M2  |
| Database management/Information retrieval | ACT800           | £225     | H4  |
|   | Apple II         | £150     | A2  |
|   | Apple II         | £150     | K2  |
|   | Apple II         | £60-140  | S2  |
|   | Apple II         | £150     | S5  |
|   | Apple II         | £75      | P2  |
|   | Apple II         | £100     | H4  |
|   | Apple II         | £100     | C8  |
|   | Apple II         | £125     | T2  |
|   | CP/M             | £150-750 | C4  |
|   | CP/M             | £100     | C3  |
|   | CP/M             | £350     | B3  |
|   | CP/M             | £400     | C3  |
|   | CP/M             | £600     | G5  |
|   | Famos            | £1500    | M2  |
|   | North Star       |          |     |
|   | Horizon          | £250     | B3  |
|   | PET/CBM          | £250     | C3  |
|   | PET/CBM          | £325     | A1  |
|   | PET/CBM          | £225     | H4  |
|   | PET/CBM          | £75      | B1  |
|   | PET/CBM          | £50/T10  | C2  |
|   | PET/CBM          | £150     | J1  |
|   | PET/CBM          | £150     | G2  |
|   | Superbrain       | £300     | S6  |
|   | Tandy Model I    | £25-80   | M1  |
|   | Tandy Model I    | £60      | S2  |
|   | Tandy Model I    | £150     | J1  |
|   | Tandy Model I    | £32.50   | H1  |
|   | Tandy Model 111  | £270     | A4  |
|   | 8000 Series      | POR      | C2  |
| Dental Records                            | Apple II         | £395     | M4  |
|   | CP/M             | £500     | T4  |
| Disk operating system                     | PET/CBM          | £150     | B1  |
| Double glazing costing                    | North Star       |          |     |
|   | Horizon          | £750     | W1  |
| Eire payroll system                       | CP/M             | £650     | M5  |
| Estate agent                              | Apple II         | £850     | A2  |
|   | Apple II         | £850     | S5  |
|   | Apple II         | £850     | K2  |
|   | Apple II         | £175     | P2  |
|   | Apple II         | £130     | C8  |
|   | Apple II         | £750     | S4  |
|   | PET/CBM          | £30      | H3  |
|   | CP/M             | £750     | C4  |
|   | CP/M             | £700     | B5  |
|   | PCC 2000         |          |     |
|   | Simplec Triton 3 | £350     | B3  |
|   | MZ-80K           | £195     | W1  |
|   | PET/CBM          | £25      | A1  |
|   | Superbrain       | £600     | S6  |
|   | Superbrain       | £600     | C12 |
| Equipment lease/rent/HP                   | CP/M             | £400     | G1  |
| File Handling                             | PET/CBM          | £225     | H4  |
| Financial modelling                       | Act Sirius 1     | £595     | A1  |
| Apple II                                  | £450             | P2       |     |
|   | Apple II         | £424-535 | A1  |
|   | Apple II         | £360     | C8  |
|   | CP/M             | £400     | G1  |
|   | CP/M             | £95      | B5  |
|   | CP/M             | £425-535 | A1  |
|   | CP/M             | £400     | B6  |
|   | Cromemco         | £95      | B5  |
|   | North Star       |          |     |
|   | Horizon          | £95      | B5  |
|   | PET/CBM          | £425-535 | A1  |
|   | RAIR Black Box   | POR      | A3  |
| Financial planning                        | Act Sirius 1     | £150     | A1  |
|   | Apple II         | £250     | S4  |
|   | Apple II         | £125     | A1  |
|   | CP/M             | £125     | A1  |
|   | PET/CBM          | £125     | A1  |
| General ledger/NL                         | Apple II         | £300     | A2  |
|   | Apple II         | £300     | S5  |
|   | Apple II         | £300     | K2  |
|   | Apple II         | £455     | P2  |
|   | Apple II         | £225     | V1  |
|   | Apple II         | £295     | C6  |
|   | Apple II         | £250P    | S4  |
|   | Apple II         | £600     | T2  |
|   | Apple II         | £490     | L4  |
|   | Apple II         | £199     | T5  |

|                                    |                    |          |     |
|------------------------------------|--------------------|----------|-----|
|                                    | CBM/8032           | £450     | C11 |
|                                    | CP/M               | £500     | L3  |
|                                    | CP/M               | £375     | L1  |
|                                    | CP/M               | £500     | C4  |
|                                    | CP/M               | £400     | G1  |
|                                    | CP/M               | £400     | M3  |
|                                    | CP/M               | £400     | B5  |
|                                    | CP/M               | £275     | S6  |
|                                    | CP/M               | £275     | S7  |
|                                    | CP/M               | £350     | B3  |
|                                    | CP/M               | £300     | W1  |
|                                    | CP/M               | £425     | B6  |
|                                    | CP/M               | £500     | T4  |
|                                    | CP/M               | £400     | M5  |
|                                    | CP/M               | POR      | B7  |
|                                    | CP/M               | £199     | T5  |
|                                    | Cromemco           | £400     | B5  |
|                                    | North Star         |          |     |
|                                    | Horizon            | £250     | B3  |
|                                    | North Star         |          |     |
|                                    | Horizon            | £400     | M3  |
|                                    | PCC 2000           |          |     |
|                                    | North Star         |          |     |
|                                    | Horion             | £400     | B5  |
|                                    | PCC 2000           |          |     |
|                                    | Simplec Triton 3   | £350     | B2  |
|                                    | PET/CBM            | £200     | C2  |
|                                    | PET/CBM            | POR      | H3  |
|                                    | PET/CBM            | £199     | T5  |
|                                    | Sharp PC3201       | £450     | P2  |
|                                    | Superbrain         | £400     | M3  |
|                                    | Superbrain         | £400     | S6  |
|                                    | Tandy Model I      | £90      | M1  |
|                                    | Tandy Model II     | £90      | M1  |
|                                    | Tandy Model I      | £225     | H1  |
|                                    | Tandy Model I      | £225/325 | T1  |
|                                    | Tandy Model 11     | £425     | T1  |
|                                    | Vector             | £400     | C5  |
|                                    | 8080/Z80           | £357     | L1  |
|                                    | 8080/Z80           | £275     | G3  |
| General purchase transaction proc. | CBM/8032           | £495     | S3  |
| Hotel management                   | Apple II           | £525     | M4  |
|                                    | CP/M               | £525     | M4  |
|                                    | RAIR Black Box     | POR      | A3  |
| Incomplete records                 | Act Sirius 1       | £1200    | S1  |
|                                    | Apple II           | £280     | S2  |
|                                    | Apple II           | POR      | K2  |
|                                    | Apple II           | £425     | P2  |
|                                    | Apple II           | £450     | P1  |
|                                    | Apple II           | £490     | L4  |
|                                    | CP/M               | £750     | M3  |
|                                    | CP/M               | £250     | B5  |
|                                    | CP/M               | £975     | B3  |
|                                    | CP/M               | £750     | W1  |
|                                    | CP/M               | £1250    | M5  |
|                                    | Cromemco           | £250     | B5  |
|                                    | North Star         |          |     |
|                                    | Horizon            | £750     | M3  |
|                                    | North Star         |          |     |
|                                    | Horizon            | £250     | B5  |
|                                    | North Star         |          |     |
|                                    | Horizon            | £975     | H3  |
|                                    | Superbrain         | £750     | M3  |
|                                    | Superbrain         | £1200    | S1  |
|                                    | Tandy Model I      | £40      | M1  |
|                                    | Tandy Model I      | £40      | H1  |
| Industrial cleaning package        | CP/M               | POR      | B7  |
| Industry Factory loading           | Apple II           | £360     | X1  |
|                                    | CP/M               | £360     | X1  |
|                                    | PET/CBM            | £300     | X1  |
| Industry work study                | Apple II           | £990     | X1  |
|                                    | CP/M               | £990     | X1  |
|                                    | PET/CBM            | £750     | X1  |
| Inn Management                     | Act Sirius 1       | £185     | C7  |
| Insurance Broker                   | Act Sirius 1       | £450     | C7  |
| Insurance renewals                 | CBM/8032           | £1200    | S3  |
| Integrated accts                   | Act Sirius 1       | £495     | A1  |
|                                    | Altos (CP/M, MP/M) | £300     | B1  |
|                                    | Apple II           | £450     | P1  |
|                                    | Apple II           | £300     | P2  |
|                                    | Apple II           | £855     | V1  |
|                                    | Apple II           | £600     | T2  |
|                                    | Apple II           | £1470    | L4  |
|                                    | Apple II           | £300     | W2  |
|                                    | Apple II           | £199     | T5  |
|                                    | CBM/8032           | £1500    | P3  |
|                                    | CBM/8032           | 900      | C11 |
|                                    | CP/M               | £950     | L1  |
|                                    | CP/M               | £1500    | C4  |
|                                    | CP/M               | £1100    | G1  |
|                                    | CP/M               | £990     | M3  |
|                                    | CP/M               | £690     | B5  |
|                                    | CP/M               | £850     | S7  |
|                                    | CP/M               | £900     | B5  |
|                                    | CP/M               | £1450    | B3  |
|                                    | CP/M               | £1200    | B6  |
|                                    | CP/M               | £199     | T5  |
|                                    | Cromemco           | £690     | B5  |
|                                    | Cromemco           | £900     | B5  |
|                                    | Famos              | £2000    | M2  |
|                                    | MZ-80K             | £150     | P2  |
|                                    | North Star Horizon | £950     | B3  |



# PACKAGES

|                                       |                       |            |           |
|---------------------------------------|-----------------------|------------|-----------|
| North Star                            |                       |            |           |
| Horizon                               | £690                  | B5         |           |
| North Star                            |                       |            |           |
| Horizon                               | £900                  | B1         |           |
| PET/CBM                               | £300                  | B1         |           |
| PET/CBM                               | £800                  | B3         |           |
| PET/CBM                               | £199                  | B5         |           |
| North Star                            |                       |            |           |
| Horizon                               | £990                  | M3         |           |
| PET/CBM                               | (£50)                 | C          |           |
| PET/CBM                               | £650                  | J1         |           |
| PET/CBM                               | £650                  | G2         |           |
| Superbrain                            | £990                  | M3         |           |
| Superbrain                            | £1200                 | S6         |           |
| Superbrain                            | £1000                 | T3         |           |
| Superbrain                            | £1200                 | S1         |           |
| Tandy Model I                         | £350                  | M1         |           |
| Tandy Model II                        | £350                  | M1         |           |
| Tandy Model I                         | £75                   | J1         |           |
| Tandy Model III                       | £550                  | A4         |           |
| Vector                                | £1000                 | C5         |           |
| 8000 Series                           | POR                   | C2         |           |
| 8080/Z80                              | £950                  | L1         |           |
| 8080/Z80                              | £995                  | G3         |           |
| <b>Investment portfolio</b>           | <b>Tandy Model I</b>  | <b>£20</b> | <b>S2</b> |
| <b>Invoicing</b>                      | Act Sirius I          | £95        | C7        |
|                                       | Apple II              | £295       | S2        |
|                                       | Apple II              | £300       | P1        |
|                                       | Apple II              | £300       | P2        |
|                                       | Apple II              | £140       | V1        |
|                                       | Apple II              | £300       | T2        |
|                                       | Apple II              | £199       | T5        |
|                                       | Challenger            | £25        | C7        |
|                                       | CP/M                  | £325       | L1        |
|                                       | CP/M                  | £150-350   | C4        |
|                                       | CP/M                  | £250       | M3        |
|                                       | CP/M                  | £150       | S7        |
|                                       | CP/M                  | £100       | B5        |
|                                       | CP/M                  | £200       | B3        |
|                                       | CP/M                  | £300       | W1        |
|                                       | CP/M                  | POR        | B7        |
|                                       | CP/M                  | £199       | T5        |
|                                       | Cromemco              | £100       | B5        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £100       | B3        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £250       | M3        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £100       | B5        |
|                                       | PET/CBM               | £350       | A1        |
|                                       | PET/CBM               | £25-50     | B1        |
|                                       | PET/CBM               | POR        | J1        |
|                                       | PET/CBM               | £199       | T5        |
|                                       | Superbrain            | £250       | M3        |
|                                       | Superbrain            | £150       | S6        |
|                                       | Tandy Model I         | £90        | M1        |
|                                       | Tandy Model II        | £90        | M1        |
|                                       | Tandy Model I         | £25        | H1        |
|                                       | Tandy Model I         | £75        | T1        |
|                                       | Tandy Model II        | £125       | T1        |
|                                       | Tandy Model III       | £280       | A4        |
|                                       | 8080/Z80              | £325       | L1        |
| <b>Job costing</b>                    | Act Sirius I          | £350       | C7        |
|                                       | Apple II              | £300       | P1        |
|                                       | Apple II              | £990       | X1        |
|                                       | Apple II              | £199       | T5        |
|                                       | CBM/8032              | £1000      | C11       |
|                                       | CP/M                  | £700       | C4        |
|                                       | CP/M                  | £350       | M3        |
|                                       | CP/M                  | £990       | X1        |
|                                       | CP/M                  | £500       | T4        |
|                                       | CP/M                  | £650       | M5        |
|                                       | CP/M                  | POR        | B7        |
|                                       | CP/M                  | £199       | T5        |
|                                       | CP/M                  | £1500      | T6        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £350       | M3        |
|                                       | PET/CBM               | £750       | X1        |
|                                       | PET/CBM               | £199       | T5        |
|                                       | Superbrain            | £350       | M3        |
|                                       | Tandy Model I         | POR        | M1        |
|                                       | Tandy Model II        | POR        | M1        |
| <b>Job order control</b>              | 8080/Z80              | £275       | G3        |
| <b>Legal precedents</b>               | CP/M                  | £1100      | C4        |
| <b>Letter writer</b>                  | Apple II              | £80        | V1        |
|                                       | Apple II              | £99        | T5        |
|                                       | CP/M                  | £150       | M3        |
|                                       | CP/M                  | £99        | T5        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £150       | M3        |
|                                       | Superbrain            | £150       | M3        |
| <b>Local government housing maint</b> | <b>RAIR Black Box</b> | <b>POR</b> | <b>A3</b> |
| <b>Lotteries Mailing List</b>         | PET/CBM               | £45        | H2        |
|                                       | Altos (CP/M, MP/M)    | £75        | B1        |
|                                       | Apple II              | £300       | A2        |
|                                       | Apple II              | £50-150    | S2        |
|                                       | Apple II              | £300       | S5        |
|                                       | Apple II              | £300       | K2        |
|                                       | Apple II              | £40        | P2        |
|                                       | Apple II              | £100       | S4        |
|                                       | CP/M                  | £50-150    | C4        |
|                                       | CP/M                  | £250       | G1        |
|                                       | North Star            |            |           |
|                                       | Horizon               | £195       | W1        |
|                                       | PET/CBM               | £45        | H2        |
|                                       | PET/CBM               | £15        | A1        |
|                                       | PET/CBM               | £75        | B1        |
|                                       | PET/CBM               | £35        | H3        |
|                                       | Superbrain            | £140       | C9        |
|                                       | Tandy Model I         | £40        | M1        |
|                                       | Tandy Model II        | £75        | M1        |
|                                       | Tandy Model I         | £50-150    | S2        |
|                                       | Tandy Model I         | £25/38/55  | H1        |
| <b>Mail shot</b>                      | Apple II              | £14        | S2        |

|                                |                |             |    |
|--------------------------------|----------------|-------------|----|
| Apple II                       | £40            | P2          |    |
| Apple II                       | £25            | T2          |    |
| Apple II                       | £99            | T5          |    |
| Challenger                     | £25            | C7          |    |
| CP/M                           | £200-360       | C4          |    |
| CP/M                           | £90            | M3          |    |
| CP/M                           | £75            | S7          |    |
| CP/M                           | £50/150        | G5          |    |
| CP/M                           | £99            | T5          |    |
| MCZ Zilog                      | £250           | I1          |    |
| North Star                     |                |             |    |
| Horizon                        | £90            | M3          |    |
| PCC 2000                       |                |             |    |
| Simplec Triton 3               | £450           | B2          |    |
| Superbrain                     | £90            | M3          |    |
| Tandy Model I                  | £75 +          | G4          |    |
| Tandy Model II                 | £75            | M1          |    |
| Tandy Model II                 | £75 +          | G4          |    |
| Tandy Model III                | £160           | A4          |    |
| <b>Membership acting</b>       | Apple II       | £75         | P2 |
|                                | MCZ Zilog      | £250        | I1 |
|                                | PET/CBM        | £85         | H2 |
| <b>Motor Dealer</b>            | Act Sirius I   | £345        | C7 |
|                                | CBM/8032       | £950 +      | P3 |
|                                | Famos          | £5000       | M2 |
| <b>Order entry/invoicing</b>   | Apple II       | £99         | T5 |
|                                | CBM/8023       | £750        | P3 |
|                                | CP/M           | £350        | G1 |
|                                | CP/M           | £500        | T4 |
|                                | CP/M           | £550        | M5 |
|                                | CP/M           | £550        | L1 |
|                                | CP/M           | POR         | B7 |
|                                | CP/M           | £99         | T5 |
|                                | 8080/Z80       | £550        | L1 |
| <b>Order Processing</b>        | Apple II       | £99         | T5 |
|                                | CP/M           | £99         | T5 |
| <b>Office admin</b>            | Apple II       | £100        | S4 |
| <b>Pad to plotter systems</b>  | Apple II       | £250        | P2 |
|                                | Apple II       | £180        | C8 |
| <b>Payroll</b>                 | Apple II       | POR         | A2 |
|                                | Apple II       | £200        | S2 |
|                                | Apple II       | POR         | S5 |
|                                | Apple II       | POR         | K2 |
|                                | Apple II       | £200        | P2 |
|                                | Apple II       | £375        | V1 |
|                                | Apple II       | £375        | C6 |
|                                | Apple II       | £250P       | S4 |
|                                | Apple II       | £400        | T2 |
|                                | Apple II       | £490        | L4 |
|                                | Apple II       | £199        | T5 |
|                                | CBM/8032       | £375        | P3 |
|                                | Challenger     | £24         | C7 |
|                                | CP/M           | £450        | L3 |
|                                | CP/M           | £475        | L1 |
|                                | CP/M           | £495        | C4 |
|                                | CP/M           | £500        | G1 |
|                                | CP/M           | £390        | M3 |
|                                | CP/M           | £500        | B5 |
|                                | CP/M           | £450        | B3 |
|                                | CP/M           | £425        | B6 |
|                                | CP/M           | Lease       | W1 |
|                                | CP/M           | £500        | T4 |
|                                | CP/M           | £450        | M5 |
|                                | CP/M           | POR         | B7 |
|                                | CP/M           | £199        | T5 |
|                                | CP/M           | £1500       | M2 |
|                                | Famos          |             |    |
|                                | North Star     |             |    |
|                                | Horizon        | £350        | B3 |
|                                | North Star     |             |    |
|                                | Horizon        | £390        | M3 |
|                                | North Star     |             |    |
|                                | Horizon        | Lease       | W1 |
|                                | PET/CBM        | £200/350    | C5 |
|                                | PET/CBM        | £200/25/195 | A1 |
|                                | PET/CBM        | £50/195     | I2 |
|                                | PET/CBM        | £150        | G2 |
|                                | PET/CBM        | £150        | J1 |
|                                | PET/CBM        | £150        | C2 |
|                                | PET/CBM        | £10         | H3 |
|                                | PET/CBM        | £199        | T5 |
|                                | Scotcher       | £250        | L2 |
|                                | Superbrain     | £390        | M3 |
|                                | Superbrain     | £400        | S6 |
|                                | Superbrain     | £250 +      | T3 |
|                                | Tandy Model I  | £249        | M1 |
|                                | Tandy Model I  | £200        | H1 |
|                                | Tandy Model I  | £218        | T1 |
|                                | Tandy Model II | £375        | T1 |
|                                | 8000 Series    | £250        | C2 |
|                                | 8080/Z80       | £475        | L1 |
|                                | 8080/Z80       | £275        | G3 |
|                                | PET/CBM        | £150        | G2 |
|                                | PET/CBM        | £150        | J1 |
|                                | PET/CBM        | £150        | C2 |
|                                | PET/CBM        | £150        | C1 |
|                                | Scotcher       | £250        | L2 |
|                                | Tandy Model I  | £249        | M1 |
|                                | TRS-80         | £200        | H1 |
|                                | TRS-80I        | £218        | K1 |
|                                | TRS-80I        | £218        | T1 |
|                                | TRS-80II       | £375        | T1 |
|                                | 8000 Series    | £250        | C2 |
|                                | 8080/Z80       | £475        | L1 |
|                                | 8080/Z80       | £275        | G3 |
| <b>Perpetual Inventory</b>     | CP/M           | £150        | B5 |
|                                | Cromemco       | £150        | B5 |
| <b>Personnel records</b>       | Apple II       | £98         | P2 |
|                                | CP/M           | £450        | C4 |
|                                | MCZ Zilog      | £400        | I1 |
|                                | PET/CBM        | £85         | H2 |
| <b>Petaid report generator</b> | PET/CBM        | £250        | S3 |
| <b>Petsoft programs</b>        | PET/CBM        | £160        | J1 |

|                                     |                  |             |     |
|-------------------------------------|------------------|-------------|-----|
| Postal advertising response package | Apple II         | £350        | S2  |
| Price lister                        | PET/CBM          | £12         | H3  |
| Product Management                  | Act Sirius I     | £245        | C7  |
| Production analysis                 | Apple II         | £75         | P2  |
|                                     | CP/M             | £700        | C4  |
|                                     | PET/CBM          | £300        | B1  |
| Production control                  | CBM/8032         | £650 +      | P3  |
|                                     | PET/CBM          | £650 +      | P3  |
| Prof appts groups                   | 8080/Z80         | £275        | G3  |
| Prof appts individ                  | 8080/Z80         | £220        | G3  |
| Prof client billing                 | 8080/Z80         | £330        | G3  |
| Programming aids                    | Apple II         | £40         | P2  |
| Property management                 | CP/M             | £450-1000   | C4  |
|                                     | CP/M             | £400        | M3  |
|                                     | CP/M             | POR         | B7  |
|                                     | North Star       | £400        | M3  |
|                                     | Superbrain       | £400        | M3  |
| Purchase ledger                     | Apple II         | £300        | A2  |
|                                     | Apple II         | £300        | S5  |
|                                     | Apple II         | £300        | K2  |
|                                     | Apple II         | £295        | C6  |
|                                     | Apple II         | £300        | P1  |
|                                     | Apple II         | £300        | P2  |
|                                     | Apple II         | £315        | V1  |
|                                     | Apple II         | £250P       | S4  |
|                                     | Apple II         | £300        | T2  |
|                                     | Apple II         | £490        | L4  |
|                                     | Apple II         | £199        | T5  |
|                                     | Challenger       | £25         | C7  |
|                                     | CBM/8032         | £500        | C11 |
|                                     | CP/M             | £500        | C4  |
|                                     | CP/M             | £450        | G1  |
|                                     | CP/M             | £500        | L3  |
|                                     | CP/M             | £425        | L1  |
|                                     | CP/M             | £400        | M3  |
|                                     | CP/M             | £400        | B5  |
|                                     | CP/M             | £275        | S7  |
|                                     | CP/M             | 350         | B3  |
|                                     | CP/M             | £300        | W1  |
|                                     | CP/M             | £425        | B6  |
|                                     | CP/M             | £500        | T4  |
|                                     | CP/M             | £400        | M5  |
|                                     | CP/M             | POR         | B7  |
|                                     | CP/M             | £199        | T5  |
|                                     | Cromemco         | £400        | B5  |
|                                     | North Star       |             |     |
|                                     | Horizon          | £250        | B3  |
|                                     | North Star       |             |     |
|                                     | Horizon          | £400        | M3  |
|                                     | North Star       |             |     |
|                                     | Horizon          | £400        | B5  |
|                                     | Superbrain       | £400        | M3  |
|                                     | Superbrain       | £300        | S6  |
|                                     | PCC 2000         |             |     |
|                                     | Simplec Triton 3 | £350        | B2  |
|                                     | PET/CBM          | £300        | B4  |
|                                     | PET/CBM          | £95/120/350 | A1  |
|                                     | PET/CBM          | £200        | C2  |
|                                     | PET/CBM          | POR         | J1  |
|                                     | PET/CBM          | £350        | H3  |
|                                     | PET/CBM          | £199        | T5  |
|                                     | Sharp PC3201     | £300        | P2  |
|                                     | Tandy Model I    | £90         | M1  |
|                                     | Tandy Model II   | £90         | M1  |
|                                     | Tandy Model I    | £225        | H1  |
|                                     | Tandy Model I    | £225        | T1  |
|                                     | Tandy Model II   | £375        | T1  |
|                                     | Vector           | £400        | C5  |
|                                     | 8000 Series      | £250        | C2  |
|                                     | 8080/Z80         | £275        | G3  |
|                                     | 8080/Z80         | £425        | L1  |
| Quotation estimating                | Act Sirius I     | £125        | C7  |
|                                     | Apple II         | £300        | P1  |
| Recruitment Agency                  | Act Sirius I     | £345        | C7  |
| Resource optimiser                  | Apple II         | £295        | C10 |
| Sales ledger                        | Apple II         | £300        | A2  |
|                                     | Apple II         | £300        | S5  |
|                                     | Apple II         | £300        | K2  |
|                                     | Apple II         | £295        | C6  |
|                                     | Apple II         | £300        | P1  |
|                                     | Apple II         | £300        | P2  |
|                                     | Apple II         | £315        | V1  |
|                                     | Apple II         | £250P       | S4  |
|                                     | Apple II         | £300        | T2  |
|                                     | Apple II         | £490        | L4  |
|                                     | Apple II         | £199        | T5  |
| CBM/8032                            | £500             | C11         |     |
|                                     | Challenger       | £25         | C7  |
|                                     | CP/M             | £500        | C4  |
|                                     | CP/M             | £450        | G1  |
|                                     | CP/M             | £500        | L3  |
|                                     | CP/M             | £425        | L1  |
|                                     | CP/M             | £400        | M3  |
|                                     | CP/M             | £400        | B5  |

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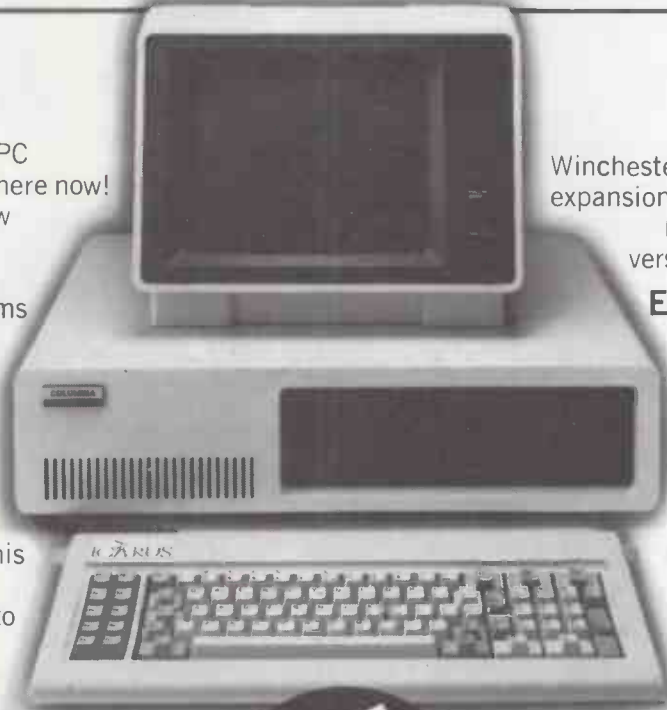
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Appearances can be deceptive as a look at the credentials of the Columbia PC machine will tell you.

Operating system software is MS-DOS® or CP/M 86®.

Its 16 BIT 8088 hardware configuration provides 128 K RAM with parity, two RS-232 serial ports, Centronics parallel printer port, DMA controller, eight levels of interrupt, dual floppy disc system with one megabyte storage,



Winchester interface and eight expansion slots.

Not bad for the standard version.

## Examine your options

Columbia like to leave your options wide open. So they've included 256K RAM boards, 8087 arithmetic co-processor for high speed math functions, dual RS-232/RS-422 boards, and a Winchester disc based system.

The Columbia PC's expansion capability can easily accommodate just about any imaginable hardware configuration including one megabyte RAM and 10 megabyte disc.

## It's here now

And you know the other great thing about the Columbia PC? It's here now. Available off the shelf. And Icarus have a nationwide dealer network waiting to start deliveries.



*For further details, or if you would like to become a dealer yourself, contact*

  
Computer Systems Ltd.

Icarus Computer Systems Ltd., Deane House, 27 Greenwood Place, London NW5 1NN.  
Tel: 01-485 5574. Telex: 264209

MS-DOS is the trademark of MICROSOFT CP/M is the trademark of Digital Research

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**401**  
AT THE PCW SHOW

# PACKAGES

|  |                    |            |    |
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|  | PCC 2000           |            |    |
|  | Simplec Triton 3   | £350       | B2 |
|  | PET/CBM            | £300       | B4 |
|  | PET/CBM            | £800       | C1 |
|  | PET/CBM            | £95/350    | A1 |
|  | PET/CBM            | POR        | J1 |
|  | PET/CBM            | £200       | C2 |
|  | PET/CBM            | £350       | C7 |
|  | PET/CBM            | £199       | T5 |
|  | Sharp PC 3201      | £300       | P2 |
|  | Superbrain         | £400       | M3 |
|  | Superbrain         | £300       | S6 |
|  | Superbrain         | £199       | T5 |
|  | Tandy Model I      | £90        | M1 |
|  | Tandy Model II     | £90        | M1 |
|  | Tandy Model I      | £225       | H1 |
|  | Tandy Model I      | £225       | T1 |
|  | Tandy Model II     | £375       | T5 |
|  | Vector             | £400       | C5 |
|  | 8000 Series        | £250       | C2 |
|  | 8080/Z80           | £275       | G3 |
|  | 8080/Z80           | £425       | L1 |
| S/L, P/L & stock control               | Apple II           | £900       | P2 |
|  | Apple II           | £1000      | T2 |
|  | CP/M               | £1000      | L3 |
|  | CP/M               | £900       | B5 |
|  | Cromemco           | £900       | B5 |
|  | North Star         |            |    |
|  | Horizon            | £900       | B5 |
| Solicitor's complete record accounting | Apple II           | £3000      | S2 |
| Solicitor's package                    | Act Sirius I       | £1400      | S1 |
|  | CBM/8032           | £1400      | S1 |
|  | CompuCorp          | £2000      | Q1 |
|  | Superbrain         | £1400      | S1 |
|  | CP/M               | £1250      | M5 |
| Statistics                             | Apple II           | £150       | G3 |
|  | Apple II           | £100-195   | P2 |
|  | Apple II           | £140       | C8 |
|  | Tandy Model I      | £45        | S2 |
| Stock control/recording                | Altos (CP/M, MP/M) | £300       | B1 |
|  | Apple II           | POR        | A2 |
|  | Apple II           | POR        | K2 |
|  | Apple II           | POR        | S5 |
|  | Apple II           | £150       | G3 |
|  | Apple II           | £80        | S2 |
|  | Apple II           | £75/300    | P2 |
|  | Apple II           | £285       | V1 |
|  | Apple II           | £300       | P1 |
|  | Apple II           | £500       | S4 |
|  | Apple II           | £490       | L4 |
|  | Apple II           | £199       | T5 |
|  | CBM/8032           | £175       | P3 |
|  | CBM/8032           | £199       | T5 |
|  | Challenger         | £25        | C7 |
|  | CP/M               | £325       | L1 |
|  | CP/M               | £500-1500  | C4 |
|  | CP/M               | £350       | G1 |
|  | CP/M               | £900       | M3 |
|  | CP/M               | £700       | B5 |
|  | CP/M               | £550       | B5 |
|  | CP/M               | £550       | B3 |
|  | CP/M               | £300       | W1 |
|  | CP/M               | £500       | T4 |
|  | CP/M               | £550       | M5 |
|  | CP/M               | POR        | B7 |
|  | CP/M               | £199       | T5 |
|  | Cromemco           | £700       | B5 |
|  | Famos              | £1500      | M2 |
|  | MZ-80K             | £150       | P2 |
|  | North Star         |            |    |
|  | Horizon            | £450       | B3 |
|  | North Star         |            |    |
|  | Horizon            | £900       | M3 |
|  | PCC 2000           |            |    |
|  | Simplec Triton 3   | £350       | B2 |
|  | PET/CBM            | £12/25/350 | A1 |
|  | PET/CBM            | £195       | I2 |
|  | PET/CBM            | £300       | B4 |
|  | PET/CBM            | £15        | A2 |
|  | PET/CBM            | £300       | B1 |
|  | PET/CBM            | £150       | C2 |
|  | PET/CBM            | £150       | J1 |
|  | PET/CBM            | £150       | G2 |
|  | PET/CBM            | £250       | H3 |
|  | PET/CBM            | £35/25     | R1 |
|  | PET/CBM            | £199       | T5 |
|  | Sharp PC3201       | £300       | P2 |
|  | Superbrain         | £900       | M3 |
|  | Superbrain         | £300       | S6 |
|  | Superbrain         | £450       | T3 |
|  | Tandy Model I      | £30-50     | M1 |
|  | Tandy Model II     | £300       | M1 |
|  | Tandy Model I      | £48        | S2 |
|  | Tandy Model I      | £200       | H1 |
|  | Tandy Model I      | £115       | J1 |
|  | Tandy Model I      | £200       | T1 |
|  | Tandy Model I      | £375       | T1 |
|  | 8080/Z80           | £275       | G3 |
|  | 8080/Z80           | £325       | L1 |
| Surveying                              | CP/M               | £500       | T4 |
| TAP business system                    | PET/CBM            | £125       | H2 |
| Text file librarian                    | Apple II           | £125       | S4 |
| Time/cost recording                    | Act Sirius I       | £800       | S1 |
|  | Apple II           | £450       | S2 |
|  | Apple II           | £300       | P1 |
|  | CBM/8032           | £800       | S1 |
|  | CP/M               | £400       | G1 |
|  | CP/M               | £200       | M3 |
|  | CP/M               | £350       | B3 |
|  | North Star         |            |    |
|  | Horizon            | £250       | B3 |
|  | North Star         |            |    |
|  | Horizon            | £200       | M3 |

|   |                  |              |    |
|---|------------------|--------------|----|
|   | North Star       |              |    |
|   | Horizon          | £450         | W1 |
|   | PCC 2000         |              |    |
|   | Simplec Triton 3 | £350         | B2 |
|   | PET/CBM          | £300         | B1 |
|   | Superbrain       | £200         | M3 |
|   | Superbrain       | £800         | S1 |
|   | Tandy Model I    | POR          | M1 |
|   | Tandy Model II   | POR          | M1 |
| Travel agency accts                         | Superbrain       | £800         | S6 |
|   | Tandy Model I    | £225         | G4 |
|   | Tandy Model II   | £225         | G4 |
| Travel Agents Dairy                         | Tandy Model I    | £100         | G4 |
|   | Tandy Model II   | £100         | G4 |
| Travel Ticket Sales                         | Tandy Model I    | £225         | G4 |
|   | Tandy Model II   | £225         | G4 |
| Utilities                                   | Apple II         | £40          | P2 |
|   | Apple II         | £20          | C6 |
|   | CP/M             | £50          | B5 |
|   | ITT 2020         | £20          | C6 |
| Utility set                                 | PET/CBM          | £78          | H3 |
| Various engineering                         | Tektronix        |              | E1 |
| Various thermal insulation industry systems | CP/M             | £2000+       | T6 |
| VAT   | PET/CBM          | £17.50       | A1 |
| VAT master                                  | PET/CBM          | £25          | H3 |
| VAT register                                | Tandy Model I    | £15          | H1 |
| Video hire system                           | Act Sirius I     | £125         | C7 |
|   | Tandy Model III  | £460         | A4 |
| Video message                               | Apple            | £200         | G3 |
| Warehousing                                 | CBM/8032         | POR          | S1 |
|   | CBM/8032         | £375         | P3 |
| Word processing                             | ACT 800          | £375         | H4 |
|   | Act Sirius I     | £295-325     | A1 |
|   | Apple II         | £60          | S2 |
|   | Apple II         | £75          | K2 |
|   | Apple II         | £75          | S5 |
|   | Apple II         | £75          | A2 |
|   | Apple II         | £150-300     | P2 |
|   | Apple II         | £75          | J1 |
|   | Apple II         | £120         | V1 |
|   | Apple II         | £180/95      | S4 |
|   | Apple II         | £30          | C8 |
|   | Apple II         | £500         | T2 |
|   | Apple II         | £99          | T5 |
|   | CP/M             | £150-260     | C4 |
|   | CP/M             | £400         | G1 |
|   | CP/M             | £250         | M3 |
|   | CP/M             | £250         | B6 |
|   | CP/M             | POR          | B7 |
|   | CP/M             | £99          | T5 |
|   | Famos            | £500         | M2 |
|   | North Star       |              |    |
|   | Horizon          | £250         | M3 |
|   | PET              | £85/65/40/20 | H2 |
|   | PET/CBM          | £375         | H4 |
|   | PET/CBM          | £225/325     | A1 |
|   | PET/CBM          | £325         | C5 |
|   | PET/CBM          | £75/150      | C2 |
|   | PET/CBM          | £75/150      | J1 |
|   | PET/CBM          | £75/150      | G2 |
|   | PET/CBM          | £35          | H3 |
|   | Superbrain       | £250         | M3 |
|   | Tandy Model I    | £50/75       | M1 |
|   | Tandy Model II   | £175-240     | M1 |
|   | Tandy Model I    | £30/60/90    | S2 |
|   | Tandy Model I    | £45/95       | J1 |
|   | Tandy Model I    | £15          | H1 |
|   | Vector           | £400         | C5 |
|   | 8000 Series      | £250         | C2 |
| Work In Progress                            | CP/M             | £850         | B5 |

## Machines

|                    |   |          |    |
|--------------------|---|----------|----|
| ACT 800            | Database management/Word processing       | £225     | H4 |
|                    |   | £375     | H4 |
| Act Sirius I       | Appointments planner                      | £115     | C7 |
|                    | Financial modelling                       | £595     | A1 |
|                    | Financial planning                        | £150     |    |
|                    | Incomplete records                        | £1200    | S1 |
|                    | Inn Management                            | £185     | C7 |
|                    | Insurance Broker                          | £450     | A1 |
|                    | Integrated Accts                          | £495     | C7 |
|                    | Invoicing                                 | £95      | C7 |
|                    | Job Costing                               | £350     | C7 |
|                    | Motor Dealer                              | £345     | C7 |
|                    | Project Management                        | £245     | C7 |
|                    | Quotation Estimating                      | £125     | C7 |
|                    | Recruitment agency                        | £345     | C7 |
|                    | Solicitors package                        | £1400    | S1 |
|                    | Time/cost recording                       | £800     | S1 |
|                    | Video hire system                         | £125     | C7 |
|                    | Word processing                           | £295/325 | A1 |
| Altos (CP/M, MP/M) | Integrated accts                          | £300     | B1 |
|                    | Mailing list                              | £75      | B1 |
|                    | Stock control/recording                   | £300     | B1 |
| Apple II           | Bill of materials                         | £199     | T5 |
| Budgeting          | £125                                      |          |    |
|                    | Cash flow                                 | £80      | V1 |
|                    | Cash flow                                 | £75      | P2 |
|                    | Cash flow                                 | £100     | C8 |
|                    | Contract costing                          | £450     | P1 |
|                    | Database management/information retrieval | £150     | K2 |

|   |          |     |
|---|----------|-----|
| Database management/information retrieval | £150     | A2  |
| Database management/information retrieval | £60-140  | S2  |
| Database management/information retrieval | £150     | S5  |
| Database management/information retrieval | £98      | P2  |
| Database management/information retrieval | £100     | S4  |
| Database management                       | £75      | P2  |
| Database management                       | £100     | C8  |
| Database management                       | £125     | T2  |
| Dental records                            | £395     | M4  |
| Estate agent                              | £850     | S5  |
| Estate agent                              | £850     | A2  |
| Estate agent                              | £850     | K2  |
| Estate agent                              | £750     | S4  |
| Estate agent                              | £130     | C8  |
| Financial modelling                       | £360     | C8  |
| Financial modelling                       | £425-535 | A1  |
| Financial planning                        | £250     | S4  |
| Financial planning                        | £125     | A1  |
| General ledger/NL                         | £300     | K2  |
| General ledger/NL                         | £300     | A2  |
| General ledger/NL                         | £450     | P2  |
| General ledger/NL                         | £300     | S5  |
| General ledger/NL                         | £225     | V1  |
| General ledger/NL                         | £295     | C8  |
| General ledger/NL                         | £250P    | S4  |
| General ledger/NL                         | £600     | T2  |
| General ledger/NL                         | £490     | L4  |
| General ledger/NL                         | £199     | T5  |
| Hotel management                          | £525     | M4  |
| Incomplete records                        | POR      | K2  |
| Incomplete records                        | £250     | S2  |
| Incomplete records                        | £450     | P1  |
| Incomplete records                        | £450     | P2  |
| Incomplete records                        | £490     | L4  |
| Industry factory loading                  | £360     | X1  |
| Industry work study                       | £990     | X1  |
| Integrated accts                          | £885     | V1  |
| Integrated accts                          | £450     | P1  |
| Integrated accts                          | £300     | P1  |
| Integrated accts                          | £600     | T2  |
| Integrated accts                          | £300     | W2  |
| Integrated accts                          | £1470    | L4  |
| Integrated accts                          | £199     | T5  |
| Invoicing                                 | £295     | S2  |
| Invoicing                                 | £300     | P2  |
| Invoicing                                 | £140     | V1  |
| Invoicing                                 | £300     | P1  |
| Invoicing                                 | £300     | T2  |
| Invoicing                                 | £199     | T5  |
| Job costing                               | £450     | S2  |
| Job costing                               | £990     | X1  |
| Job costing                               | £300     | P1  |
| Job costing                               | £199     | T5  |
| Job costing                               | £99      | T5  |
| Letter writer                             | £300     | K2  |
| Mailing list                              | £300     | A2  |
| Mailing list                              | £300     | A2  |
| Mailing list                              | £40      | P2  |
| Mailing list                              | £50-150  | S2  |
| Mailing list                              | £300     | S5  |
| Mailing list                              | £100     | S4  |
| Mailing List                              | £25      | T2  |
| Mail shot                                 | £14      | S2  |
| Mail shot                                 | £225     | P1  |
| Mail shot                                 | £99      | T5  |
| Order entry/invoicing                     | £99      | T5  |
| Order Processing                          | £99      | T5  |
| Pad to plotter system                     | £250     | P2  |
| Pad to plotter system                     | £180     | C8  |
| Payroll                                   | POR      | S5  |
| Payroll                                   | POR      | K2  |
| Payroll                                   | POR      | A2  |
| Payroll                                   | £200     | S2  |
| Payroll                                   | £375     | V1  |
| Payroll                                   | £200     | P2  |
| Payroll                                   | £375     | C6  |
| Payroll                                   | £250P    | S4  |
| Payroll                                   | £400     | T2  |
| Payroll                                   | £490     | L4  |
| Payroll                                   | £199     | T5  |
| Personal records                          | £75      | P2  |
| Postal advertising response package       | £350     | S2  |
| Production analysis                       | £75      | P2  |
| Programming aids                          | £40      | P2  |
| Purchase ledger                           | £300     | K2  |
| Purchase ledger                           | £300     | P2  |
| Purchase ledger                           | £300     | A2  |
| Purchase ledger                           | £300     | S5  |
| Purchase ledger                           | £315     | V1  |
| Purchase ledger                           | £300     | P1  |
| Purchase ledger                           | £295     | C6  |
| Purchase ledger                           | £250P    | S4  |
| Purchase ledger                           | £300     | T2  |
| Purchase ledger                           | £490     | L4  |
| Purchase ledger                           | £199     | T5  |
| Quotation estimating                      | £300     | P1  |
| Resource optimiser                        | £295     | C10 |
| Sales ledger                              | £300     | A2  |
| Sales ledger                              | £300     | K2  |
| Sales ledger                              | £300     | S5  |
| Sales ledger                              | £300     | P2  |
| Sales ledger                              | £315     | V1  |
| Sales ledger                              | £300     | P1  |
| Sales ledger                              | £295     | C6  |
| Sales ledger                              | £250P    | S4  |
| Sales ledger                              | £300     | T2  |
| Sales ledger                              | £490     | L4  |
| Sales ledger                              | £199     | T5  |
| SL, PL stock control                      | £1000    | T2  |
| Solicitor's complete record accounting    | £3000    | S2  |
| Statistics                                | £150     | G3  |
| Statistics                                | £100/195 | P2  |
| Statistics                                | £100-195 | P2  |
| Statistics                                | £140     | C8  |
| Stock control/recording                   | £150     | G3  |

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| Stock control/recording | POR     | K2 |
| Stock control/recording | P2      | P2 |
| Stock control/recording | POR     | A2 |
| Stock control/recording | S2      | S2 |
| Stock control/recording | POR     | S5 |
| Stock control/recording | £285    | V1 |
| Stock control/recording | £300    | P1 |
| Stock control/recording | £500    | S4 |
| Stock control/recording | £490    | L4 |
| Stock control/recor-    |         |    |
| din                     | £199    | T5 |
| Text file librarian     | £125    | S4 |
| Time/cost recording     | £450    | S2 |
| Time/cost recording     | £300    | P1 |
| Utilities               | £20     | C6 |
| Video message           | £200    | G3 |
| Word processing         | £75     | K2 |
| Word processing         | £75     | A2 |
| Word processing         | £60     | S2 |
| Word processing         | £300    | P2 |
| Word processing         | £75     | S5 |
| Word processing         | £120    | V1 |
| Word processing         | £75     | J1 |
| Word processing         | £180/95 | S4 |
| Word processing         | £30     | C8 |
| Word processing         | £500    | T2 |
| Word processing         | £99     | T5 |

|          |                         |       |     |
|----------|-------------------------|-------|-----|
| CBM/8032 | Cheque writer           | £90   | P3  |
|          | General ledger/NL       | £450  | C11 |
|          | General purpose trans-  |       |     |
|          | action proc.            | £495  | S3  |
|          | Insurance renewals      | £1200 | S3  |
|          | Integrated accts        | £1500 | P3  |
|          | Integrated accts        | £900  | C11 |
|          | Job costing             | £1000 | C11 |
|          | Motor trader            | £950+ | P3  |
|          | Order entry/invoicing   | £750  | P3  |
|          | Payroll                 | £375  | P3  |
|          | Production control      | £650+ | P3  |
|          | Purchase ledger         | £500  | C11 |
|          | Sales ledger            | £500  | C11 |
|          | Solicitors package      | £140  | S1  |
|          | Stock control/recording | £175  | P3  |
|          | Stock control/recording | £250  | C11 |
|          | Time/cost recording     | £800  | S1  |
|          | Warehousing             | £375  | P3  |

|            |                     |       |    |
|------------|---------------------|-------|----|
| Compucorp  | Solicitors package  | £2000 | Q1 |
| Challenger | Appointment Planner | £25   | C7 |
|            | Invoicing           | £25   | C7 |
|            | Mail Shot           | £25   | C7 |
|            | Payroll             | £25   | C7 |
|            | Purchase Ledger     | £25   | C7 |
|            | Sales Ledger        | £25   | C7 |
|            | Stock Control       | £25   | C7 |

|      |                       |          |    |
|------|-----------------------|----------|----|
| CP/M | Bill of materials     | £500     | B5 |
|      | Bill of materials     | £199     | T5 |
|      | Bookmakers package    | POR      | B7 |
|      | Budgeting package     | £95      | B5 |
|      | Cash flow             | £250     | L3 |
|      | Cash flow             | £95      | B5 |
|      | Cash register         | £30      | T4 |
|      | Company secretary     | £450     | C4 |
|      | Container accounting  | £750     | M5 |
|      | Contract costing      | £2000    | L3 |
|      | Database              | £350     | B3 |
|      | Database management/  |          |    |
|      | information retrieval | £150-750 | C4 |
|      | Database management/  |          |    |
|      | information retrieval | £100     | G3 |
|      | Database management/  |          |    |
|      | information retrieval | £400     | C3 |
|      | Database management/  |          |    |
|      | information retrieval | £600     | G5 |
|      | Dental records        | £500     | T4 |
|      | Bire payroll system   | £650     | M5 |
|      | Equipment lease/rent/ |          |    |
|      | HP                    | £400     | G1 |
|      | Estate agents         | £750     | C4 |
|      | Estate agent          | £700     | B5 |
|      | Financial modelling   | £400     | G1 |
|      | Financial modelling   | £95      | B5 |
|      | Financial modelling   | £425/535 | A1 |
|      | Financial modelling   | £400     | B6 |
|      | Financial planning    | £125     | A1 |
|      | General ledger/NL     | £500     | L3 |
|      | General ledger/NL     | £500     | C4 |
|      | General ledger/NL     | £400     | G1 |
|      | General ledger/NL     | £375     | B7 |
|      | General ledger/NL     | £200     | B7 |
|      | General ledger/NL     | £275     | S7 |
|      | General ledger/NL     | £400     | M3 |
|      | General ledger/NL     | £350     | B3 |
|      | General ledger/NL     | £300     | W1 |
|      | General ledger/NL     | £425     | B6 |
|      | General ledger/NL     | £500     | T4 |
|      | General ledger/NL     | £400     | M5 |
|      | General ledger/NL     | POR      | B7 |
|      | General ledger/NL     | £199     | T5 |
|      | Hotel management      | £525     | M4 |
|      | Incomplete Records    | £250     | B5 |
|      | Incomplete Records    | £750     | M3 |
|      | Incomplete Records    | £975     | B3 |
|      | Incomplete Records    | £750     | W1 |
|      | Incomplete Records    | £1250    | M5 |
|      | Industrial cleaner    |          |    |
|      | package               | POR      | B7 |
|      | Industry factory      |          |    |
|      | loading               | £360     | X1 |
|      | Industry work study   | £990     | X1 |
|      | Insurance brokers     | £995     | W1 |
|      | Integrated accts      | £1500    | C4 |
|      | Integrated accts      | £1100    | G1 |
|      | Integrated accts      | £950     | L1 |
|      | Integrated accts      | £690     | B5 |
|      | Integrated accts      | £850     | S7 |
|      | Integrated accts      | £990     | M3 |
|      | Integrated accts      | £900     | B5 |
|      | Integrated accts      | £1450    | B3 |
|      | Integrated accts      | £1200    | B6 |
|      | Integrated accts      | £199     | T5 |

|                         |           |    |
|-------------------------|-----------|----|
| Invoicing               | £325      | L1 |
| Invoicing               | £150-350  | C4 |
| Invoicing               | £150      | S7 |
| Invoicing               | £250      | M3 |
| Invoicing               | £100      | B5 |
| Invoicing               | £200      | B3 |
| Invoicing               | £300      | W1 |
| Invoicing               | POR       | B7 |
| Invoicing               | £199      | T5 |
| Job costing             | £700      | C4 |
| Job costing             | £990      | X1 |
| Job costing             | £350      | M3 |
| Job costing             | £500      | T4 |
| Job costing             | £650      | M5 |
| Job costing             | POR       | B7 |
| Job costing             | £199      | T5 |
| Job costing             | £1500     | T5 |
| Legal precedents        | £1100     | C4 |
| Letter writer           | £150      | M3 |
| Letter writer           | £99       | T5 |
| Mailing list            | £50-150   | C4 |
| Mailing list            | £250      | G1 |
| Mailing list            | £75       | S7 |
| Mail shot               | £200-360  | G4 |
| Mail shot               | £90       | M3 |
| Mail shot               | £50/150   | G5 |
| Mail shot               | £99       | T5 |
| Order entry/invoicing   | £350      | G1 |
| Order entry/invoicing   | £500      | T4 |
| Order entry/invoicing   | £550      | M5 |
| Order entry/invoicing   | POR       | B7 |
| Order entry/invoicing   | £99       | T5 |
| Order processing        | £550      | L1 |
| Order processing        | £99       | T5 |
| Payroll                 | £450      | L3 |
| Payroll                 | £495      | C4 |
| Payroll                 | £500      | G1 |
| Payroll                 | £475      | B5 |
| Payroll                 | £500      | M5 |
| Payroll                 | £390      | B3 |
| Payroll                 | £450      | B3 |
| Payroll                 | Lease     | W1 |
| Payroll                 | £425      | B6 |
| Payroll                 | £500      | T4 |
| Payroll                 | £450      | M5 |
| Payroll                 | POR       | B7 |
| Payroll                 | £199      | T5 |
| Payroll                 | £150      | B5 |
| Perpetual Inventory     | £450      | C4 |
| Personnel records       | £700      | C4 |
| Production analysis     | £450-1000 | C4 |
| Property management     | £400      | M3 |
| Property management/    |           |    |
| Property management     | POR       | B7 |
| Purchase ledger         | £500      | L3 |
| Purchase ledger         | £450      | G1 |
| Purchase ledger         | £425      | L1 |
| Purchase ledger         | £500      | C4 |
| Purchase ledger         | £200      | B5 |
| Purchase ledger         | £275      | S7 |
| Purchase ledger         | £400      | M3 |
| Purchase ledger         | £350      | B3 |
| Purchase ledger         | £300      | W1 |
| Purchase ledger         | £425      | B6 |
| Purchase ledger         | £500      | T4 |
| Purchase ledger         | £400      | M5 |
| Purchase ledger         | POR       | B7 |
| Sales ledger            | £500      | L3 |
| Sales ledger            | £500      | C4 |
| Sales ledger            | £450      | G1 |
| Sales ledger            | £425      | L1 |
| Sales ledger            | £200      | B5 |
| Sales ledger            | £275      | S7 |
| Sales ledger            | £400      | M3 |
| Sales ledger            | £350      | B3 |
| Sales ledger            | £300      | W1 |
| Sales ledger            | £425      | B6 |
| Sales ledger            | £500      | T4 |
| Sales ledger            | £400      | M5 |
| Sales ledger            | POR       | B7 |
| Sales ledger            | £199      | T5 |
| Solicitors              | £1250     | M5 |
| S/L, P/L + stock        |           |    |
| control                 | £1000     | L3 |
| S/L, P/L + stock        |           |    |
| control                 | £900      | B5 |
| Stock control/recording | £325      | L1 |
| Stock control/recording | £500-1500 | C4 |
| Stock control/recording | £350      | G1 |
| Stock control/recording | £500      | B5 |
| Stock control/recording | £900      | M3 |
| Stock control/recording | POR       | B7 |
| Stock control           | £550      | B3 |
| Stock control           | £300      | W1 |
| Stock control           | £500      | T4 |
| Stock control           | £550      | M5 |
| Stock control           | £199      | T5 |
| Surveying               | £500      | T4 |
| Time/cost recording     | £400      | G1 |
| Time/cost recording     | £200      | M3 |
| Time ledger             | £350      | B3 |
| Utilities               | £50       | B5 |
| Various thermal in-     |           |    |
| sulation industry       |           |    |
| systems                 | £2000+    | T6 |
| Word processing         | £400      | G1 |
| Word processing         | £150-260  | B1 |
| Word processing         | £250      | M3 |
| Word processing         | £250      | B6 |
| Word processing         | POR       | B7 |
| Word processing         | £99       | T5 |
| Word processing         | £850      | B5 |
| Work in progress        |           |    |

|       |                  |       |    |
|-------|------------------|-------|----|
| Famos | Customer file    | £1000 | M2 |
|       | Data base        | £1500 | M2 |
|       | Integrated accts | £2000 | M2 |
|       | Motor dealer     | £5000 | M2 |
|       | Payroll          | £1500 | M2 |
|       | Stock control    | £1500 | M2 |
|       | Word processing  | £500  | M2 |

|           |                   |      |    |
|-----------|-------------------|------|----|
| MCZ Zilog | Mail shot         | £250 | I1 |
|           | Membership acting | £250 | I1 |

|        |                         |      |    |
|--------|-------------------------|------|----|
|        | Personnel records       | £400 | I1 |
| MZ-80K | Estate agent            | £195 | W1 |
|        | Integrated accounts     | £150 | P2 |
|        | Stock control/recording | £150 | P2 |

|            |                         |       |    |
|------------|-------------------------|-------|----|
| North Star | Budgeting package       | £95   | B5 |
| Horizon    | Cash flow               | £95   | B5 |
|            | Database management/    |       |    |
|            | information retrieval   | £250  | B3 |
|            | Double glazing costing  | £750  | W1 |
|            | Estate agent            | £750  | B5 |
|            | Financial modelling     | £95   | B5 |
|            | General ledger/NL       | £250  | B3 |
|            | General ledger/NL       | £400  | M3 |
|            | General ledger/NL       | £400  | B5 |
|            | Incomplete records      | £750  | M3 |
|            | Incomplete records      | £250  | B5 |
|            | Incomplete records      | £975  | B3 |
|            | Integrated accts        | £950  | B3 |
|            | Integrated accts        | £990  | M3 |
|            | Integrated accts        | £690  | B5 |
|            | Integrated accts        | £900  | B5 |
|            | Invoicing               | £100  | B3 |
|            | Invoicing               | £250  | M3 |
|            | Invoicing               | £100  | B5 |
|            | Job costing             | £350  | M3 |
|            | Letter writer           | £150  | M3 |
|            | Miling List             | £195  | W1 |
|            | Mail shot               | £90   | M3 |
|            | Payroll                 | £350  | B3 |
|            | Payroll                 | £390  | M3 |
|            | Payroll                 | Lease | W1 |
|            | Property Management     | £400  | M5 |
|            | Purchase ledger         | £250  | B3 |
|            | Purchase ledger         | £400  | M3 |
|            | Purchase ledger         | £400  | B5 |
|            | Sales ledger            | £250  | B3 |
|            | Sales ledger            | £400  | M3 |
|            | Sales ledger            | £400  | B5 |
|            | SL, PL + stock          |       |    |
|            | control                 | £900  | B5 |
|            | Stock control/recording | £450  | B3 |
|            | Stock control/recording | £900  | M3 |
|            | Time/cost recording     | £250  | B3 |
|            | Time/cost recording     | £200  | M3 |
|            | Time/cost recording     | £450  | W1 |
|            | Word processing         | £250  | M3 |

|          |                         |      |    |
|----------|-------------------------|------|----|
| PCC 2000 | Estate Agent            | £350 | B2 |
| Simplec  | General ledger/NL       | £700 | B2 |
| Triton 3 | Mail Shot               | £450 | B2 |
|          | Purchase ledger         | £350 | B2 |
|          | Sales ledger            | £350 | B2 |
|          | Stock control/recording | £500 | B2 |
|          | Time/cost recording     | £350 | B2 |

|         |                       |          |    |
|---------|-----------------------|----------|----|
| PET/CPM | Assembler dev         | £50      | C2 |
|         | Bill of materials     | £199     | T5 |
|         | Bureau de change      | £8       | H3 |
|         | Cash flow             | £8       | A1 |
|         | Cheque writer         | £90      | P3 |
|         | Credit control        | £650     | B4 |
|         | Database management/  |          |    |
|         | information retrieval | £75      | B1 |
|         | Database management/  |          |    |
|         | information retrieval | £50/150  | C2 |
|         | Database management/  |          |    |
|         | information retrieval | £150     | G2 |
|         | Database management/  |          |    |
|         | information retrieval | £150     | J1 |
|         | Database management/  |          |    |
|         | information retrieval | POR      | C1 |
|         | Database management/  |          |    |
|         | information retrieval | £325     | A1 |
|         | Database management/  |          |    |
|         | information retrieval | £225     | H4 |
|         | Database management/  |          |    |
|         | information retrieval | £250     | C3 |
|         | Disk operating system | £150     | B1 |
|         | Estate agent          | £25      | A1 |
|         | Estate agent          | £30      | H3 |
|         | File handling         | £225     | H4 |
|         | Financial modelling   | £425-535 | A1 |
|         | Financial planning    | £125     | A1 |
|         | General ledger/NL     | £200     | C2 |
|         | General ledger/NL     | £1000    | L1 |
|         | General ledger/NL     | £200     | H3 |
|         | General ledger/NL     | £199     | T5 |
|         | Industry factory      |          |    |
|         | loading               | £300     | X1 |
|         | Industry work study   | £750     | X1 |
|         | Integrated accts      | £300     | B1 |
|         | Integrated accts      | £500     | C2 |
|         | Integrated accts      | £650     | G2 |
|         | Integrated accts      | £650     | J1 |
|         | Integrated accts      | £800     | S3 |
|         | Integrated accts      | £199     | T5 |
|         | Invoicing             | POR      | J1 |
|         | Invoicing             | £25-50   | B1 |
|         | Invoicing             | £350     | A1 |
|         | Invoicing             | £400     | C1 |
|         | Invoicing             | £199     | T5 |
|         | Job costing           | £750     | X1 |
|         | Job costing           | £199     | T5 |
|         | Lotteries             | £45      | H2 |
|         | Mailing list          | £75      | B1 |
|         | Mailing list          | £15      | A1 |
|         | Mailing list          | £45      | H2 |
|         | Mailing list          | £35      | H3 |
|         | Mailing list          | £85      | H2 |
|         | Membership acting     | £150     | G2 |
|         | Payroll               | £150     | J1 |
|         | Payroll               | £150     | C2 |
|         | Payroll               | £50/195  | I2 |
|         | Payroll               | £50/25/  | A1 |
|         | Payroll               | £195     | A1 |
|         | Payroll               | POR      | C1 |
|         | Payroll               | £200/350 | C5 |
|         | Payroll               | £10      | H3 |
|         | Payroll               | £199     | T5 |
|         | Personnel records     | £85      | H2 |

# PLUTO

## INTELLIGENT COLOUR GRAPHICS

*Pluto provides YOUR machine with a high quality Colour Graphics Display.*

*Meet the Family:-*

**BABY PLUTO**... 320(H) x 288(V) x 8 Colour. 96K bytes of memory to provide two full screen buffers.  
**PLUTO**..... 640(H) x 288(V) x 8 Colour. 192K bytes of memory to provide two full screen buffers.  
Double resolution option. .... 640(H) x 576(V) x 8 Colour. Software selectable between 288(V) & 576(V).  
Start with Baby and then Upgrade!

**Pluto** uses the latest technology to provide unprecedented performance and reliability on a single PCB.  
**Pluto** may be readily connected to most Computer Systems or plugged straight into an 80-BUS or NASBUS.

*Look at what Pluto offers:-*

- 16 bit Intel 8088 microprocessor.
- 192K bytes of dual-ported display memory for fast flicker-free screen updates. (*Outside the host address space*).
- Fast parallel I/O interface usable with ALMOST ANY COMPUTER.
- Operates from a single +5v supply. .

*Here are just some of the high level functions that Pluto provides:-*

- Fast vector draw – over 100,000 pixels/sec. Lines can be drawn using REPLACE, XOR, AND, OR functions.
- Built-in character set providing an 80 x 28 character display.
- User definable characters or symbols.
- Spare display memory with memory management facilities for allocating symbol storage space or workspace.
- Rectangle Fill and Copy using nine logic functions.
- Fast access to single pixels.
- Write protected memory planes during copy.
- Double buffered screen memory for animated displays.
- Complex polygon colour fill.

**Pluto** is also available as a boxed unit with integral power supply with cables and connectors and custom interface card for a range of machines:-

**PET, APPLE, SIRIUS, NASCOM, GEMINI, RAIR, RML, S100 etc.**

*Our range of interfaces is being continuously expanded, please ask us for details of others including RS 232. Pluto is expandable. Available very soon is an expansion board enabling Pluto to display 256 colours simultaneously from a very large palette for producing high quality shaded images.*

**Pluto prices:-**

|   |                  |
|---|------------------|
| BABY PLUTO .....                                    | £299.00 plus VAT |
| PLUTO .....   | £399.00 plus VAT |
| BOXED PLUTO AND INTERFACE .....                     | £599.00 plus VAT |
| DOUBLE RESOLUTION OPTION .....                      | £50.00 plus VAT  |
| 8MHz PROCESSOR OPTION (40% speed improvement) ..... | £50.00 plus VAT  |

(Carriage £6.00 on boxed Pluto)

Dealer and OEM enquiries invited.

 **iO research Ltd.**

6 Laleham Avenue · Mill Hill · London NW7 3HL  
Telephone: 01-959 0106

# PACKAGES

|                         |                                 |          |
|-------------------------|---------------------------------|----------|
| Petsoft programs        | £160                            | J1       |
| Petaid report generator | £250                            | S3       |
| Prise lister            | £12                             | H3       |
| Production analysis     | £300                            | B1       |
| Production control      | £650+                           | P3       |
| Purchase ledger         | £200                            | C2       |
| Purchase ledger         | POR                             | J1       |
| Purchase ledger         | £95/120                         |          |
| 350                     | A1                              |          |
| Purchase ledger         | £1000                           | C1       |
| Purchase ledger         | £300                            | B4       |
| Purchase ledger         | £350                            | H3       |
| Purchase ledger         | £199                            | T5       |
| Sales ledger            | POR                             | J1       |
| Sales ledger            | £200                            | J1       |
| Sales ledger            | £300                            | B4       |
| Sales ledger            | £800                            | C1       |
| Sales ledger            | £95/350                         | A1       |
| Sales ledger            | £350                            | H3       |
| Sales ledger            | £199                            | T5       |
| Stock control/recording | £150                            | C2       |
| Stock control/recording | £300                            | B1       |
| Stock control/recording | £150                            | G2       |
| Stock control/recording | £150                            | J1       |
| Stock control/recording | £195                            | I2       |
| Stock control/recording | £12/25/350                      | A1       |
| Stock control/recording | £15                             | A2       |
| Stock control/recording | £300                            | B4       |
| Stock control/recording | £35/25                          | H3       |
| Stock control           | £199                            | T5       |
| TAP business system     | £125                            | H2       |
| Time/cost recording     | £300                            | B1       |
| Utility set             | £78                             | H3       |
| VAT                     | £17.50                          | A1       |
| VAT master              | £25                             | H3       |
| Word processing         | £75/150                         | J1       |
| Word processing         | £75/150                         | G2       |
| Word processing         | £75/150                         | C2       |
| Word processing         | £85/65                          |          |
| Word processing         | £40/20                          | H2       |
| Word processing         | £375                            | H4       |
| Word processing         | £25/325                         | A1       |
| Word processing         | £325                            | C5       |
| Word processing         | £35                             | H3       |
| PET/Computhink          | Stock control/recording         | £250 R1  |
| RAIR Black Box          | Financial modelling             | POR A3   |
|                         | Hotel management                | POR A3   |
|                         | Local government housing maint. | POR A3   |
| Sharp PC-3201           | General ledger                  | £450 P2  |
|                         | Sales ledger                    | £300 P2  |
|                         | Purchase ledger                 | £300 P2  |
|                         | Stock control                   | £300 P2  |
| Sorcerer                | Payroll                         | £250 L2  |
| Superbrain              | Bill of materials               | £450 T3  |
|                         | Database                        | £300 S6  |
|                         | Estate agent                    | £800 S6  |
|                         | Estate agent                    | £600 M2  |
|                         | General ledger                  | £400 M3  |
|                         | General ledger                  | £400 S6  |
|                         | Incomplete Records              | £750 M3  |
|                         | Incomplete Records              | £1200 S1 |
|                         | Integrated accts                | £1200 S6 |
|                         | Integrated accts                | £990 M3  |
|                         | Integrated accts                | £1000 T3 |

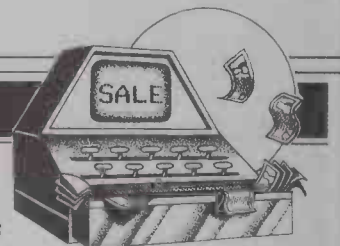
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|---------------------|---|-------------|
| Integrated accts    | £1200                                     | S1          |
| Invoicing           | £250                                      | M3          |
| Invoicing           | £150                                      | S6          |
| Job costing         | £350                                      | M3          |
| Letter writer       | £150                                      | M3          |
| Mailing list        | £140                                      | C9          |
| Mail shot           | £90                                       | M3          |
| Payroll             | £400                                      | S6          |
| Payroll             | £390                                      | M3          |
| Payroll             | £250+                                     | T3          |
| Property management | £400                                      | M1          |
| Purchase ledger     | £300                                      | S6          |
| Purchase ledger     | £400                                      | M3          |
| Sales ledger        | £300                                      | S6          |
| Sales ledger        | £400                                      | M3          |
| Sales ledger        | £199                                      | T5          |
| Solicitors package  | £1400                                     | S1          |
| Stock control       | £300                                      | S6          |
| Stock control       | £900                                      | M3          |
| Stock control       | £450                                      | I3          |
| Time/cost recording | £800                                      | S1          |
| Time recording      | £200                                      | M3          |
| Word processing     | £250                                      | M3          |
| Travel agency accts | £800                                      | S6          |
| Tandy Model 1       | Database management/information retrieval | £25-80 M1   |
|                     | Database management/information retrieval | £270 A4     |
|                     | Database management/information retrieval | £60 S2      |
|                     | Database management/information retrieval | £32.50 H1   |
|                     | Database management/information retrieval | £150 J1     |
|                     | General ledger/NL                         | £90 M1      |
|                     | General ledger/NL                         | £90 M1      |
|                     | General ledger/NL                         | £225 H1     |
|                     | General ledger/NL                         | £225/325 T1 |
|                     | General ledger/NL                         | £425 T      |
|                     | Incomplete records                        | £40 M1      |
|                     | Incomplete records                        | £40 H1      |
|                     | Invoicing                                 | £90 M1      |
|                     | Invoicing                                 | £280 A4     |
|                     | Invoicing                                 | £90 M1      |
|                     | Invoicing                                 | £75 T1      |
|                     | Invoicing                                 | £125 T1     |
|                     | Integrated accts                          | £350 M1     |
|                     | Integrated accts                          | £550 A4     |
|                     | Integrated accts                          | £100 M1     |
|                     | Integrated accts                          | £75 J1      |
|                     | Investment portfolio                      | £20 S2      |
|                     | Invoicing                                 | £25 H1      |
|                     | Job costing                               | POR M1      |
|                     | Job costing                               | POR M1      |
|                     | Mailing list                              | £40 M1      |
|                     | Mailing list                              | £75 M1      |
|                     | Mailing list                              | £25/38 M1   |
|                     | Mailing list                              | £5 M1       |
|                     | Mailing list                              | £50-150 S2  |
|                     | Mail shot                                 | £75+ G4     |
|                     | Mail shot                                 | £160 A1     |
|                     | Mail shot                                 | £75 M1      |
|                     | Mail shot                                 | £75+ G4     |
|                     | Payroll                                   | £249 M1     |
|                     | Payroll                                   | £200 H1     |
|                     | Payroll                                   | £218 T1     |
|                     | Payroll                                   | £371 T1     |
|                     | Purchase ledger                           | £90 M1      |
|                     | Purchase ledger                           | £90 M1      |
|                     | Purchase ledger                           | £225 H1     |
|                     | Purchase ledger                           | £375 T1     |

|                         |   |          |
|-------------------------|---|----------|
| Purchase ledger         | £375                                      | T1       |
| Sales ledger            | £90                                       | M1       |
| Sales ledger            | £90                                       | M1       |
| Sales ledger            | £235                                      | H1       |
| Sales ledger            | £225                                      | T1       |
| Sales ledger            | £375                                      | T1       |
| Statistics              | £45                                       | S2       |
| Stock control/recording | £30-50                                    | M1       |
| Stock control/recording | £300                                      | M1       |
| Stock control/recording | £200                                      | H1       |
| Stock control/recording | £48                                       | S2       |
| Stock control/recording | £115                                      | J1       |
| Stock control/recording | £200                                      | T1       |
| Stock control/recording | £375                                      | T1       |
| Travel Agency Accts     | £225                                      | G4       |
| Travel Agency Accts     | £225                                      | G4       |
| Travel Agents Dairy     | £100                                      | G4       |
| Travel Agents Dairy     | £100                                      | G4       |
| Travel Ticket Sales     | £225                                      | G4       |
| Travel Ticket Sales     | £225                                      | G4       |
| Time/cost recording     | POR                                       | M1       |
| Time/cost recording     | POR                                       | M1       |
| VAT register            | £15                                       | H1       |
| Video hire system       | £460                                      | A4       |
| Word processing         | £50/75                                    | M1       |
| Word processing         | £175-240                                  | M1       |
| Word processing         | £45-95                                    | J1       |
| Word processing         | £100                                      | H1       |
| Word processing         | £30/60/90                                 | S2       |
| Vector                  | General ledger/NL                         | £400 C5  |
|                         | Integrated accts                          | £1000 C5 |
|                         | Purchase ledger                           | £400 C5  |
|                         | Sales ledger                              | £400 C5  |
|                         | Word processing                           | £40 C5   |
| 8000 Series             | Database management/information retrieval | POR C2   |
|                         | Integrated accts                          | POR C2   |
|                         | Payroll                                   | £251 C2  |
|                         | Purchase ledger                           | £250 C2  |
|                         | Sales ledger                              | £250 C2  |
|                         | Word processing                           | £250 C2  |
| 8080/Z80                | General ledger/NL                         | £275 G3  |
|                         | General ledger/NL                         | £375 L1  |
|                         | Integrated accts                          | £350 L1  |
|                         | Integrated accts                          | £995 G3  |
|                         | Invoicing                                 | £325 L1  |
|                         | Job order control                         | £257 G3  |
|                         | Order processing                          | £550 L1  |
|                         | Payroll                                   | £475 L1  |
|                         | Payroll                                   | £275 G3  |
|                         | Prof appts groups                         | £275 G3  |
|                         | Prof appts individ                        | £220 G3  |
|                         | Prof client billing                       | £330 G3  |
|                         | Purchase ledger                           | £425 L1  |
|                         | Purchase ledger                           | £275 G3  |
|                         | Sales ledger                              | £275 G3  |
|                         | Sales ledger                              | £425 L1  |
|                         | Stock control/recording                   | £325 L1  |
|                         | Stock control/recording                   | £275 G3  |

# TRANSACTION FILE

Readers will be pleased to know that, due to our clever marketing 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 co-operating.



★ Wanted 32-64k 80 column microcomputer/word processor. Part package capable of modification considered. Also required vg quality electric typewriter/printer especially if interfacable. Cash paid. Tel: 01-527 0511 anytime (evenings preferred).  
 ★ ZX81 - + 16k RAM. Sinclair complete: leads, manual, etc. £87.50 (inc postage). ZX printer £49.50 (inc postage). Write to: Rod Postans, 300 Amhurst Rd, Stoke Newington, London N16.  
 ★ Sharp MZ80K - 48k five months old still under guarantee. Still in packing, plenty of software, also manual. Must sell £365. Tel: Russell (0792) 794816.  
 ★ Sharp PC1211 - + cassette interface. Still in box, all manuals etc. £70. Tel: 01-527 3572.  
 ★ ZX81 - Sinclair built inc 16k RAM. As new, perf cond., hardly used, in box with leads, adaptor & manual. Genuine reason for sale. Tel: Nottingham 285010.

★ Acorn Atom - 12k RAM, FP ROM, leads, psu, manuals, magic book, Galaxian, Invaders & other software £150 ono also 3k RAM (6 x 2114) £5. Tel: Sedgfield 20403 after 5pm.  
 ★ Acorn Atom - 12k + 12k. 6522 VIA chip, printer plug, psu, manuals, also £50 plus of software £225, or would consider ZX81 + cash. Tel: Sheffield 0742 339147.  
 ★ ZX81 - mounted in Fuller case with keyboard 16k RAM all vgc, manual, all leads 2 games £100. Tel: Farnham (0252) 711162 after 4pm or weekends.  
 ★ Atom - 12k + 12k lots of software/books. Factory assembled £200 ono. Potts, 4 Littleway, Dunsford Hill, Exeter, Devon.  
 ★ ZX81 16k RAM all Sinc built original box leads & manual exc cond. quick sale wanted £60 ono. Tel: 01-398 2750 (Esher).  
 ★ ZX81 - with 16k RAM & games tape, Sinclair built, £80. Tel: 021 354 6438 eve.

★ TI 994/A - complete. Little used, cost £300 will accept £160 ono. Features good T.I. maths, sound and graphics. Tel: Harrogate (0423) 58588.  
 ★ SWTP - 69A, SS50 Bus, 6809 40k Statis RAM + 16k socketed card. 2 serial ports, 20 amp supply. Full data, easily modified to a S/09 £600 ono. Tel: 01-422-4724.  
 ★ Video Genie 16k - keyboard/lower case/sound mode. Acculab Floppy tape. Over £150 in software inc Basic 4, books + manual £500 R. Beattie. Lincoln 730421 ext 423 (daytime).  
 ★ PCW's - all issues from vol 1. no 1 except 4, £25. Tel: Biggin Hill 74089.  
 ★ BBC Computer - Model B. As new, with games software, leads, mnuual & cassette recorder, £350 ono. Tel: Guildford 71255 ext. 3099, office hours only.  
 ★ PET 2001 - 32k small keyboard plus 4022 printer for sale,

together price £600. Consider P/lex for printer & interface for computar M30/40. Tel: 0135 39441 daytime, Cooden 3194 eve.  
 ★ ZX81 - + 16k RAM Sinc built. Housed in matching console with power switch. Software, tapes, books + cassette player. Bargain at £80 ono. Tel: 01-950 6365 after 6pm.  
 ★ Disk system - twin 8in single-sided drives with PS's in cabinets, double-density controller for S-100 bus, cables £650, can sell separately. Tel: John Gaeth 01-861 8798.  
 ★ ZX81 - 16k RAM, PSU, Sinc built still under guarantee + manual, leads, games, business education & chess cassettes £95. Tel: 0742 364834.  
 ★ ZX81 - + 16k RAM Sinclair built, for £90. All leads, manual etc. Five software tapes '30 programs for the ZX81', five months warranty remaining worth over £130. Tel: 01-808 0620.





# TRANSACTION FILE

Asteroids, Adventures, utilities worth £850. Selling for £450 ono. Phone 0742 302665.

★ ZX81 — manual, leads, also inc 3 of the popular ZX81 games books plus cassette of 6 games inc golf and sub-attack £49. Phone (0628) 72629 eve.

★ VIC20 — C2N cassette and Teach Yourself to Programme, ie manual with 2 cassettes, as new. Cost £250 — £185 ono. Tel: Cramlington (Northumberland) 0670 716196.

★ ENM parallel printer. (Licensed Centronics copy) 5x7 Dot Matrix. Width adjustable to 132 characters. TTL logic. Tractor feed. Heavy duty construction cables. Ink ribbons £75 ono. Tel: 0553 86 618 Steve.

★ ZX81 — +16k RAM, Sinc built, manual, leads, 2 games cassettes, 1 game & 2 m/c books all for £85. vgc. Contact Mark, 173 Mayfield Gardens, Brentwood, Essex. Tel: (0277) 232439.

★ Centronics 101A — £75. LX180 with stand £175. Thermal printer £45. Petivid £35. ASCII keyboard £20. Nascom2 copy, Zeap, Naspen, Debug etc. £245, 073477 5438 Wokingham, Berks.

★ Atari VCS — & cartridges, Asteroids, M/Command, S/Invaders, Adventure Superman, Skydiver, Combat Air/Sea Battle. Tel: Earidoms 318 Salisbury Wilts. £180 ono.

★ PET — 32k large keyboard with Basic 4.0 upgrade & cassette deck. Command-0 ROM. More than 100 programs incl in price £525 ono. Tel: 0235 831449.

★ ZX81 — complete with powerpack, 16k (Sinclair), leads, manual, book. Many large taped programs, Defenders, Nightmare Park, Zombies, Galactic Wars, CUBE, Tank & many more £65 ono. Tel: Capel Bangor (097084) 411.

★ PAL — T199/4 home computer, colour graphics + sound, 16k RAM + software as new £230 ono. Also Microtan 65 with damaged but working keypad £40. Tel: Headley Down 713012 weekends or after 6pm.

★ MZ80k games — 16k, six games incl Lunar Rescue, Breakout, Star Fighter, all fast graphical games £6.95. Send cheque or p/o to Paul Grant, 81 Frenchwood Ave, Preston, Lancs.

★ Teletype — Datadynamics 390 with paper tape reader & punch, vgc quiet operation 20mA current loop-interface £150 ono. Tel: 01-360 5354.

★ Tandy Model III — business system (48k twin disk RS232), line printer vi, all bought from Tandy software. Scripsit, 12

Adventures, Edtasm & more.

Owner going CP/M! Tel: Bracknell 24277 or Knowle 78218.

★ Superboard III — 8k RAM, 10k ROM, rosewood case, Basic 5 new Basic 4, 8k Eprom board, psu & manual. Exc condition. Tel: (0222) 831246.

★ BBC Microcomputer Model B 32K. Mint unopened and guaranteed with games paddles. To the first enthusiast fed up with waiting £420. Tel: 01-445 2114 day; 01-349 9370 eve & weekends.

★ UK101 — 8k RAM cased, separate psu. 300/600 baud case Mon01, Mon02, WEMON. Extensive documentation: manuals, programs cassettes, games & practical. £155 Tel: (0723) 68786 work, 78421 home.

★ ZX81 — 16k RAM Sinc built as new, 2 Sinc games cassettes. Asteroids, golf, Breakout, leads, manual. 10 months old £99 ono. Tel: Whitburn (West Lothian) 0501-40469

★ MK14 — RAM I/O extra RAM, revised monitor, replacement keyboard, boxed, manuals etc £40 ono. Tel: 0367 (Faringdon) 21631 eve.

★ Acorn Atom — 12k RAM 12k ROM psu, only 5 months old, hardly used, manual & leaflets £185. Contact Wayne Davis, The Archer Arms, Lewannick, Launceston, Cornwall PL15 7QD.

★ Acorn Atom — 2k RAM + 8k ROM with leads, manuals & software (incl 2 Acornsoft packs) £120 ono. 164 Alexandra Rd South, Manchester M212RB. Tel: 061-881 5641.

★ KSR 33 RO — Printers, stands as new £100, older £60. 4k x 1 Dram (MCM 6605) with circuit 32/£4. ET1 System 68 Microsystem, CUTS, TTY, VDÚ, RAM, D/A, NCU, PSU, card frame, working £70. Tel: 01-289 7415.

★ Texas T159 — & PC100C both little used & as new. With Master Library, magnetic cards, programming pads, printing paper & many programs, £175. Tel: Keith Basingstoke 881586.

★ ZX81 — + 16k Sinc built. Fuller keyboard, software books & cassettes incl 3d Monster Maze, leads, power, supply, manual £110. Tel: Harpenden 60701 John Clamp.

★ Video Genie — EG3003 hardly used. Still under warranty. £230 o.n.o. Deliver within 50 miles of Newbury else collect. Tel 063 527 587.

★ TRS80 Level 2 16K — as new. All leads and manuals. Over £100 software inc. microchess, asylum, invaders, level 4 basic, scripsit, editor assembler and lots more £300 o.n.o. Tel Little Haywood 881 468

★ VIC20 — 8K RAM cassette unit, joystic, etc; still under guarantee plus cartridge and cassette games, books etc. All worth over £400. Will accept £300 o.n.o. Phone 021 360 1736 after 6pm.

★ ATARI — television game with 13 games cartridges including space invaders, chess, superman, missile command, pele soccer etc. Everything in excellent condition. £220 Phone Sunderland 841194 evenings only.

★ VIC20 — cassette unit several cartridges & books including Vic revealed and book on assembly language programming. £50 of programs worth £450 + will accept £350 o.n.o. Tel 0656 50696 evenings.

★ APPLE 2+ — 64K, disc drive DOS 3.3, eurocolour card, serial/parallel interface, joystick. Works perfectly. Boxed. Best offer or £1250. Phone Bethersden (Kent) 316 after 8pm. Uncased monitor £45. Kaga £110.

★ WordPro — 4+ and Visicalc for sale. I have decided to save up for Silicon office and must reluctantly part with these excellent programmes. 1st come 1st served. Redhill 60986 24-hrs.

★ TermiNet 1200 — Printer, 1200 baud, RS232 interface, vgc, £115, CASE200 monitor £20. Tel: UXbridge 30617 evening.

★ PETITE 32K — add on memory for PET. Complete in case with PUS. Hardly used. Perfect condition. £100 o.n.o. Tels: 0604 412785 evenings. Buyer collects. ★ CBM/PET — 4032-32K plus cassette, tapes, books, £500. Also 4022 printer complete with cable and paper £400, or both for £850 o.n.o. hardly used. Ring Wimbrough Green (0403) 700777 evenings.

★ APPLE II — 48K Europlus, two disc drives plus controller virtually unused, boxed. New unwanted gifts £1150 (might split) Phone Hatfield 71524 after 6.00pm.

★ ZX81 — Sinc built, 1K, one cassette lead, TV lead, manual, mains adaptor + plug. £45.00. Casio — VL-tone perfect condition + case, 100 note memory synthesiser, rhythms. £29.95 Tel: Robert (061) 902 0980

★ ZX81 — + 16K RAM Sinclair built PSU leads manual plus three Sinclair cassettes (2 games 1 business) £80. Oxford (0865) 779257

★ 48K Sorcerer — £350 o.n.o., tapes (inc word processor, toolkit machine code tutorial, galaxians, cadas, ESC games tape) manuals cables and all back copies of ESC. Taylor 01-272 5896 after 6.00.

★ Acorn Atom — 8K ROM 9K RAM PSU TV & tape leads all manuals some software Acorn

assembled. Excellent condition, hardly used, ready to run. £155 Mr C. Dineen, Grove House, Fermoy, Cork, Ireland.

★ ATARI CX2600 video computer system with combat, video olympics casino cartridges. Plus extra pair of paddles for 4-player games. Cost £150, accept £85 for quick sale. Tel: Billericay (02774) 55850.

★ ATARI 800 — 48K, 410 program recorder, joysticks, etc. As new condition. Over £200 games software. Swap for Apple II Europlus in similar condition, or sell for first £450. Tel: 031 331 3651.

★ Two Casio 502p's — with 256 program steps and 21 non volatile memories £40 each, also one FA-1 cassette interface £10. All excellent condition, ask for Paul 01-736 3596 after 7pm.

★ Video Genie — Sound box, extra keys, manuals + leads. Over £300 software incl. editor/ass, T-Bug, Mon 3 and many arcade games. £350 o.n.o. Tel Disley (06632) 3271.

★ ZX81 + 16K RAM — Sinclair built, manual, transformer, leads, software, (inc. 'Monster Maze', Bug-byte M/code assembler + disassembler), 'Mastering machine code' book. Perfect condition. £85 o.n.o. Tel: 0243 785560. W. Young.

★ Apple — Pascal language system. B/W modulator. Desktop plan. Circuit analysis. GoodsPell. Visicalc. Typing tutor. Offers: Wanted — Apple disk drive. Tel: 0205 750365 Mitchell.

★ ZX81 — Sinc built + 16K RAM, power supply, Sinclair cassettes, Startrek, ZXBUG, etc in original boxes and in excellent condition. £110 o.n.o. Telephone Castleton (N. Yorks) 667.

★ Genie 1 48K — colour sound. Joy sticks, monitor, centronics 739 printer, many progs. Complete ready to go. £1250. Seikosha GP80A printer £130. All approx 6 months old. Tunbridge Wells (0892) 23206.

★ VIC-20 Cassette unit — software programs, and Joystick, six months old, price £230 o.n.o. Contact Chris on Merthyr Tydfil 77173.

★ Genie I — 48K on board. Full keyboard, lower case, sound, and prog. sound, plus ACULAB floppy tape, 20 wafers, keypad and joystick. Extensive software £230 o.n.o. for quick sale. Leicester (0533) 898850.

★ PET 3032 — with EPSON TX-80 printer and cassette deck. Games, utilities, cassettes, paper. All in perfect condition. Bargain at £575 George Sobala, 90 Old Road, Headington, Oxford.

★ VIC 20 — as new, original packaging. plus cassette unit. Offers above £200. Tel: Bracknell (0344) 25179.

## ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club

Yes, personal computing *does* exist outside London On 24-25 July this year 'Microfest '82' was held at UMIST (that's in Manchester for those who have never ventured north of Watford). This was a combination of exhibition and seminars, and was a great success. Needless to say, the ACC was there with our club database, which was in great demand as we put hundreds of people in touch with their local clubs.

Of course, we didn't know where *all* the clubs in the North-West area; while we may be truly wonderful, the ACC aren't telepathic, and if you don't bother to tell us of your existence, then we can't tell anybody else about it. So hurry along there and send the details of your club to Peter Whittle, 49 Bartlemas Road, Oxford, OX4.

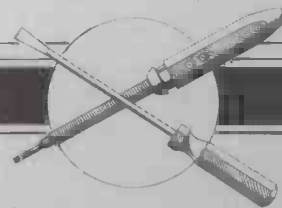
Peter was there with me, and frequently deserted me on the stand to visit the

various talks that were going on. Steve Adams gave a thorough discussion of the internals of the Sinclair Spectrum with a talk 'Inside the Spectrum' and, among others, there was a talk on telesoftware, for which Peter got roped in to helping (hinder?) the presentation.

As a result of the various discussions that went on during the show, it looks as if there is going to be an Association of North-Western

Computer Clubs, along the lines of the ALCC, for the Manchester area. Several of this, and the business is being coordinated by David Wade of the Manchester Computer Club: his address is 28 Hazel Road, Altrincham, Cheshire; 061 941 2486.

The general atmosphere at Microfest was very positive and friendly; the emphasis was strongly on the hobbyist sector rather than the expensive business machines, and



# ACC NEWS

there was a lot of educational work going on; not only were some of the seminars on Computers in Schools, but there were a lot of teachers visiting the show. The Sinclair Spectrum was the machine of the show; they were everywhere. (But where was the Beeb machine? Its keepers Acorn were nowhere to be seen.)

The organisers were so pleased with the show that they are planning a repeat performance at UMIST on 11-12 December. They have asked the ACC to organise the club stands (there was a problem at Microfest in that many clubs who might have gone didn't know about it), so any club wanting to go should contact David Annal, the ACC's exhibition man, at 142 Windermere Road, London, SW16 5HE. We'll mention this in our next club circular (but then this only goes to clubs who have told us of their existence).

The ACC's AGM is coming up soon, so it's not long before the membership gets its annual chance to be really nasty to the committee (it's the other way round for the rest of the time). It will be at 2pm at the Polytechnic of North London, Holloway Road on 16 October 1982. Rumour has it that somebody even more important than our chairman, Peter Whittle, will address the meeting.

The next PCW Show is coming up soon. The ACC is organising the clubs area in the new, expanded, improved Show. See you there, either around the club stands or on the ACC stand itself.

A few people gave me information at Microfest, and one or two have written to me. A Mr Ian Thornton-Bayer of 25 Southfield Drive, West Bradford, Clitheroe, Lancs BB7 4ZU; tel (0200) 25933, wants to set up a local club and is interested in communicating with like-minded individuals locally. So is Mr G M Flanagan, of 11 Sundown Close, New Mills, Stockport,

Cheshire, SK12 3DH; tel (0663) 44051. Also David Webb of 4 Ashfield, Dewsbury, West Yorks.

While we are up north, Mr King of the Holmes Chapel Computer Club, 3 Jodrell Close, Holmes Chapel, Crewe, Cheshire CW4 8BU would be glad to hear from anybody in the area thinking of joining. Going across the country to the North-East, I hear that Harrogate Junior Chamber is running a competition called 'MAC '82', the results of which will be announced at a Computer Fair in the Royal Bath Assembly Rooms, Harrogate, on 6 November 1982. For more information, write to Robert Hopkins, 54 Crimble Meadows, Parral, Harrogate, North Yorks HG3 1EN.

Prestel... there is going to be an official club area on Prestel at the PCW Show for the Computer Clubs to publicise themselves and to set up telesoftware for other people to download. This area will be numbered 8008 and will be administered by the ACC. For more details about what is proposed contact Peter Whittle. The ACC's pages, starting at 292500, should indicate when 8008 is going, and you should be able to request 8008 information by use of a response frame. Prestel still rather too expensive for you? Watch this space... like calls Europe, Prestel might cost less than you think.

I am now in a position to describe more fully Peter's attempts to communicate via modems with some people in Rome. The idea was to make a demonstration for a high technology festival in Rome, which was part of an arts festival that was on there. The people were very interested in what was going on in personal computing in the UK and said that there was no Italian home computer user movement, as there seems to be in this country. They were also very interested in Prestel and general datacomms, so

the following was done:

They were running an Apple with a 300 baud acoustic coupler, while Peter was running a 380Z with a GPO modem. After a fair amount of setting up (described below), the 380Z was set up to emulate a dumb terminal down the modem line, and the Apple was set to remote mode. Therefore the Apple in Rome was run from the 380Z in Oxford, over the phone system. The it was run the other way round, and the Apple was used to run the 380Z over the phone. In the live demonstration, a chess program was run on the 380Z and played in Rome.

It is absolutely essential to have carrier detect lights on the modems, and it is convenient to have the use of two phone lines. Otherwise, it is impossible to talk to the operator at the other end to ask how things are going. Therefore, each user watches the carrier detect light on his modem coupler; if this goes out, it usually means that the guy at the other end wants to talk.

Most of the lines to the States are simplex, with voice detection turn-around, which is not possible for data. However, within Europe most of the lines are duplex and therefore suitable for data use. One thing that has to be done is to switch off the echo suppressors on the line by sending a 2.1 KHz tone for three seconds at the start of the call.

Setting up is easily done in originate mode; after making telephone contact, the originator should listen for the whistle from the answer modem; this should be detected by the originate modem (when you connect it), which then should light the carrier detect. If it doesn't, check the positions of the originate/answer switches on both modems (one should be orig, the other answer; the orig and answer data are modulated on different frequencies, so it

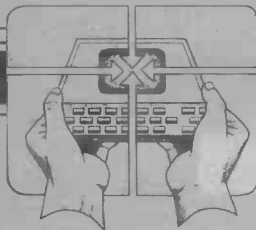
is essential that the modems are listening to each other's frequencies, rather than both talking on one frequency, both listening on the other). If this doesn't identify the fault, make sure that your modems are the right system, namely CCITT V21 standard; the American Bell 103 system is not compatible with the CCITT international standards, so beware acoustic couplers from the States or Japan.

At this point, the answer end should detect the originate end's carrier, and the link should work. The easiest test is to short the send and receive RS232 connections at one end (but see RS232 handshakes below!) and type away at the other to see if anything appears on the screen (computer set up to emulate terminal). This technique is known as using a loop-back.

If there are problems, it is advisable to check that the RS232 handshakes are correct for both the modem and the computer. The following should occur:

1. Set DTR true (Data Terminal Ready - pin 20). This tells the modem to connect to the line.
2. Set RTS true (Request To Send - pin 4) This tells the modem to turn its carrier on.
3. DCD (Data Carrier Detect - pin 8) should go true.
4. DSR (Data Set Ready - pin 6) also goes true.
5. CTS (Clear To Send - pin 5) goes true. When CTS is true, the system thinks that everything is okay and is ready to go.

Note that if your computer RS232 interface doesn't have modem control you will need to set DTR and RTS yourself. Another tip; if CTS is true but nothing is happening, try all possible combinations of swapping connections of pins 2 and 3 at both ends since it is quite likely that these (data send and receive) have got connected the wrong way round at one end or the other.



## CTUK! CONTACTS

For further information on ComputerTown UK! see 'CTUK News' or Prestel page 3574831

David Sharp  
5 Bridgenhall Road  
Enfield  
Middx

Andrew Stoneman  
135 Birchdale Avenue  
Newcastle-Upon-Tyne  
Tyne & Wear

J M A Kilburn  
(Headmaster)  
Shawfield Norden  
Community Middle School  
Shawfield Lane  
Norden  
Rochdale  
OL12 7QR

Brigitte Gordon  
18 Purbright Crescent  
New Addington  
Croydon CR0 0RT

Richard Powell  
22 Downham Court  
South Shields  
Tyne & Wear

Pam Pollicott  
South Ruislip Library  
Victoria Road  
South Ruislip  
Middx

Ted Ellerton  
25 Beachdale  
Winchmore Hill  
London N21

Vernon Gifford  
111 Selhurst Road  
Croydon  
London SE25 6LH

John Stephen Bone  
2 Claremont Place  
Gateshead  
Tyne & Wear  
NE8 1TL

Alan Hooley  
21 Brammay Drive  
Tottington  
Bury BL8 3HS

Vernon Quaintance  
50 Beatrice Avenue  
Norbury  
London SW16 4UN

Keith Taylor  
Carter Hydraulic Works  
Thornbury  
Bradford BD3 8HG

Derek Moody  
2 Victoria Terrace  
Dorchester  
Dorset DT1 1LS

Derek Knight or Bob Carter  
Rayners Lane Library  
Imperial Drive  
Rayners Lane  
Middx

Peter Earchy  
46 High Street  
Church Stretton  
Shropshire  
SY6 6BX

Tony Cartmell  
54 Foregate Street  
Worcester WR1 1DX

R L Saunders  
14 St Nicholas Mount  
Hemel Hempstead  
Herts

Christopher Bates  
Ashford Main Library  
Church Road  
Ashford  
Kent

Ray Skinner  
62 Central Avenue  
Billingham  
Cleveland  
TS23 1LN

# CTUK! CONTACTS

Andrew Holyer  
10 Masons Road  
Mannings Heath  
Horsham  
Sussex RH13 6JP

Roger Shears  
18 Woodmill Lane  
Bltterne Park  
Southampton  
SO2 4PY

Bill Gibbings  
3 Longholme Road  
Retford  
Notts DN22 6TU

Chris Cooper  
110 Church Road  
Hanwell  
London W7

Ted Broadhead  
27 Cardinal Road  
Leeds LS11 8EY

Paul Maddison  
Gardenways  
Chilworth Towers  
Chilworth  
Southampton  
SO1 7JH

Lyn Antill  
1 Defoe House  
Barbican  
London EC2

Chris Woodford  
11 Hopley Road  
Anslow  
Burton-On-Trent  
Staffordshire

Peter Jarvis  
c/o Health Dept  
Corporation of London  
Guildhall  
London EC2

Robin Bradbeer  
Polytechnic of North London  
Holloway Road  
London N7

Brian Taylor  
Tonbridge Area Library  
Avebury Avenue  
Tonbridge  
Kent

Peter J Kiff  
52 Stone Road  
Broadstairs  
Kent CT10 1DZ

Patrick Colley  
52 Queensway  
Caversham Park Village  
Reading  
Berks RG4 0SJ

Pete Shaw  
15 St Vincent Road  
Clacton-on-Sea  
Essex CO15 1NA

Phillip Joy  
130 Rush Green Road  
Romford  
Essex

Derrick Daines  
18 Cuttings Avenue  
Sutton in Ashfield  
Notts

BJ Candy  
9 Oakwood Drive  
Gloucester GL3 3JF

Susan Kelly  
Head of Reference  
Services  
PO Box 4  
Civic Centre  
Harrow  
Middx

Alan Sutcliffe  
4 Binfield Road  
Wokingham  
Berks RG11 1SL

Rex Shipton  
17 Woodlands Avenue  
Eastcote  
Middx

## USER GROUPS 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*

### International

Laserbug-user group for the BBC Micro. Originally based in London but due to countrywide enquiries is now operating nationally. Monthly magazine, local and larger meetings to be held. Membership £12pa or send £1 for a sample copy of the magazine to: Laserbug, 4, Station Bridge, Woodgrange Road, Forest Gate, London E7 0NF.

'68 Micro user Group. Newly formed. Newsletter planned, regular meetings. Contact: Jim Anderson, 41, Pebworth Road, Harrow, Middx HA1 3UD.

International Electronic Spreadsheet User Group, for all interested in Visicalc, Supercalc and other spreadsheet packages. Information exchange. Membership £15.00 including subscription to Spreadsheet newsletter, published bi-monthly. Details from: InterCalc (UK), Alpha House (7th Floor), Rowlandsway, Manchester M22 5RG.

National Atom User Group: Contact Peter Frost, 18, Frankwell Drive, Potters Green, Coventry CV2 2FB. Quarterly newsletter, software library. Membership £4pa.

### Towns

Basildon Computer Club. Meetings 1st & 3rd Fridays monthly. Contact: Pete Silver, 24, Havengore, Pitsea, Essex SS13 1JT. Tel: Basildon 726141

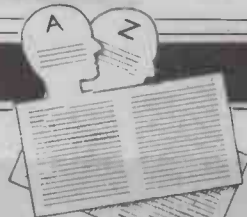
Bournemouth TRS-80/Video Genie User Group. Meetings twice monthly. Contact: D Washford, 1, Alexandra Road, Bournemouth BH6 5JA. Tel: 0202 761122 (day), 0202 423064 (evening).

Is anyone interested in forming a computer club in Caerphilly/Cardiff? If so, please contact me, Nigel, on Caerphilly 884315 after 5pm.

Fife Computer User's Club. Contact: Murray Simpson, 31, Tom Stewart Lane, St Andrews, Fife, KY16 8YB.

Leeds Microcomputer Group-Secretary's new address, 27, Richmond Road, Leeds LS6. Venue for meetings: British Telecom House, Leeds.

Southgate Technical College Computer Club. Meetings, talks and demonstrations welcome, beginner or guru. Contact: Kevin Pretorius, 01-882 2282 (after 6pm) for details.



## 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 H.Q.) 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 to 10.00pm.

Forum-80 London... Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

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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.

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Mailbox-80 Liverpool... 051-220 9733. System Operator: Peter Tootill, Electronic mail, downloading TRS-80 information.

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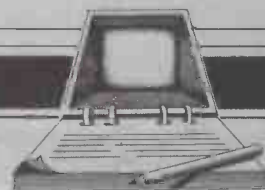
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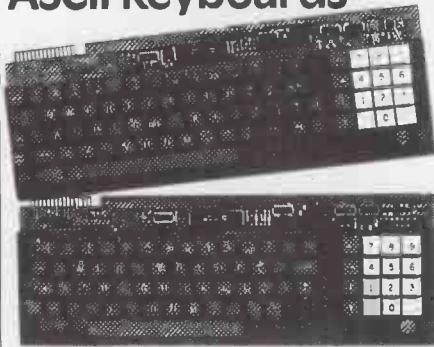
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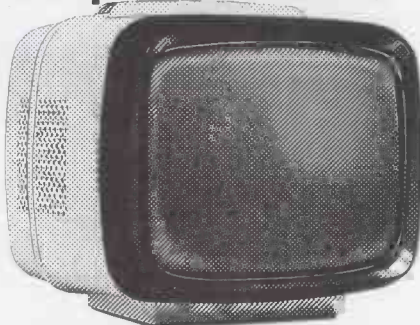
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The machine code inverts a window in the middle of the screen which is used as the scenario for the game. This would be of use in other ZX81 programs especially if one knew machine code and could alter the screen parameters. The use of machine code also means that the program should be saved before it is run.

Instructions are included in the program and these are very complicated — not at all easy to take in at one reading. It is helpful to remember that although you are allowed to input numbers with a decimal point for warp factor, this will spoil the display and make it harder to read. The basic idea is, of course, to blow up as many Klingon ships as possible before running out of energy — which you can replenish by calling at starbases. The program can be made more difficult or easier by changing the distance between bases (line 3510), changing the frequency of Klingon attack (line 3410) or changing the amount of energy available (lines 1050 and 5300).

```

10 REM .....
20 DIM Q$(56)
21 LET Q$="2A0C40060AC50620237EFE7F3804DE80
1802C6807710F123C110EAC9"
22 LET X=16514
23 FOR I=1 TO 28
24 LET N=16*(CODE(Q$(I))-28)
25 LET N=N+CODE(Q$(2))-28
26 POKE X,N
27 LET Q$=Q$(3 TO )
28 LET X=X+1
29 NEXT I
30 RAND
100 DIM C$(6)
110 DIM P$(5)
120 DIM T$(5)
130 DIM S$(4)
140 DIM R$(3)
150 DIM H$(17)
200 LET H$="S T A R T R E K" (inverse video)
210 PRINT AT 5,8;" "
220 PRINT TAB 12;" "
    
```

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## PROGRAMS

```

230 PRINT TAB 13;" "
240 PRINT TAB 13;" "
250 PRINT AT 13,7;
260 FOR I=1 TO 17
270 PRINT H$(I);
280 NEXT I
290 PRINT AT 18,0;"DO YOU WANT INSTRUCTIONS?"
300 INPUT A$
310 IF A$="YES" OR A$="Y" THEN GOSUB 98000
500 REM *DISPLAY*
510 CLS
520 PRINT "thirty two graphics H characters"
530 FOR I=1 TO 9
540 PRINT "graphic H, thirty black squares, graphic H"
550 NEXT I
560 PRINT "nine graphic H, USS ENTERPRISE (inverse video),
    nine graphic H"
570 PRINT " STARDATE 1000";TAB 21;"ENERGY 5000"
580 PRINT "CONDITION GREEN";TAB 21;"SHIELD DOWN"
590 PRINT "WARP 1 VECTOR 1 SENSORS OFF"
600 PRINT "PHASERS READY";TAB 21;"TORPEDOS 10"
610 PRINT "DAMAGE 0";TAB 21;"SCORE 0"
999 REM*INITIALISE*
1000 LET S$="DOWN"
1010 LET C$="GREEN"
1020 LET T$="READY"
1030 LET R$="OFF"
1040 LET P$=T$
1050 LET E=50000
1060 LET W=1
1070 LET D=0
1080 LET DATE=10000
1090 LET E$="thirty two spaces"
1100 LET S=PEEK 16396 +256*PEEK 16397 +35
1110 LET ST1=S
1120 LET ST2=S
1130 LET SS=0
1140 LET SCORE=0
1150 GOSUB 34000
1160 LET SH=0
1180 LET Z$="five spaces"
1190 LET DOCKED=0
1200 LET WB=1
1210 LET WMAX=9
1220 LET NT=10
1230 LET P=1
1240 LET V=1
1250 GOSUB 35000
1260 LET U$="eleven black squares"
2000 REM ** MAIN LOOP **
2010 LET DATE=DATE+1
2020 LET E=E-W*W-SH*10-SS*5-15*(D>0) -5
    
```

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```

2030 IF E<=0 THEN LET E=0.
2040 PRINT AT 11,10;DATE;TAB 28;"four spaces";
      AT 1.1,28;E
2050 IF E=0 THEN GOTO 3200
2100 IF W=0 THEN GOTO 2250
2110 POKE ST1,128
2120 POKE ST2,128
2130 LET ST1=S+INT (RND*9)*33+RND*10
2140 LET ST2=S+INT (RND*9)*33+(RND*10+18)
2150 POKE ST1,151
2160 POKE ST2,151
2170 LET BD=BD+W
2180 IF BV=V THEN LET BD=BD-W*2
2200 IF W<8 OR KV<>V THEN GOTO 2300
2205 IF DK>3 THEN GOTO 2210
2206 LET DK=2
2207 GOSUB 5600
2210 LET DK=DK+2+(W=9)
2220 IF DK>20 THEN GOSUB 3400
2300 LET DK=DK-(DK>0)
2310 IF BD<1 AND NOT DOCKED THEN GOSUB 5000
2400 IF SS AND (DK<3) THEN GOSUB 8200
2500 IF NOT DK THEN GOSUB 9000
2600 IF D=0 THEN GOTO 2700
2610 IF DK THEN LET D=D-1
2620 IF D<1 THEN GOSUB 4030
2630 PRINT AT 15,7;Z$;AT 15,7;D
2700 GOSUB 3000
2800 IF (D>40) AND RND<(W*W/2000+.001) THEN GOSUB 5500
2900 GOTO 2000
2999 REM *****
3000 LET A$=INKEY$
3010 IF A$="" THEN RETURN
3020 IF A$="W" THEN GOSUB 8000
3030 IF A$="S" THEN GOSUB 8100
3040 IF A$="P" THEN GOSUB 7000
3050 IF A$="Z" THEN GOSUB 8500
3060 IF A$="B" THEN GOSUB 8600
3070 IF A$="V" THEN GOSUB 8800
3080 IF A$="T" THEN GOSUB 4100
3090 IF A$="E" THEN GOSUB 4000
3100 RETURN
3200 REM **OUT OF ENERGY**
3210 PRINT AT 19,0;"OUT OF ENERGY.MISSION TERMINATED" (inverse)
3220 LET A$="AN ABSOLUTE DISASTER"
3230 IF SCORE>5 THEN LET A$="TERRIBLE"
3240 IF SCORE>20 THEN LET A$="QUITE GOOD"
3250 IF SCORE>40 THEN LET A$="VERY GOOD"
3260 IF SCORE>60 THEN LET A$="EXCELLENT"
3270 IF SCORE>100 THEN LET A$="KLINGON ZAPPER SUPREME"
3280 PRINT "YOUR PERFORMANCE IS RATED AS"
3290 PRINT A$
    
```

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# PROGRAMS

```

3295 STOP
3400 REM **RESET KLINGONS**
3410 LET DK=INT (RND*10+10)
3420 LET NK=INT (RND*3+1)
3430 LET KV=INT (RND*8+1)
3440 LET C$="GREEN"
3445 PRINT AT 12,10;C$
3450 IF SS THEN PRINT AT 17,0;E$;AT 17,0;"NO
    KLINGONS IN SENSOR RANGE"
3460 RETURN
3500 REM **RESET STARBASE**
3510 LET BD=INT (RND*2000+2000)
3520 LET BV=INT (RND*8+1)
3530 RETURN
3600 REM*PAUSE ROUTINE*
3610 FOR T=1 TO 25
3620 NEXT T
3630 RETURN
3700 REM*CLEAR LINES 20,21**
3710 GOSUB 3600
3720 PRINT AT 20,0;E$;AT 21,0;E$
3730 RETURN
3800 REM *LEAVE STARBASE*
3810 LET DOCKED=0
3820 GOSUB 3500
3830 PRINT AT 2,12;U$;AT 3,13;U$;AT 4,10;U$;
    AT 5,11,U$
3840 RETURN
4000 REM *EMERGENCY REPAIRS*
4005 IF E>D+350 THEN GOTO 4025
4010 PRINT AT 20,0;"NOT ENOUGH ENERGY FOR REPAIRS"
4015 GOSUB 3700
4020 RETURN
4025 LET E=E-350
4030 REM *GENERAL REPAIRS*
4035 IF WMAX=9 THEN GOTO 4060
4040 LET WMAX=9
4045 PRINT AT 18,0;"WARP ENGINES REPAIRED.MAX WARP=9"
4050 GOSUB 3600
4055 PRINT AT 18,0;E$
4060 LET WE=1
4065 LET P=1
4070 LET P$="READY"
4075 LET D=0
4080 IF R$="OUT" THEN LET R$="OFF" (nb. "OUT" is inverse)
4082 IF S$<>"OUT" THEN GOTO 4090 " "
4084 LET S$="DOWN"
4086 LET SH=0
4090 PRINT AT 11,28;"four spaces";AT 11,28;E;AT 13,29;R$;
    AT 14,8;"four spaces";AT 14,8;P$;AT 15,7;" "
4092 PRINT AT 12,28;S$;AT 16,0;E$
    
```

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- A PROLOG program comprises a set of facts and rules about one or more relations. It unifies:
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  - pattern directed rule based programming,
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- Current applications: Expert Systems, Natural Language Understanding, Intelligent Data Bases.
- It is used to teach school children the logic of programming. Teaching material is available.
- micro-PROLOG is a full implementation of PROLOG with with significant extensions:-
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# PROGRAMS

- 4095 RETURN
- 4100 REM \*PHOTON TORPEDOS\*
- 4110 IF NT THEN GOTO 4140
- 4120 PRINT AT 20,0;"NO TORPEDOS"
- 4125 GOSUB 3700
- 4130 RETURN
- 4140 IF DK=0 THEN GOTO 4162
- 4150 PRINT AT 20,0;"TARGET OUT OF RANGE"
- 4155 GOSUB 3700
- 4160 RETURN
- 4162 IF SGC<>"UP " THEN GOTO 4170 (nb 2 spaces in string)
- 4164 PRINT AT 20,0;"SHIELD MUST BE DOWN TO FIRE"
- 4165 PRINT "TORPEDOS"
- 4166 GOSUB 3700
- 4168 RETURN
- 4170 PRINT AT 3,16;"+";AT 5,13;"=";AT 5,19;"=";  
AT 7,16;"-" (nb all symbols in inverse video)
- 4175 PRINT AT 20,0;"TORPEDO SYSTEM ACTIVE"
- 4180 LET K=S+3
- 4190 FOR I=1 TO 5
- 4200 POKE K,147
- 4210 POKE K+1,146
- 4220 POKE K,128
- 4230 POKE K+1,128
- 4240 LET K=K+36
- 4250 NEXT I
- 4260 FOR I=1 TO 4
- 4261 LET UU=USR 16514
- 4262 FOR J=1 TO 1
- 4263 NEXT J
- 4264 NEXT I
- 4270 LET NT=NT-1
- 4280 LET NK=NK-1
- 4281 LET SCORE=SCORE+1
- 4282 PRINT AT 15,28;SCORE
- 4290 IF NT AND NK THEN GOTO 4180
- 4300 PRINT AT 3,16;"■";AT 5,13;"■";AT 5,19;"■";  
AT 7,16;"■"
- 4310 PRINT AT 14,30;" ";AT 14,30;NT
- 4320 IF NK THEN GOTO 4400
- 4330 GOSUB 3400
- 4370 GOSUB 3700
- 4380 RETURN
- 4400 GOSUB 3700
- 4410 PRINT AT 20,0;"TORPEDOS OUT";AT 21,0;NK;  
"KLINGONS LEFT"
- 4415 GOSUB 3700
- 4420 RETURN
- 5000 REM \*\*STAREASE\*\*
- 5010 LET W=0
- 5015 PRINT AT 13,5;W
- 5020 PRINT AT 2,12;"████████"

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# PROGRAMS

```

5030 PRINT AT 3,13;" "
5040 PRINT AT 4,10;">= "
5050 PRINT AT 5,11;" "
5060 IF DK>2 THEN GOTO 5300
5070 PRINT AT 20,0;"DANGER. KLINGON ATTACK"
5080 PRINT AT 2,12;US;AT 3,13;US;AT 4,10;US;AT 5,11;US
5090 LETZ=S+147
5100 LET Z1=Z-36
5110 LET Z2=Z-30
5120 LET Z3=Z+30
5130 LET Z4=Z+36
5140 FOR I=1 TO 4
5150 POKE Z1,151
5160 POKE Z2,8
5170 POKE Z3,6
5180 POKE Z4,0
5190 POKE Z1,128
5200 POKE Z2,128
5210 POKE Z3,128
5220 POKE Z4,128
5230 LET Z1=Z1-36
5240 LET Z2=Z2-30
5250 LET Z3=Z3+30
5260 LET Z4=Z4+36
5270 NEXT I
5275 LET DOCKED=0
5280 GOSUB 3500
5285 PRINT AT 20,0;ES
5290 RETURN
5300 LET E=5000
5305 LET DOCKED=1
5310 LET NT=NT+2*(NT<8)+(NT=9)
5315 PRINT AT 14,30;NT
5320 GOSUB 4030
5325 LET BD=0
5330 RETURN
5500 REM *METEORITE SHOWER*
5510 LET TV=INT (RND*(WMAX/2)+1).
5520 LET WMAX=WMAX-TV
5525 IF WMAX<1 THEN LET WMAX=1
5530 PRINT AT 18,0;"METEORITE SHOWER. DAMAGE TO WARP
    ENGINES. MAX WARP = ";WMAX
5540 GOSUB 3000
5550 PRINT AT 18,0;ES;AT 19,0;ES
5560 IF W<WMAX THEN RETURN
5570 LET W=WMAX
5580 PRINT AT 13,5;W
5590 RETURN
5600 REM *ESCAPED KLINGONS*
5610 LET CG="GREEN"
5620 PRINT AT 12,10;CS
    
```

# MICROMART

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| BAS12K (a 12K BASIC interpreter under NASMON)                           | £20 |
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## PROGRAMS

- 8625 IF SS THEN PRINT AT 17,0;E0;AT 17,0;"NO KLINGONS IN SENSOR RANGE"
- 5630 RETURN
- 6000 REM \*PHASER ROUTINE\*
- 6010 FOR I=1 TO 10
- 6020 NEXT I
- 6030 LET K=S+23
- 6040 FOR I=1 TO 8
- 6050 POKE K,147
- 6060 POKE K+1,146
- 6070 IF INKEY<>" " AND E>50 THEN GOTO 6190
- 6080 POKE K,128
- 6090 POKE K+1,128
- 6100 LET K=K+31
- 6110 NEXT I
- 6120 RETURN
- 6190 LET E=E-50
- 6191 LET UU=USR 16514
- 6192 FOR J=1 TO 2
- 6193 NEXT J
- 6194 LET UU=USR 16514
- 6195 IF K=S+147 THEN GOTO 6300
- 6210 GOTO 6080
- 6301 POKE K,128
- 6302 POKE K+1,128
- 6305 LET NK=NK-1
- 6306 LET SCORE=SCORE+1
- 6307 PRINT AT 15,28;SCORE
- 6310 RETURN
- 7000 REM \*\*PHASERS\*\*
- 7010 IF P THEN GOTO 7040
- 7020 PRINT AT 20,0;"PHASERS ARE OUT"
- 7025 GOSUB 3700
- 7030 RETURN
- 7040 IF NOT DK THEN GOTO 7070
- 7050 PRINT AT 20,0;"TARGET OUT OF PHASER RANGE"
- 7055 GOSUB 3700
- 7060 RETURN
- 7070 IF E>50 THEN GOTO 7100
- 7080 PRINT AT 20,0;"NO ENERGY FOR PHASERS"
- 7085 GOSUB 3700
- 7090 RETURN
- 7100 PRINT AT 3,16;"+";AT 5,13;"=";AT 5,19;"=";  
AT 7,16;"-" (nb inverse video)
- 7105 PRINT AT 14,8;"ARMED";AT 20,0;"PHASERS ARMED AND READY" " "
- 7110 GOSUB 6000
- 7115 PRINT AT 11,28;"four spaces";AT 11,28;E
- 7120 IF E<50 THEN GOTO 7200
- 7130 IF NK=0 THEN GOTO 7150
- 7140 GOTO 7110
- 7150 GOSUB 3400

## ATOM BBC

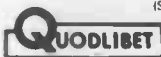
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## PROGRAMS

```

7160 PRINT AT 14,8;"READY"
7180 PRINT AT 3,16;"■";AT 5,13;"■";AT 5,19;"■";
    AT 7,16;"■"
7185 PRINT AT 20,0;E0
7190 RETURN
7200 PRINT AT 20,0;E0;AT 20,0;"ENERGY BANKS DRAINED"
7210 PRINT NK;" KLINGONS LEFT";AT 14,8;"OUT " (nb OUT is inverse)
7215 GOSUB 3700
7220 GOTO 7180
8000 REM *CHANGE WARP*
8005 IF W THEN GOTO 8025
8010 PRINT AT 20,0;"WARP DRIVE OUT OF ACTION"
8015 GOSUB 3700
8020 RETURN
8025 LET OW=W
8030 PRINT AT 20,0;"NEW WARP FACTOR?"
8035 INPUT W
8040 IF W>WMAX THEN GOTO 8070
8045 PRINT AT 13,5;W;AT 20,0;E0
8050 IF OW=0 AND DOCKED THEN GOSUB 3800
8060 RETURN
8070 PRINT AT 20,0;"THE ENGINES WONT TAKE THAT CAP"
8075 GOSUB 3700
8080 GOTO 8030
8100 REM *SHIELD*
8105 IF S0="OUT " THEN GOTO 8170 (nb OUT is inverse)
8110 LET SH=NOT SH
8130 LET S0="DOWN"
8140 IF SH THEN LET S0="UP"
8150 PRINT AT 12,28;S0
8160 RETURN
8170 PRINT AT 20,0;"SHIELD IS OUT OF ACTION"
8180 GOSUB 3700
8190 RETURN
8200 REM *SENSORS DETECT KLINGON
8205 IF DK<>2 THEN GOTO 8230
8210 LET C0="ORANGE"
8220 PRINT AT 12,10;C0
8230 LET TV=KV+4
8240 IF TV>8 THEN LET TV=TV-8
8250 PRINT AT 17,0;NK;" UFOS, ";DK;" LIGHT YEARS,VECTOR ";TV
8260 RETURN
8500 REM **SENSORS**
8510 IF R0<>"OUT" THEN GOTO 8540 (OUT is inverse video)
8520 PRINT AT 20,0;"SENSORS OUT OF ACTION"
8525 GOSUB 3700
8530 RETURN
8540 LET SS=NOT SS
8550 LET R0="OFF"
8560 IF SS THEN LET R0="ON"
8570 PRINT AT 13,29;R0;AT 17,0;E0
8580 IF SS THEN PRINT AT 17,0;"NO KLINGONS IN SENSOR RANGE"
8590 RETURN
    
```

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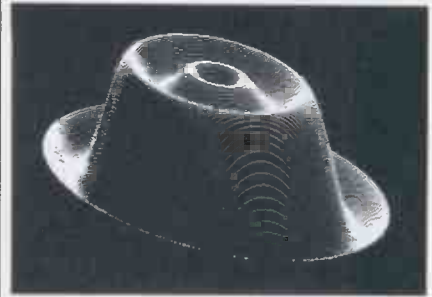
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# PROGRAMS

- 8600 REM \*NEXT STARBASE\*
- 8620 PRINT AT 20,0;"NEAREST STARBASE ";BD;" LIGHT"
- 8625 PRINT "YEARS AT VECTOR ";EV
- 8630 GOSUB 3700
- 8650 RETURN
- 8800 REM\*CHANGE VECTOR\*
- 8810 PRINT AT 20,0;"NEW VECTOR?"
- 8820 INPUT V
- 8825 LET V=INT V
- 8830 IF V>0 AND V<9 THEN GOTO 8850
- 8840 GOTO 8820
- 8850 PRINT AT 13,16;V;AT 20,0;E0
- 8860 RETURN
- 9000 REM \*\*KLINGON ATTACK
- 9010 LET C0="RED" (inverse video)
- 9020 PRINT AT 12,10;C0
- 9025 IF DOCKED THEN GOSUB 5000
- 9030 LET K=S+21
- 9040 FOR I=1 TO 5
- 9050 POKE K,147
- 9060 POKE K+1,146
- 9070 POKE K,128
- 9080 POKE K+1,128
- 9090 LET K=K+64
- 9100 NEXT I
- 9110 FOR I=1 TO NK\*2
- 9120 LET UU=USR 16514
- 9130 FOR J=1 TO 2
- 9140 NEXT J
- 9150 NEXT I
- 9160 GOSUB 9200
- 9170 RETURN
- 9200 REM\*CALCULATE DAMAGE\*
- 9210 LET D=D+NK\*(20+20\*(NOT SH))
- 9215 PRINT AT 15,7;D
- 9220 IF D>=400 THEN GOTO 9300
- 9230 LET TV=INT (D/100)
- 9240 GOTO 9700-100\*TV
- 9300 LET W=0
- 9310 LET W=0
- 9320 PRINT AT 13,5;W;AT 16,0;"WARP ENGINES OUT" (OUT is inverse)
- 9400 LET P=0
- 9410 LET P0="OUT" (inverse)
- 9420 PRINT AT 14,8;P0
- 9500 LET S0="OUT" (inverse)
- 9510 LET SH=0
- 9520 PRINT AT 12,28;S0
- 9600 LET SS=0
- 9610 LET R0="OUT" (inverse)
- 9620 PRINT AT 13,29;R0;AT 17,0;E0
- 9700 RETURN
- 9750 REM \*NEXT PAGE\*

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## PROGRAMS

```

9760 PRINT AT 21,Ø;"PRESS ANY KEY TO CONTINUE." (inverse)
9770 IF INKEYØ="" THEN GOTO 977Ø
9780 CLS
9790 RETURN
9800 REM *INSTRUCTIONS*
9802 CLS
9804 PRINT "YOU ARE IN COMMAND OF STARSHIP"
9806 PRINT "ENTERPRISE. YOUR MISSION IS TO"
9808 PRINT "DESTROY KLINGON BATTLE CRUISERS"
9810 PRINT "IN THIS QUADRANT OF THE GALAXY."
9812 PRINT "YOU ARE ARMED WITH PHASERS AND"
9814 PRINT "PHOTON TORPEDOS. TORPEDOS CAN"
9816 PRINT "ONLY BE FIRED IF YOUR SHIELD IS"
9818 PRINT "DOWN, AND YOU HAVE A LIMITED"
9820 PRINT "SUPPLY, BUT THEY NEVER MISS."
9822 PRINT "PHASERS ARE FIRED BY YOU, AND"
9824 PRINT "SOMETIMES MISS.THEY USE 50 UNITS"
9826 PRINT "OF ENERGY PER SHOT. IF YOU RUN"
9828 PRINT "OUT OF ENERGY THE MISSION ENDS."
9830 PRINT "ENERGY DRAINS ARE LIFE SUPPORT"
9832 PRINT"(CANNOT BE SWITCHED OFF), WARP"
9834 PRINT "DRIVE (HIGH SPEED USES MORE"
9836 PRINT "ENERGY), SENSORS (IF ON), SHIELD"
9838 PRINT "(IF ON), AND DAMAGE REPAIR."
9840 PRINT "DAMAGE IS SUSTAINED AS A RESULT"
9842 PRINT "OF KLINGON ATTACK AND IS WORSE"
9844 PRINT "IF UNSHIELDED.IF MORE THAN 100"
9846 GOSUB 975Ø
9848 PRINT "UNITS, SENSORS ARE LOST;>200 -"
9850 PRINT "SHIELD IS LOST; >300 - PHASERS"
9852 PRINT "ARE LOST;>400 - WARP DRIVE LOST."
9854 PRINT "FUNCTIONS ARE NOT RESTORED UNTIL"
9856 PRINT "DAMAGE IS <10 UNITS, OR UNLESS"
9858 PRINT "YOU REQUEST EMERGENCY REPAIR"
9860 PRINT "(USES A LOT OF ENERGY), OR UNTIL"
9862 PRINT "YOU DOCK AT A STARBASE. EACH"
9864 PRINT "STARBASE CAN REFUEL ONLY ONE"
9866 PRINT "SHIP, SO YOU WILL NEED TO CALL"
9868 PRINT "AT SEVERAL DURING A LONG"
9870 PRINT "MISSION, BUT DO NOT LEAD THE"
9872 PRINT "KLINGONS THERE OR THE BASE WILL"
9874 PRINT "BE DESTROYED."
9876 PRINT "COMMANDS ARE GIVEN BY PRESSING"
9878 PRINT "A CERTAIN KEY (YOU MAY HAVE TO"
9880 PRINT "WAIT A FEW SECONDS BEFORE THE"
9882 PRINT "SHIPS COMPUTER OBEYS)."
```

```

9884 PRINT "OPTIONS ARE :-"
9886 GOSUB 975Ø
9888 PRINT "S CHANGE SHIELD STATUS"
9890 PRINT "Z CHANGE SENSOR STATUS"
9892 PRINT "W CHANGE WARP FACTOR (Ø TO 9)"
9894 PRINT "V CHANGE VECTOR(DIRECTION 1-8)"

```

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- 9890 PRINT "Z CHANGE SENSOR STATUS"
- 9892 PRINT "W CHANGE WARP FACTOR (Ø TO 9)"
- 9894 PRINT "V CHANGE VECTOR(DIRECTION 1-8)"
- 9896 PRINT "E DO EMERGENCY REPAIRS"
- 9898 PRINT "T FIRE PHOTON TORPEDOS"
- 9896 PRINT "E DO EMERGENCY REPAIRS"
- 9898 PRINT "T FIRE PHOTON TORPEDOS"
- 9900 PRINT "P ARM PHASERS. YOU THEN FIRE BY"
- 9902 PRINT " PRESSING ANY KEY (HOLD DOWN"
- 9904 PRINT " FOR CONTINUOUS FIRE."
- 9906 PRINT "B GIVES DISTANCE AND DIRECTION"
- 9908 PRINT " OF NEXT STARBASE."
- 9910 PRINT "VECTORS ARE :-"
- 9912 PRINT " 1"
- 9914 PRINT " 8 2"
- 9916 PRINT " 7 3"
- 9918 PRINT " 6 4"
- 9920 PRINT " 5"
- 9922 PRINT "AT WARP 8 OR 9 YOU CAN OTRUN"
- 9924 PRINT "KLINGONS FROM THE OPOSITE"
- 9926 PRINT "DIRECTION. EG. IF THEY COME FROM"
- 9928 PRINT "VECTOR 2, YOU MUST TAKE VECTOR 6"
- 9930 GOSUB 975Ø
- 9932 PRINT "THE DISPLAY SHOWS THE MAIN"
- 9934 PRINT "SCREEN AND INSTRUMENT PANEL OF"
- 9936 PRINT "THE ENTERPRISE. YOU MUST KEEP"
- 9938 PRINT "ALERT FOR ATTACKS BY KLINGONS"
- 9940 PRINT "(WHO LOOK LIKE <>) AND TRY TO"
- 9942 PRINT " CONSERVE ENERGY SO AS TO REACH"
- 9944 PRINT "THE NEXT STARBASE."
- 9946 PRINT "IF SENSORS ARE ON, YOU GET A"
- 9948 PRINT "WARNING OF KLINGONS NEARBY"
- 9950 PRINT
- 9952 PRINT
- 9954 PRINT "GOOD LUCK CAPTAIN."
- 9956 GOSUB 975Ø
- 9958 RETURN

## PET Knockout

by Paul Bradshaw

This is an application program which will organise and control a knockout tournament for any number of players. The author tells me that it was written for an Egg-Jarping contest at Easter but readers will have to use their imagination on what exactly this involves, as no further explanation was offered!

Players are entered either through

the keyboard or from a previous record on tape. The ability to save competitors' names on tape is useful if several tournaments are being held using the same players. A printed list of competitors can also be obtained.

When all the players' names have been entered, the computer will allocate matches at random. The user is asked to

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## PROGRAMS.

input all the results and the winner is eventually decided.

This program will run on any PET—it was developed on the 3.0 ROM. Some POKEs will have to be added to the

tape file routines for 'old ROM' PETs and these are detailed in the latest manual.

Listing courtesy of Mr S Warner.

```

100 A=RND(0)
110 PRINT"J"TAB(16)"KNOCKOUT
120 PRINTTAB(16)"
130 PRINT"PLEASE CHOOSE YOUR OPTION:
140 PRINT"
150 PRINT"01. INPUT COMPETITORS FROM KEYBOARD
160 PRINT"02. INPUT COMPETITORS FROM CASSETTE
170 PRINT"03. STORE COMPETITORS ON CASSETTE
180 PRINT"04. PRINT OUT LIST OF COMPETITORS
190 PRINT"05. CARRY OUT KNOCKOUT COMPETITION
200 PRINT"06. EXIT TO BASIC
210 PRINT"WHICH ONE DO YOU WANT?
220 GETH$:H=VAL(H$):IFH<10RH>6THEN220
230 IFH=6THENPRINT"J";END
240 ONHGO SUB260,390,550,660,810
250 GOTO110
260 REM *** ENTER COMPETITORS FROM KEYBOARD ***
270 CLR
280 PRINT"HOW MANY COMPETITORS? ";
290 GOSUB1420:NC=A
300 IFNC<2THEN280
310 DIMC$(NC),X$(NC),Y$(NC/2+1),B$(SGR(NC)+1),F(NC)
320 PRINT"J";
330 FORJ=1TONC
340 PRINT"TYPE NAME OF COMPETITOR"J":
350 GOSUB1420:C$(J)=A$
360 FORK=1TOJ-1:IFC$(K)<>A$THENNEXT
370 IFK<JTHENPRINT"SAME NAME ENTERED TWICE!":GOTO340
380 NEXTJ:GOTO110
390 REM *** INPUT COMPETITORS FROM CASSETTE ***
400 GOSUB1460
410 PRINT"TYPE FILE NAME OR * TO USE
420 PRINT"FIRST FILE FOUND: ":GOSUB1420
430 IFLEN(A$)>10THENPRINT"MAXIMUM LENGTH
IS 10 CHARACTERS!J":GOTO410
440 F$="K:"+CHR$(1):IFA$<>"*"THENF$=F$+A$
450 PRINT:OPEN1,1,0,F$
460 PRINT"THE FILE HAS BEEN FOUND.
470 INPUT#1,NC:CLOSE1
480 POKE16,INT(NC/256):POKE15,NC-256*PEEK(16)
490 CLR
500 NC=PEEK(15)+256*PEEK(16)
510 DIMC$(NC),X$(NC),Y$(NC/2+1),B$(SGR(NC)+1),F(NC)
520 OPEN1
530 FORJ=1TONC:INPUT#1,C$(J):NEXT
540 CLOSE1:GOTO110
550 REM *** STORE COMPETITORS ON CASSETTE ***
560 IFNC=0THENRETURN
570 GOSUB1460
580 PRINT"TYPE FILE NAME: ":GOSUB1420
590 IFLEN(A$)>10THENPRINT"MAXIMUM LENGTH
IS 10 CHARACTERS!J":GOTO580
600 F$="K:"+CHR$(1)+A$
610 PRINT:OPEN1,1,1,F$
620 PRINT#1,NC
630 CLOSE1:OPEN1,1,1
630 CLOSE1:OPEN1,1,1
640 FORJ=1TONC:PRINT#1,C$(J):NEXT

```

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# PROGRAMS

```

650 CLOSE1:RETURN
660 REM *** PRINT LIST OF COMPETITORS ***
670 IFNC=@THENRETURN
680 PRINT"OPRESS 'SPACE' TO CONTINUE AFTER EACH
690 PRINT"OSCREENFUL OF NAMES.
700 PRINT"OPRESS 'SPACE' FOR LISTING...
710 GETH$:IFH#<>" THEN710
720 PRINT"J"
730 FORJ=1TONC
740 PRINT"Q"J":TAB(6)C$(J)
750 IFJ/11>INT(J/11)THEN770
760 GETH$:IFH#<>" THEN760
770 NEXT
780 PRINT"OPRESS 'SPACE' TO CONTINUE...
790 GETH$:IFH#<>" THEN790
800 RETURN
810 REM *** CARRY OUT COMPETITION ***
820 IFNC=@THENRETURN
830 PRINT"QWHEN THE MATCHES ARE BEING PRINTED OUT,
840 PRINT"OPRESS 'SPACE' TO CONTINUE AFTER EACH
850 PRINT"OSCREENFUL OF INFORMATION.
860 PRINT"QWHEN ENTERING THE WINNERS OF EACH MATCH,
870 PRINT"PRESS 31 OR 32 TO INDICATE WHICH
880 PRINT"OCOMPETITOR WON.
890 PRINT"OPRESS 'SPACE' TO CONTINUE...
900 GETH$:IFH#<>" THEN900
910 PRINT"J"
920 BP=0
930 FORJ=1TONC:X$(J)=C$(J):NEXT
940 N=NC:B=0:R=1
950 FORJ=1TON:P(J)=0:NEXT:B=0
960 PRINT"ROUND"R"MATCHES":P=POS(0):PRINT
970 FORJ=1TOP:PRINT" ":NEXT:PRINT
980 IFN/2=INT(N/2)THEN1040
990 B=INT(RND(1)*N)+1:IFBP=@THEN1020
1000 FORJ=@TOBP-1:IFB$(J)=X$(B)THEN990
1010 NEXT
1020 B=X$(B):B$(BP)=B$:BP=BP+1
1030 P(B)--1
1040 FORJ=1TON/2
1050 X=INT(RND(1)*N)+1:IFP(X)=@THEN1050
1060 Y=INT(RND(1)*N)+1:IFX=YORP(Y)=@THEN1060
1070 P(X)--1:P(Y)--1
1080 IFX<YTHENP(X)=Y
1090 IFY<XTHENP(Y)=X
1100 NEXT
1110 CN=0:P=1:FORJ=1TON/2
1120 IFP(P)--1THENP=P+1:GOTO1120
1130 X=X$(P):Y=X$(P(P)):P=P+1
1140 PRINT"Q"TAB(16-LEN(X$))X$  QVERSUS  "Y$:CN=CN+1
1150 IFCN/10>INT(CN/10)THEN1170
1160 GETH$:IFH#<>" THEN1160
1170 NEXT
1180 BB$=B$+" HAS A BYE"
1190 IFB>@THENPRINT"Q"TAB((40-LEN(BB$))/2+1)BB$
1200 PRINTTAB(6)"OPRESS 'SPACE' TO CONTINUE...
1210 GETH$:IFH#<>" THEN1210
1220 PRINT"CENTER WINNERS OF ROUND"R":P=POS(0)-1
1230 PRINT"FORJ=1TOP:PRINT" ":NEXT
1240 PRINT
1250 P=1:FORJ=1TON/2
1260 IFP(P)--1THENP=P+1:GOTO1260
1270 X=X$(P):Y=X$(P(P))
    
```

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## PROGRAMS

```

1280 FRINT"Q#1# "X#" OR Q# "Y#TAB(35)
1290 GETH#:IFH#<>"1"ANDH#<>"2"THEN1290
1300 FRINTH#
1310 IFH#="1"THENY#(J)=X#(P)
1320 IFH#="2"THENY#(J)=X#(P<P))
1330 P=P+1:NEXT
1340 IFB>0THENY#(J)=B#
1350 N=INT(N/2+.5)
1360 FORJ=1TON:X#(J)=Y#(J):NEXT
1370 IFN>1THENR=R+1:GOTO950
1380 PRINT"THE WINNER IS:"X#(1)
1390 PRINT"PRESS 'SPACE' TO CONTINUE..."
1400 GETH#:IFH#<>" "THEN1400
1410 RETURN
1420 REM *** INPUT SUBROUTINE ***
1430 OPEN1,0:INPUT#1,A#:PRINT:CLOSE1
1440 A=VAL(A#)
1450 RETURN
1460 REM *** CASSETTE POSITIONING ROUTINE ***
1470 PRINT"INSERT AND CORRECTLY POSITION CASSETTE
1480 PRINT"AND BE USED, THEN PRESS ANY KEY."
1490 GETH#:IFH#=""THEN1490
1500 IFPEEK(59411)=61THENRETURN
1510 PRINT"PRESS 'STOP' ON THE CASSETTE DECK."
1520 IFPEEK(59411)<61THEN1520
1530 RETURN
READY.

```

## PET Trains

by Jeff Aughton

Trains is great fun to play, and not just for children. A grid on the screen defines a track on which run an increasing number of trains. The player's job is to control these little trains and stop them hitting either each other or the buffers. Just to make things interesting, random

closures of junctions have been thrown in as well. It is by no means an easy game to play, and it's unlikely that readers who key in this game will ever last longer than four minutes or so. As a program it is easy and clear to follow. It was tested on a 3022 PET.

```

100 DIMA$(12),PX(18),TX(8,3)
150 GOSUB9000
160 F=0:M=1:U=1:X=160:Y=160:Z=32768
200 I#=""
210 A$(0)=""
220 A$(1)=""
230 A$(2)=""
240 A$(3)=""
250 A$(4)=""
260 A$(5)=""
270 A$(6)=""
280 A$(8)=""
290 A$(9)=""
300 A$(10)=""
310 A$(11)=""
320 A$(12)=""
330 Z#="0":FORI=1TO39:Z#=Z#+1"
340 NEXT Z#:Z#=Z#+1"
350 IFV<.2THENA$(2)=""
360 IFV<.4THENA$(8)=""
400 FORI=1TO8:TX(I,1)=200:TX(I,2)=-1
410 TX(I,3)=X:NEXT
500 PRINT"Q#":FORI=1TO3
510 GOSUB7000:FORJ=1TO6

```

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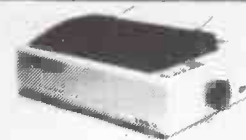
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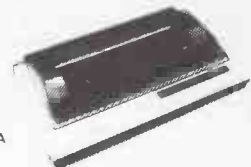
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## PROGRAMS

```

520 GOSUB7100:PRINT"Q " :NEXTJ,I
530 GOSUB7000
540 POKE32849,233:POKE32885,223
550 POKE33689,95:POKE33725,105
560 FORI=0TO10:READJ:POKE2+J,96:NEXT
580 FORI=65TO82:K#=CHR#(I)
610 GOSUB7200:IFP%(A)=5THENNEXT
620 IFRND(1)<.5THENP%(A)=12-P%(A)
630 PRINT"Q";K#;"*";A#(P%(A)):NEXT
640 PRINT"*****"
650 B=TI
1000 T=TI
1010 GETK#:IFK#<"A"OR"K">"R"THEN2000
1020 GOSUB7200:P%(A)=12-P%(A)
1030 PRINTA#(P%(A))
2000 I=T%(U,2):P=2+T%(U,1):K=T%(U,3)
2010 IFK#>THEN2050
2020 IFK#>YORK=1700RK=32THEN6000
2040 D=40/D:IFKAND32THEND=-D
2050 T%(U,2)=D:POKEP,T%(U,3)
2060 IFPEEK(P+D)=96THENT%(U,2)=SGN((UAND1)
-.5)*40/D:GOTO2000
2070 P=P+D:T%(U,3)=PEEK(P):POKEP,Y
2080 T%(U,1)=T%(U,1)+D
2090 FORI=1TO100/M-7*M:NEXT
2100 U=U+1:IFU>MTHENU=1
2110 IFTI-T<800*(1+RND(1))THEN1010
2115 IFTI-B>14400THEN6300
2120 IFFTHEN5200
2130 IFRND(1)<.5VTHENGOSUB5000
2140 M=M-(M/2):GOTO1000
4000 FORI=0TO12:PRINT"Q";TAB(I)K#
4010 FORJ=1TO110:NEXTJ,I
4020 PRINT:RETURN
4500 GETK#:IFK#<">" THEN4500
4510 PRINT"Q":RETURN
5000 Q=6-5*(RND(1)<.5)+INT(3*RND(1))
5010 K#=CHR#(Q+64):P=1
5020 PRINTZ#:" POINTS AT ";K#:" CLOSING DOWN SOON!!!"
5030 PRINT"*****"
5040 GOSUB7200:PRINT"Q";K#:RETURN
5200 PRINTZ# : IFF=2THEN5400
5210 A=Q:GOSUB7205:PRINTA#(6)
5220 P%(A)=6:F=2:GOTO1000
5400 F=0:A=Q:P%(A)=0
5410 PRINT"POINTS NOW CLEAR"
5420 GOSUB7205:PRINTA#(0):GOTO1000
6000 B=INT((TI-B)/60)
6010 PRINTZ#:"CRAAAASH!!!!"
6020 S=37:FORI=0TO9:RESTORE:FORJ=1TO9
6030 READC:POKEP+C,S+I:NEXTJ,I
6040 FORI=1TO1000:NEXT
6050 PRINT"YOU SURVIVED FOR";B;"SECONDS"
6060 PRINT"YOUR SCORE IS";INT(100*(B/240)+(1-V))%"Z"
6070 PRINT"PLAY AGAIN (Y/N)?"
6080 GETK#:IFK#="N"THENEND
6090 IFK#<"Y"THEN6000
6100 RESTORE:GOSUB9500:GOTO160
6300 FORI=0TO2000:NEXT
6310 PRINT"YOU LASTED OVER FOUR MINUTES!!!!!!!"
6320 PRINT"DO BRITISH RAIL KNOW ABOUT YOU ?"
6330 GOTO6070
7000 PRINT"!!";FORJ=1TO37
7010 PRINT"Q " :NEXT:PRINT:RETURN
    
```

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# PROGRAMS

READY

```

7020 S=36:FORI=0T09:RESTORE:FORJ=1T09
7030 READC:POKEP+C,S:NEXTJ
7040 S=79-S:NEXTI
7100 PRINT"||||":FORK=1T04
7110 PRINT"||||":NEXT:RETURN
7200 A=ASC(K#)-64
7205 R=INT(A/5):C=9*(A-5*R)
7210 PRINTLEFT$(D#,2+7*R):SPC(C):
7220 RETURN
8000 DATA -41,-40,-39,1,41,40,39,-1,0
8100 DATA 1,1,5,5,5,0,0,0,5
8110 DATA 2,5,0,5,3,5,4,5,4
8200 DATA 1,1,1,5,5,0,5,0,3
8210 DATA 2,0,0,5,5,5,5,4,4
8300 DATA 1,1,1,5,2,0,0,0,3
8310 DATA 2,0,0,0,3,5,4,4,4,0
8400 DATA 50,59,68,200,360,398
8410 DATA 640,678,970,979,988
9000 PRINT"|||||
9010 K#=" TRAINS":GOSUB4000
9020 K#=" " :GOSUB4000:PRINT
9030 K#=" BY J.AUGHTON":GOSUB4000
9040 PRINT"|||||ALWAYS PRESS THE SPACE BAR WHENEVER YOU"
9050 PRINT"|||||ARE READY TO PROCEED TO THE NEXT PAGE"
9060 GOSUB4500
9310 PRINT"TRY TO CONTROL THE TRAINS(##) AS THEY GO"
9320 PRINT"ROUND THE SYSTEM . EACH OF THE POINTS"
9330 PRINT"IS LABELLED WITH A LETTER A-R.YOU CAN"
9340 PRINT"SWITCH THE POINTS BY PRESSING THE KEY"
9350 PRINT"HAVING THE SAME LETTER.KEEP THEM MOVING"
9360 PRINT"AS LONG AS YOU CAN!!"
9370 PRINT"IN THE EVENT OF ANY ACCIDENTS,THE GAME"
9380 PRINT"STOPS AND YOUR SCORE IS GIVEN"
9390 PRINT"AT IRREGULAR INTERVALS SOME POINTS MAY"
9400 PRINT"CLOSE FOR A WHILE FOR REPAIRS.KEEP AN"
9410 PRINT"EYE ON THE TOP OF THE SCREEN FOR DETAILS"
9420 GOSUB4500
9500 PRINT"|||CHOOSE DIFFICULTY LEVEL 1,2 OR 3"
9505 PRINT"1=EASY...3=HARD-YOUR CHOICE":
9510 INPUT"|||. ||||":K#:V=ASC(K#)-48
9520 IFV<1ORV>3THEN9505
9530 FORI=1T09+18*(V-1):READS:NEXT
9540 FORI=1T018:READP%(I):NEXT
9550 FORI=0T018*(3-V):READS:NEXT
9560 N=2+2*V:V=V/7:RETURN
    
```

## POSITRON 9000

Continued from page 134

good in places, obscure in others and occasionally out of date elsewhere. As with much technical documentation, a fairly creative approach should be adopted to its interpretation, although a first-time user would have a bit of trouble dealing with some of the terms which were introduced without much

explanation (eg, recursion).

The manuals covered the following major topics : OS-9, Basic09, Pascal, CIS Cobol, the interactive assembler and debugger, the text editor, Stylographic and system programming.

## Multi-user Benchmarks

We had a certain amount of trouble with the multi-user Benchmarks owing

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# POSITRON 9000

Continued from previous page

to the restriction of four concurrent processes per memory management unit. Regular PCW readers will remember these tests, introduced in February 1981. They include a processor test (actually Basic BM7 above) and two disk access tests which write and read 100 128-byte records to and from the disk, in the first case opening and closing the file after each read/write; in the second using only a single open and close for all writes and reads. These are designed to look at filing system overheads and record locking schemes. Finally the I/O test lists the printable ASCII subset 100 times. The disk tests utilised the winchester disk.

In the event, it was not possible to observe any degradation in performance although equally we were disappointed not to be able to run more than two tasks simultaneously on the review system (with an additional terminal attached).

The timings appear below:

|                   | 1 User | 2 Users |
|-------------------|--------|---------|
| Processor         | 19.0   | 36.4    |
| Disk (single R/W) | 67.7   | 134.4   |
| Disk (100 R/W)    | 8.4    | —       |
| I/O               | 56.0   | 102.1   |

Attempts to get more processes running resulted in a memory full error which is a pity since we wouldn't have

mindful waiting if the tasks could have been queued.

## Conclusions

The Positron 9000 is a flexible, well-built multi-user system that runs a Unix-influenced operating system, OS-9. It has an unconventional but powerful Basic compiler, a Pascal compiler and CIS Cobol. There is a word-processing package and the promise of a record management system, a suite of accounting software and a C compiler. It can take up to 512 kbytes of RAM and 256 kbytes of ROM, has up to 12 RS232 ports, an IEEE-488 bus, floppy and hard disks, and a network.

However, we believe it is based on a faulty design philosophy: in the days of cheap processors, a lot of hardware and software has been made dependent on a single, slow 8-bit processor. The basic system is more expensive than its competitors because it has so much built-in potential for expansion, yet for many applications requiring the extra resources the processor is likely to run out of power. Nevertheless, applications which may not be processor bound and which can exploit the low-cost multi-tasking software, perhaps in the field of process and industrial control, could find the Positron has few real competitors.

END

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# PERSONAL PEARL

Continued from page 164

would be clumsy to use on a system with small disks — even on a system with ½ Mb disks I couldn't get all the programs on one disk. My review copy was supplied by Pearl Software International (UK) of Poole, the UK importer — the software originates in the USA.

## Conclusions

Considered as a data management system Pearl has several advantages. It provides quite straightforward facilities for novice users, and should enable them to design and implement a simple file management system fairly easily. Accessing information in related files is well catered for and much less limited in its scope than in some of Pearl's competitors. The methods of data storage should be quite economical in that Pearl does not need to reserve the maximum

permitted field length for every field in a record, and stores only the data which is actually there.

On the other hand, the way the data dictionary which permits these goodies has been implemented means that the user cannot decide, after the data file is set up, to index on extra fields. The selection facilities are rather restricted, and the one-to-one connection between screen display (for data entry and updating) and data file could be a serious drawback in many applications.

Finally — you either like menu-driven systems or you don't; I prefer them to command-driven systems only if they permit the user who has gained some experience to override the menu options completely, so I think people might get irritated with this aspect of the Pearl user image as they get experienced with the package.

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# THE ULTIMATE TEST?

Continued from page 141

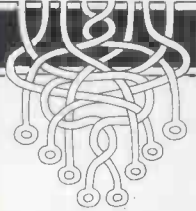
Finally, the Pascal program published in *Byte* is, in fact, a UCSD Pascal version, utilising FILLCHAR and the function SIZEOF to initialise the Boolean array. Gilbreath regarded as legitimate the use of such implementation-dependent features for his comparisons but we have produced a 'plain' Pascal program to compare with the Fortran and Basic ones. Nevertheless, it is interesting to note that the LSI-11 timing quoted in the articles (for a Terak running UCSD Version II) at

317 sec is 156 per cent slower than our system. Table 1 shows the timings of the programs. The benchmark programs are also listed.

As expected, the UCSD Pascal version runs faster but takes longer to compile (probably due to the need to reference the library more extensively). True to its reputation, the Fortran compiler is fast, but its code does not run quite so quickly as the Pascal versions.

## LEISURE LINES

by J J Clessa



We received 160 entries to the July Puzzle. Quite a few got the answer wrong, although again many people complained that it was too easy. There's no satisfying some folks!

The answer was 5000 since  $300^3 - 2 \text{ million} = 5000^2$

The winner, chosen at random, was Mr Stephen Bennington of Clifton, Bedfordshire. Congratulations, Mr B your prize will be on its way forthwith — if not sooner.

## Quickie

No answers, no prizes. If it takes four men eight days to dig four holes, how

long does it take one man to dig half a hole? The answer is not four days.

## Prize puzzle

This should test your micros! A certain number, greater than 5000 but less than 50,000, when divided by four gives a remainder of three; when divided by five gives a remainder of one; when divided by seven gives a remainder of two; when divided by 11 gives a remainder of 2 and when divided by 17 gives a remainder of 12. What is that number?

Answers, on postcards only, please to: October Prize Puzzle, *PCW*, 62, Oxford Street, London W1A 2HG to arrive not later than 31 October 1982.

## BLUDNERS

Readers will remember the article 'Pouring Quarts Into Pint Pots' which we published in June *PCW*. We have to admit that we made rather a dog's dinner of it and, in fact, left the piece out of the contents page altogether. It was, actually, on page 149. Adding insult to injury, the author's name did not appear beneath the title (or anywhere else on the page!) and so we'll apologise here instead to Erwin Schneider for this mistake.

There were also three little slip-ups in the text and these are as follows: At the end of paragraph four the number

195,000 should read 105,000; in the fourth paragraph from the end the text refers to 'altering the value of 1' the '1' should be 'I' and finally in the program listing (line 330) the first character before the '=' should be a 'k'.



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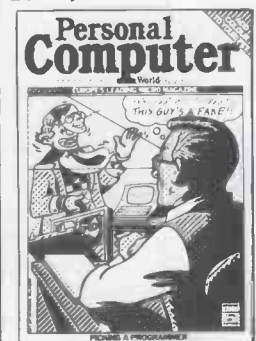
**Volume 3 No 12**  
December 1980  
Benchmark: Microwriter/Printerfac: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat &

Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon Benchmark: Raand SP1

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Benchmark: Transam Tuscan/Real-time control using trains — part 1/Recover from a data tape disaster/PET Music Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram



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Benchmark: Onyx C8002/Multi-user Benchmark: MP/M/Benchmark: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchmark: Wordpro 4 plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.



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Benchmark: Pascal 640/WP Benchmark: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers

on micros/Apple music-making/Multi-user Benchmark: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.



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**Volume 4 No 7**  
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Benchmark: Sharp PC-3201/Multi-user Benchmark: Acorn Econet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchmark: Format-80/Pascal Benchmarks: readers' letters/Quicker Casio computations/Programs: ZX80 Sliding Letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX91 Sketch Pad.

**Volume 4 No 8**  
August 1981

Benchmark: Tandy Model III/Viewdata update/WP Benchmark: Spellbinder/Printer survey/Micro-holism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Foot ball.



**Volume 4 No 9**  
September 1981  
Benchmarks: Tandy Color Computer, Commodore VIC/Checkouts: Hi-Tech Speakeasy, Tanelt/Multi-user Benchmark: HMSOS/



WP Benchmark: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printer facing extra/Calc Corner: Casio fx602p review/Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.



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Benchmark: OKI if-800/Checkouts: Heuristics speech link, Softy 2/Calc Corner: Texas TI51-111/Jeff Taylor on computer literacy projects/Introducing TJ's Workshop/Control your own Substation pt 1/Programs: TRS-80 Sailing.

**Volume 4 No 11**  
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Benchmarks: 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.



**Vol 4 No 12**  
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Benchmarks: Sharp MZ-80B Philips P2000/School network/ BBC Micro inside story/ 'Turtle' Graphics for Apple/ Forth language/ Curve fitting/ Calc corner: HP14C review/ Programs: PET Fantasy, ZX81 Battleships and cruisers.



**Vol 5 No 1** January 1982  
Benchmarks: BBC Micro, Xerox 820/Frames of Reference (new series)/ ZX81 Printer Checkout/ Digital Drummer for PET/ Calc Corner: Benchmarks/ Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.

**Vol 5 No 2** February 1982  
Benchmarks: Sirius-I, Casio fx-9000p, Gemini Multiboard/Word Processor Benchmark: Scripsit 2.0/ Plotter Checkout: Watanabe/Hardware feature: High Density VDU card project/Music system: FREQUOT/Calc Corner: Aerial Navigation/Programs: Pet Haemophilia, Pet Cheese, TRS-80 Extra, Sharp PC1211 Exam, Personality test.

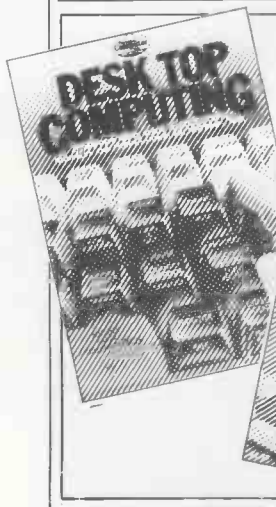
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Volume 5 No 4  
 April 1982  
 Benchtest: Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/Generating screen forms/Comal/Logo/Brain Dump-New series/Calc Corner:

Casio FP-10 printer/Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.



Vol 5 no 5 - May 1982  
 Benchtests: Apple III, Hitachi Peach/Database Benchtest: dBase II/3D Graphics Made Easy/Equation Solving/Calc Corner: fx 602 quirks/Programs: PET Mini-Animate, MZ-80K Catch, Apple Maze, Atari Sums For Kids, ZX81 Book Index, PET Stockmarket, Microtan 3D Rotation, Extra for MZ-80K, UK101 Crossword Notepad. With free Word Pro-

cessing Supplement containing a summary of all PCW's WP Benchtests.

Vol 5 No 6.  
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 Benchtests: Sharp MZ-80A/ZX Spectrum/Database Benchtest: DBMS2/West Coast Faire Report/Lisp/VIC 20 games/Calc Corner: Sharp PC1500/



Programs: RML Altered Basic/VIC-20 Large Characters/BBC Breakout/VIC-20 Trailblazer/MZ-80K 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.

Vol 5 No 8  
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 Benchtests: Sord M23/



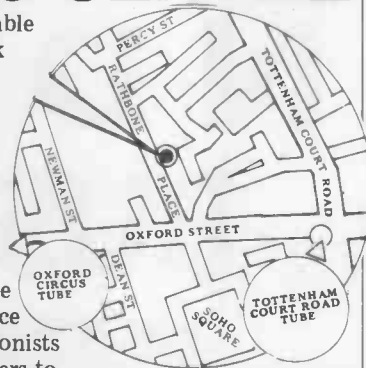
Dragon 32/Database Benchtest: Cardbox/Preview: Sony SMC-70/UCSD p-System/R/S232 Interface/Sirius graphics/NGC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/Apple Trees/Nascom Snail Racing/UK101 Long Multiplication & addition.

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 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/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.



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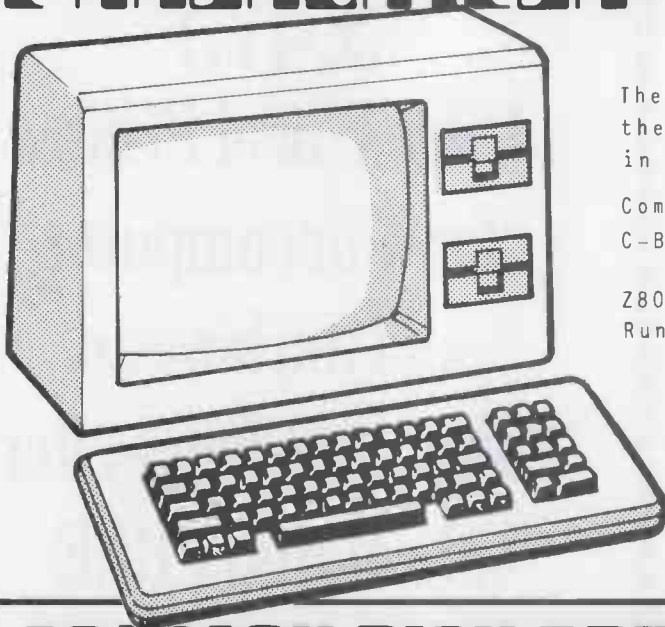
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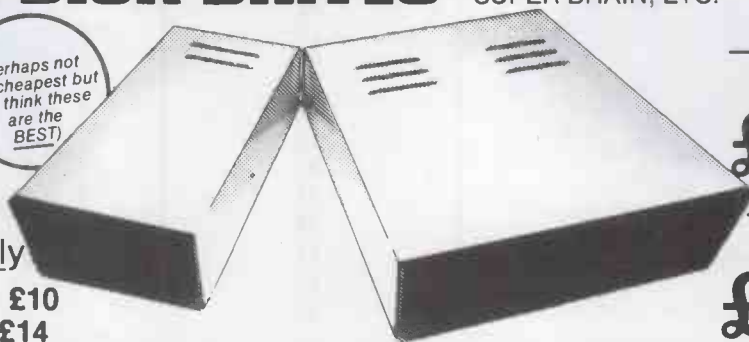
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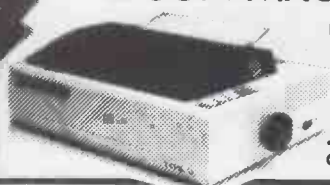
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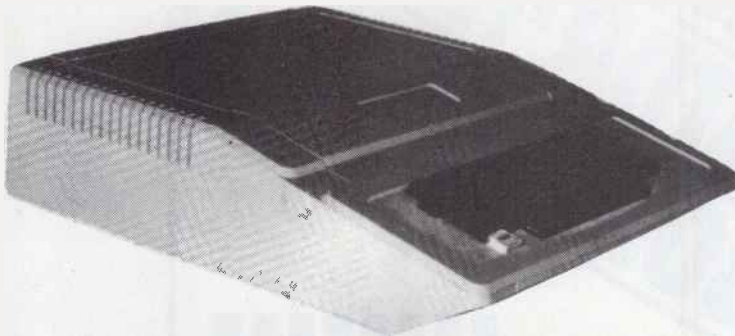
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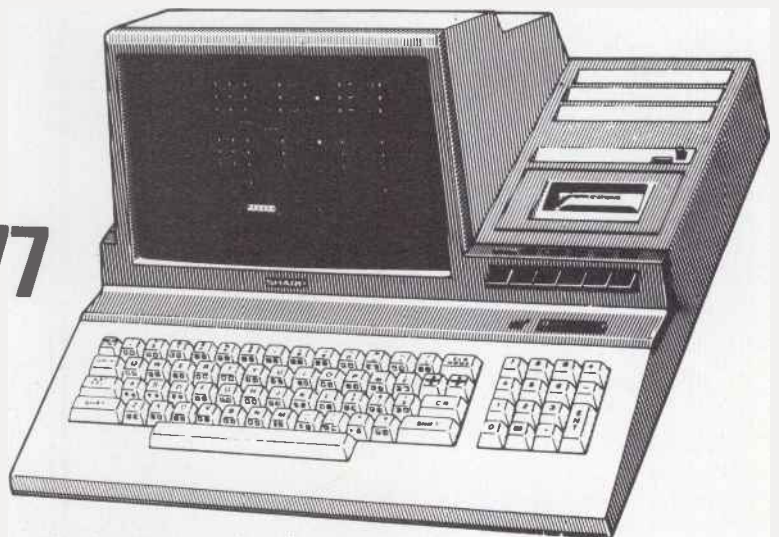
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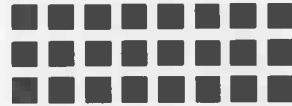


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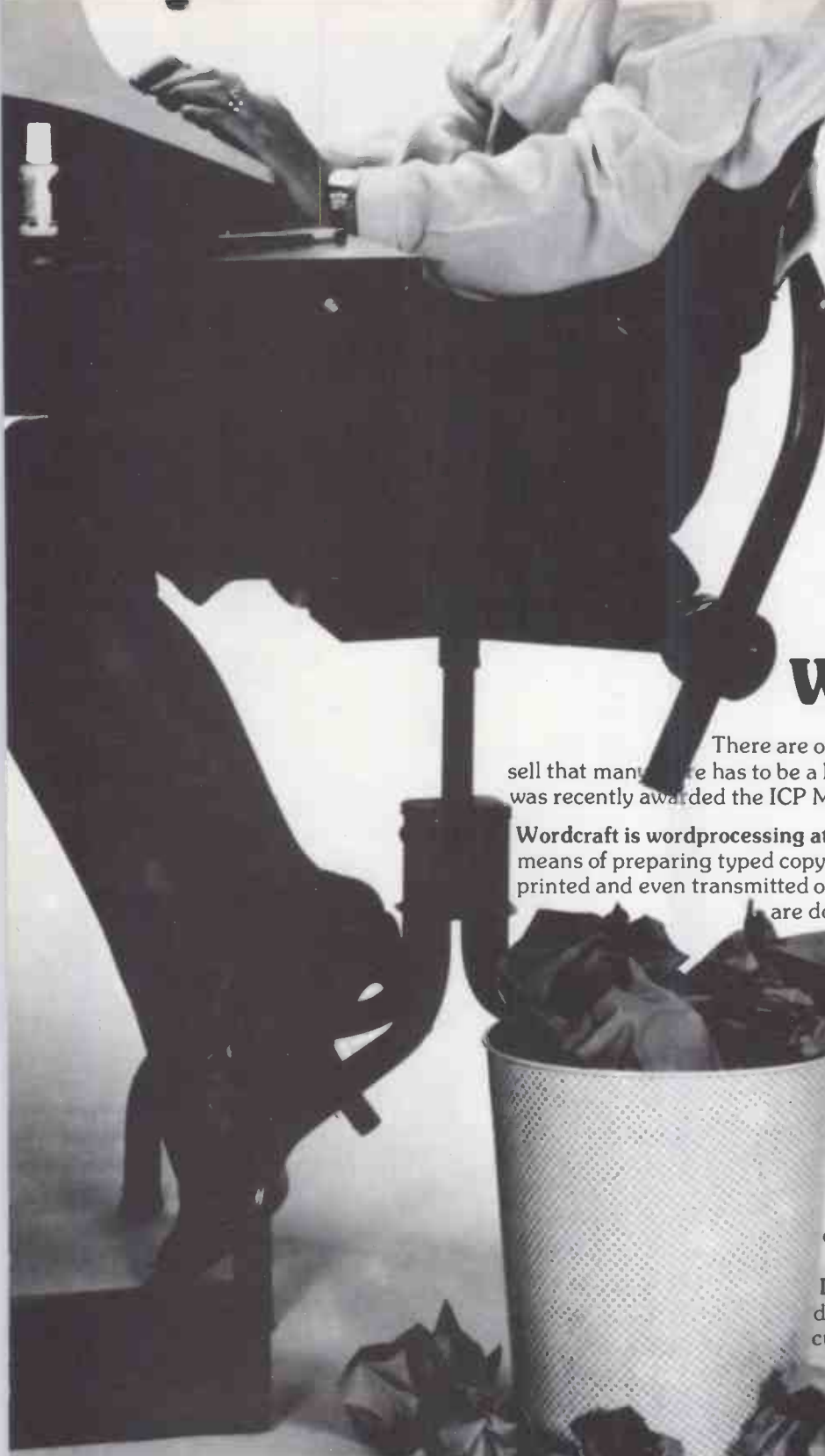
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| Atom Games Packs 1-11   | 11.50A each | Peeko Computer             | 11.50A      |
| Word Pack ROM           | 29.95A      | Maths Pack I & II          | 11.50A each |
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| Forth Theory & Practice | 6.95A       | Adventures                 | 11.50A      |
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| Business Book           | 6.95A       | Floating Point ROM         | 23.00A      |
| Synthesiser             | 11.50A      | BBC ROM Pack               | 49.95A      |
| Life Package            | 11.50A      | Magic Book                 | 7.95A       |
| Desk Diary              | 11.50A      | BBC Basic Programming Book | 5.95A       |
| Database                | 11.50A      | Acom Atom Dust Cover       | 4.60A       |
| Utility Pack I          | 11.50A      |                            |             |

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| <b>BBC</b>                  |       | <b>Peeko Computer Pack</b> | 9.95A  |
| BBC Dust Cover              | 4.55A | (in manual)                |        |
| Desk Diary                  | 9.95A | Forth Book                 | 7.50A  |
| Creative Graphics Book      | 7.50A | Forth Pack                 | 16.85A |
| Creative Graphics Pack      | 9.95A | Lisp Book                  | 7.50A  |
| Graphs & Charts Book        | 7.50A | Lisp Pack                  | 16.85Q |
| Graphs & Charts Pack        | 9.95A |                            |        |
| Algebraic Manipulation Pack | 9.95A |                            |        |

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| Defenders          | 9.95A |                 |       |

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| <b>MZ80A SOFTWARE</b> |        | <b>Reactor</b>                | 6.32A  |
| Star Trek             | 6.32A  | Wordpro Word Processor (tape) | 45.43B |
| Cassette Database     | 33.93A | Packman                       | 9.20A  |
| Forth                 | 40.20B | Apollo Word Processor (tape)  | 28.70B |
| Zed Editor Assembler  | 22.43B |                               |        |

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| <b>MZ80K SOFTWARE</b>           |        | <b>Chess</b>     | 16.67A |
| Wordpro Word Processor (tape)   | 45.43B | Tankwarp         | 6.32A  |
| Wordpro Word Processor (disk)   | 91.74B | Space Invaders   | 6.32A  |
| Apollo Word Processor (atape)   | 28.69B | Head On          | 6.32A  |
| Database (cassette based)       | 33.93B | Racing           | 6.32A  |
| MZ80 Calc II                    | 39.68B | Showjumping      | 6.32A  |
| Zen Editor Assembler            | 22.43B | Fireballs        | 6.32A  |
| Zen Mod (modifies Zen)          | 12.08B | Monkey Climb     | 6.32A  |
| Zen Dos (Editor Assembler Disk) | 43.13B | Football Manager | 5.75A  |
| Zen Disassembler                | 12.08B | Combat           | 5.75A  |
| Program Filing Index            | 6.32A  | Composer         | 5.75A  |
| Lunar Lander                    | 6.32A  | Bank Account     | 4.60A  |
| Map of England                  | 6.32A  |                  |        |

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| <b>VIDEO GENIE SOFTWARE</b> |            | <b>Alien Armada</b>       | 10.06A |
| Acquire Business Game       | 12.96C     | Android Nim               | 10.06A |
| B1 Nuclear Bomber Pilot     | 10.96C     | Asteroids                 | 10.06A |
| Conflict 2500               | 10.96C     | Battle of Britain         | 15.53A |
| Midway Campaign             | 10.96C     | Copypis Program Copier    | 12.94A |
| North Atlantic Convoy       | 10.96C     | Cube Hunt                 | 10.35A |
| Nukewar                     | 10.96C     | Database                  | 28.75A |
| Planet Miners               | 10.96C     | Duel-N-Droids             | 10.93A |
| Tanktics                    | 15.97C     | Editor Assembler Plus     | 24.95A |
| Adventures (various titles) | 13.77 each | Invaders                  | 14.95A |
| Adventure Sampler           | 10.06A     | Dust Cover for Genie I/II | 5.75A  |

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| <b>VIC 20</b>                      |        | <b>VIC Programmers Rer</b>  | 14.95B |
| Programmers Aid Cartridge          | 34.95B | VIC Programmers Reference   | 14.95C |
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| 3K RAM Cartridge                   | 29.95B | VIC Avenger ROM Pack        | 19.95B |
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| Joystick                           | 7.50B  | VIC Jelly Monsters ROM Pack | 19.95B |
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| Fire Trek                 | 6.50A | Slot Machine               | 6.50A |
| Alien Wars                | 6.50A | Am! Raiders                | 7.50A |
| Head On                   | 6.50A | Missile Command/Sub Hunt   | 7.50A |
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| VIC Breakout  | 7.00A |                      |       |

## BOOKS

|                                   |        |                               |        |
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| Apple Pascal Games                | 11.45C | Apple Basic Data File Progs.  | 8.95B  |
| CP/M Handbook                     | 11.50C | Applesoft Language            | 7.65C  |
| DO-N'T (how to look after micros) | 9.65C  | Basic Basic                   | 9.95B  |
| Intro to Word Processing          | 11.45C | Basic Computer Games          | 6.95B  |
| Pascal Handbook                   | 13.95C | Book of Apple Software        | 10.50C |
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| 6502 Games                        | 10.25C | Microsoft Basic               | 8.95B  |
| A-Z Computer Games                | 5.60B  | Sharp Software Secrets        | 5.95B  |
| Apple II Users Guide              | 11.85C | Peeking & Poking on the MZ80K | 5.00B  |

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| Adler P2 Computer System with wor processor & daisy wheel typewriter/printer | 3335.00E | Sirius One Computer System | PHONE FOR BEST PRICE |
| Apple II 48K Computer  | 770.00E  | Sharp MZ80A (48K)          | 79.95D               |
| VIC 20 Computer  | 179.95E  | Sharp MZ80B (64K)          | 169.00D              |
| CIV Cassette Deck  | 44.95D   | PC 1211 Pocket Computer    | 295.00E              |
|  |          | PC1500 Pocket Computer     | 179.95D              |
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| Atom Disc Pack, 96K Single Disk Drive | 343.85E | Genie Single Disk Unit         | 228.85E |
| VIC 20 Single Disk Drive              | 632.50E | Apple Drive with Controller    | 329.00E |
| Sharp Dual Disk Drive                 | 228.85E | Apple Drive without Controller | 279.00E |

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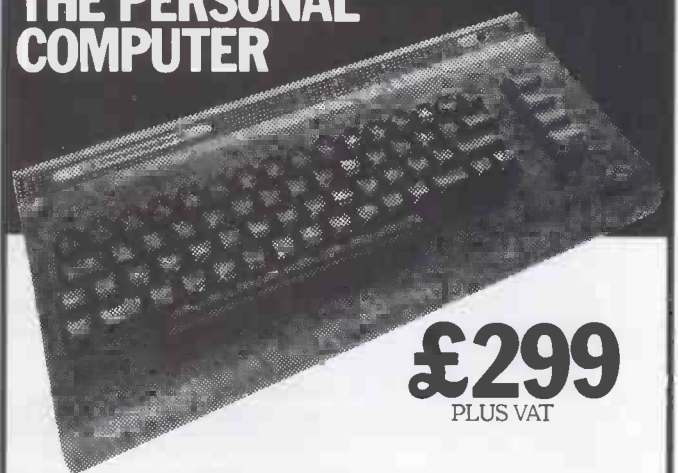
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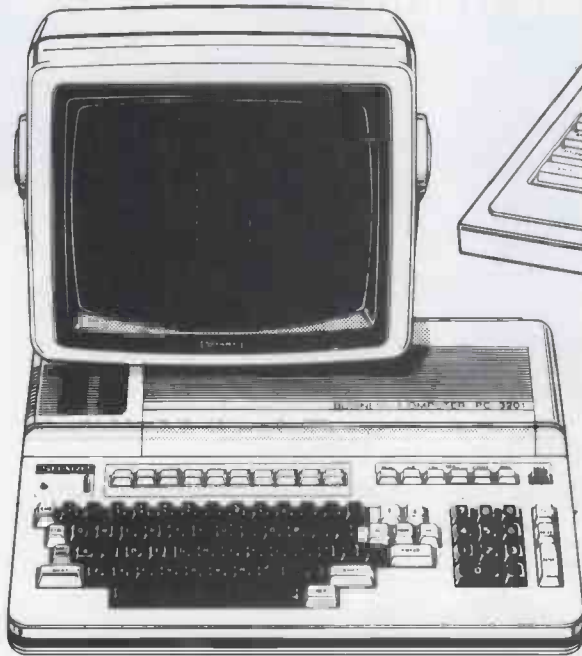
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CP/M is also available as an option on the Sharp PC 3201. It is available in two forms. The first is a relocated CP/M giving you 46.5K of user memory, all you need do is insert a disk and off you go. This version will only run the products marked # in our price list. The second provides you with a second Z80A processor on a card which plugs in to the I/O interface card chassis and runs standard CP/M, 64K memory, with access to the whole library of products in our price list. This together with the PC 3201's large screen and keyboard makes the PC 3201 a superb business machine.

CP/M for both these machines is available from your local Sharp dealer, or in case of difficulty, please call us on (0892) 32116.

# RUN ALL THIS CP/M BASED SOFTWARE

**WORDSTAR** # Powerful word-processing package, made easy to use by full function key support on the MZ-80B. **£242**

**MAILMERGE** Add on to WORDSTAR, provides mail-shot and text inclusion. **£73**

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Mbasic & word-star compatible.  
32000 records per file-name.  
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user createable files.  
callable selection criteria.  
if 'then' questioning  
12 question types per field:  
endless 'either/or' matching  
either/or, one/all fields.  
same string/same number.  
greater/smaller than.  
number range matching.  
not equal strings.  
greater/smaller related flds.  
'not' identical fields.  
selected record shortfiling.  
history filing (audit trail).  
field protection.  
field classification.  
file passwords.  
PASSWORD password.  
scratchpad totalling.  
scratch' collation totalling.  
alpha/numeric sort any charctr.  
many other subtleties unlistable.

### \*\*\*SOME POSSIBILITIES\*\*\*

This program is the first of its type world-wide.  
Once you have designed your file, your report, and stored your records you will be able to 'clone copy' from the master database disk, a task disk whose life purpose will be to produce specific reports without your user-interaction. The task you have specified, begins itself at precisely the moment you have inserted the diskettes in their drives, and closed the doors; you don't have to touch a key or select from a menu.  
Imagine building a small library of such 'task' disks from suggestions outlined here, or others you may have around you.  
Nominal analysis, stock re-order reporting, stock valuation, sale — analysis, purchase analysis, address mailing, text writing, employees analysis, patient analysis, research analysis, simulations, bureaux personnel analysis, time recording, librarian analysis, budgetting, to name a few.  
Here's an arbitrary example to indicate the power of DBMS III.  
You have set up a filing system of 20,000 records concerning employees and wish to short-list those who meet certain criteria, then write to them. The records in the file have fifteen fields that look like this.

|              |                          |
|--------------|--------------------------|
| 1-Record     | (33)                     |
| 2-Name       | (John Smith (Sir))       |
| 3-Addr       | (55 Bedford Cr. London.) |
| 4-Age        | (40)                     |
| 5-Sex        | (M)                      |
| 6-C.V.       | (5-0 levels, 6-a levels) |
| 6-Exp        | (3 yrs)                  |
| 8-Sal        | (12,000)                 |
| 9-Loen       | (London/South)           |
| 10-Type      | (Computer analyst)       |
| 11-Sport     | (Tennis/golf/riding)     |
| 12-Langu     | (English/French/German)  |
| 13-Pr/emp    | (Local government)       |
| 14-status    | (married/2 children)     |
| 15-code[ c ] | (classified information) |

Just one of a thousand selection criteria might take the form:

"Find all persons that are not Esq, who live in London or Surrey or Croydon, in the age range of 30-45 Male, with 6-a levels, experience less than 5 yrs, prepared for work in London or the South, at computer analysis, whose interests are golf or tennis, speaks German or French has worked in Local government and is married. Finally matches our own classified code [grade 5]".  
Output the short list to a second file for a mail shot.

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|           | -SUPERBRAIN | 64K.RAM/10M   | DISKS | 7777.00 |
|           | -COMPUSTAR  | 64K.RAM/OK    | DISKS | 1495.00 |
|           | -COMPUSTAR  | 64K.RAM/320K  | DISKS | 1995.00 |
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|           | -HORIZON    | 64K.RAM/700K  | DISKS | 1950.00 |
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|           | -806        | 64K.RAM/10M   | DISKS | 4595.00 |
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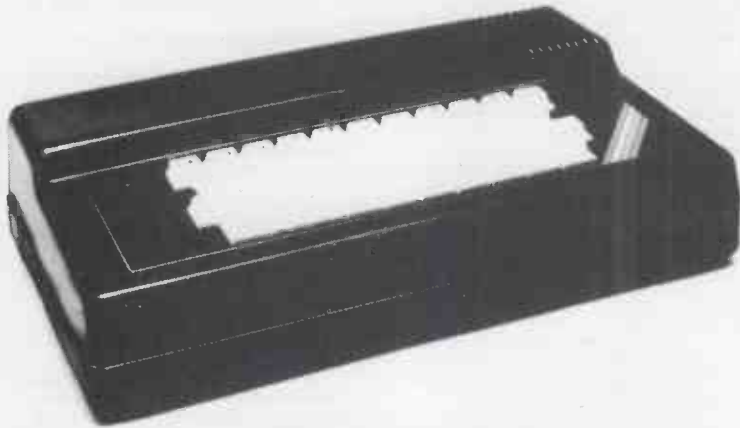
## TERMS & ETC

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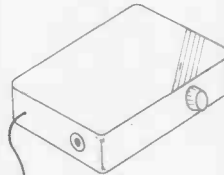
**INSTALLATION** - Simply unscrew the ZX printed circuit board from its case and screw it into the FD case, plug in the keyboard and that's it. No technical know how or soldering required, the built unit is tested and comes with a money back guarantee.

### Spectrum Keyboard and Case Kit £33.95

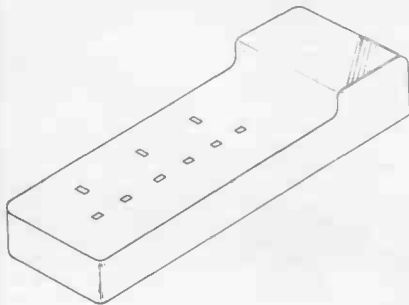
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Complete with 3 metres of cable, three 13 amp sockets for TV, Tape etc AND 9 volt at 2 amp power supply with power jack to fit Spectrum or ZX81

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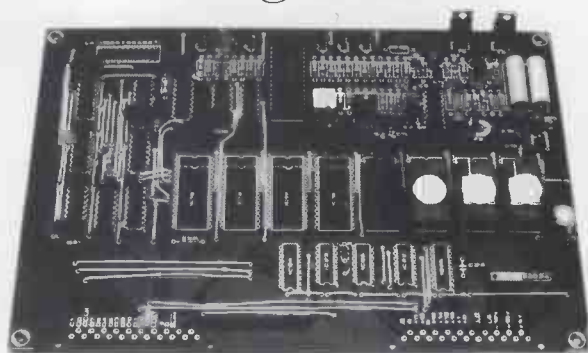
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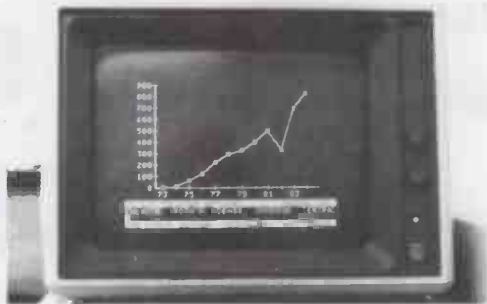
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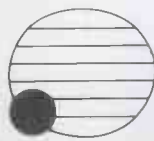
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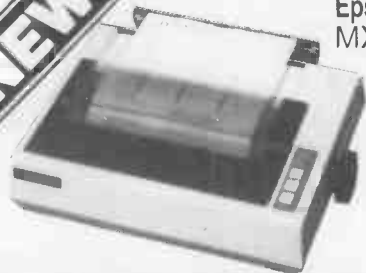


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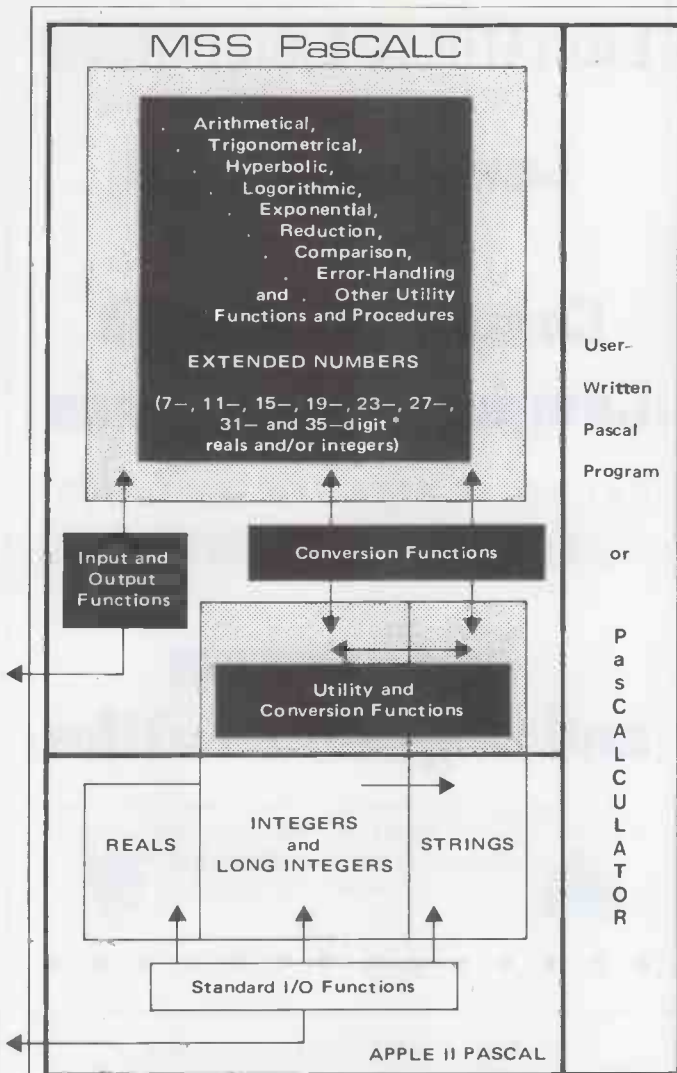
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Y:=Y+P^(2*LOGE[10-(5*E/4)])
0.936471836457736E0
Enter command:
A:=0.125E1
0.125000000000000E1
Enter command:
X-SINIP-EXPCA/(B+Y)J^D]
-0.185890363973163E1
Enter command:
RETAIN
Retained as command 5
Enter command:
A:=0.15E1
0.150000000000000E1
Enter command:
COMMANDS
X-SINIP-EXPCA/(B+Y)J^D]
0.826354927584729E-1
Enter command:
LISTV
-----
LIST OF VARIABLES
-----
A = 0.150000000000000E1
B = 1
D = 5
E = 0.271828182845905E1

```

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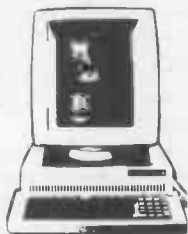
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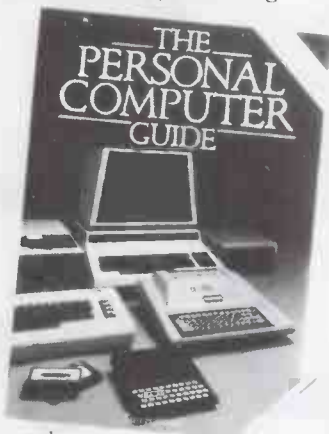
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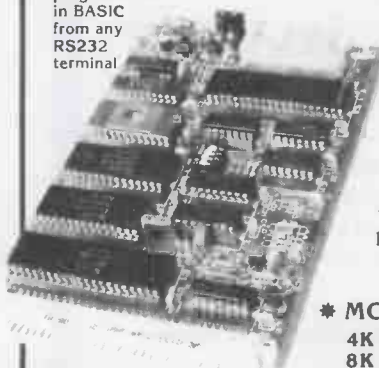
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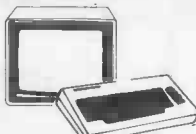
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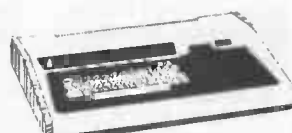
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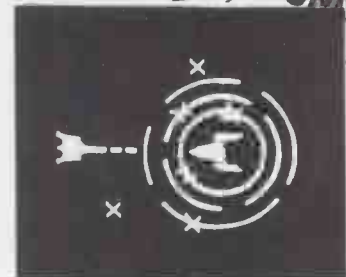
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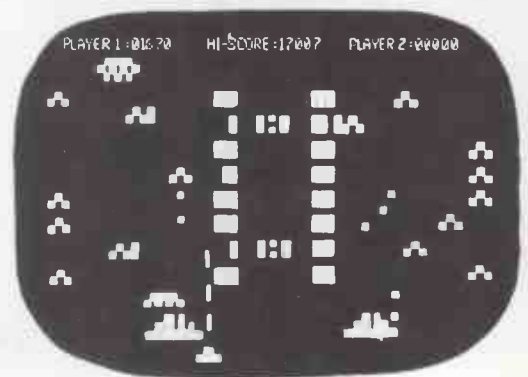
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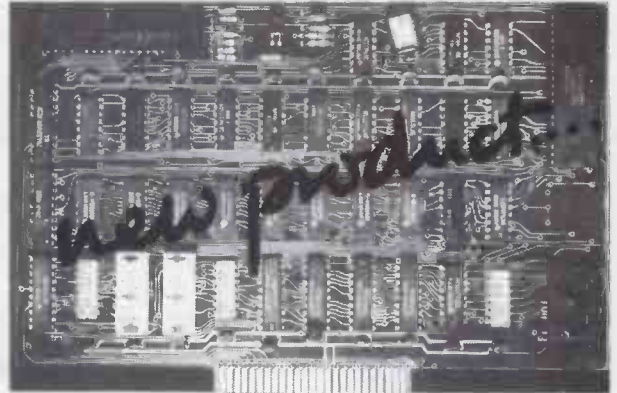
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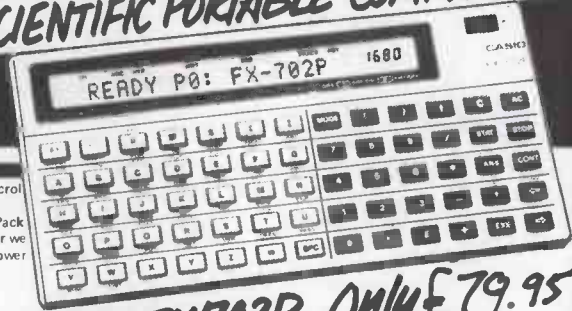
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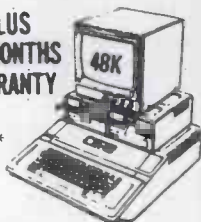
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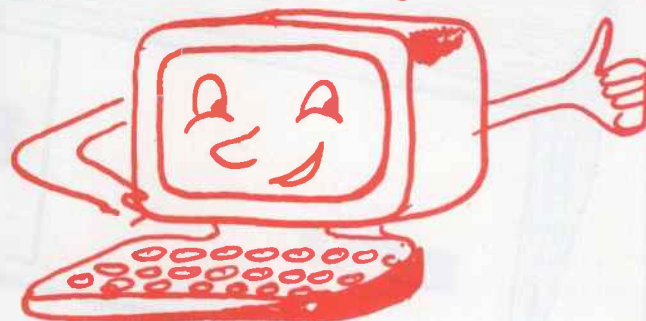


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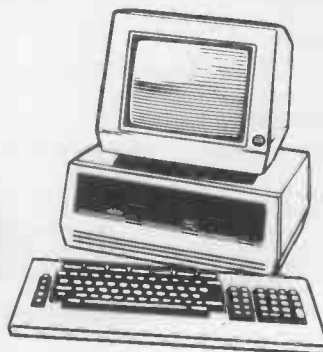
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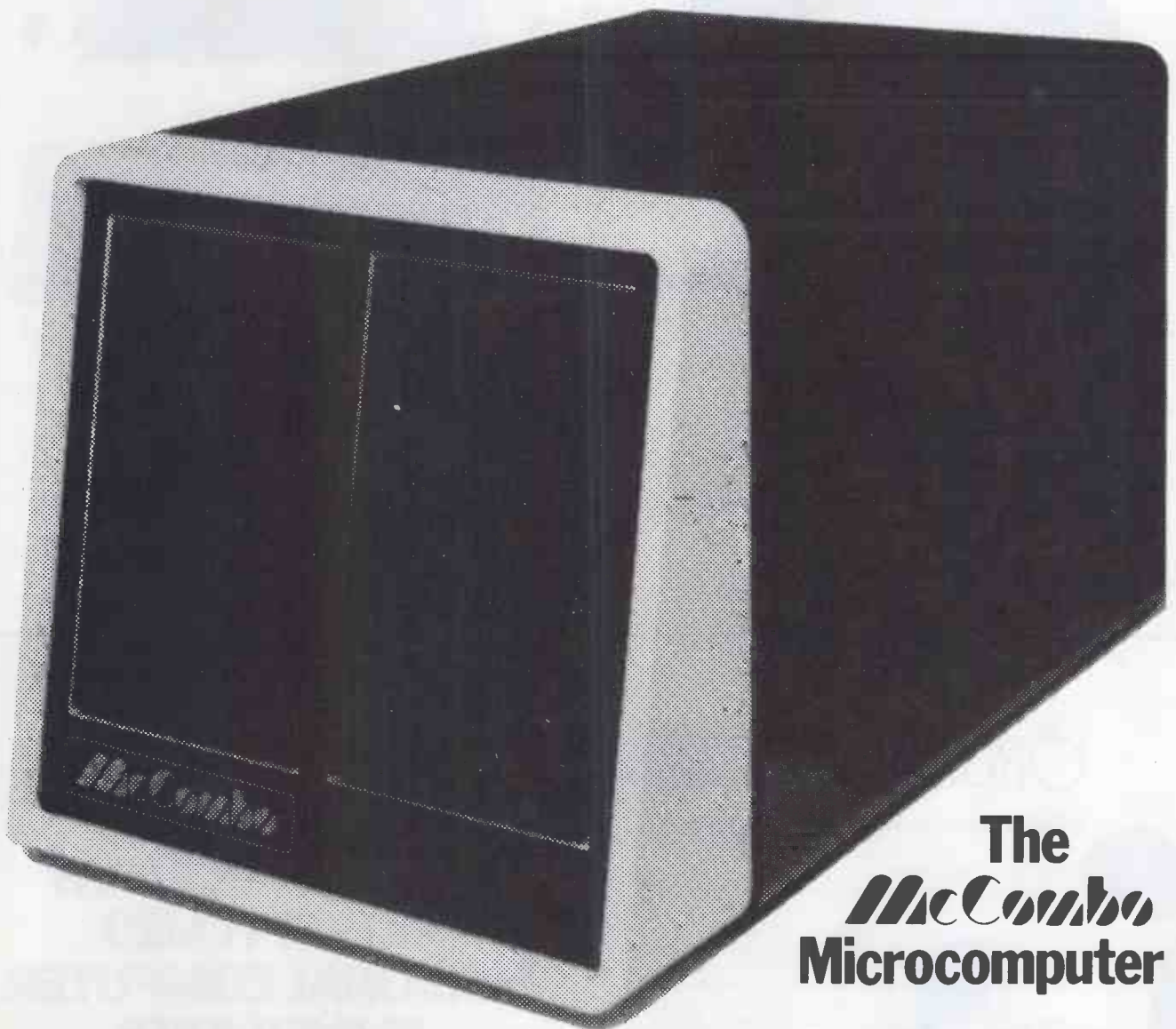
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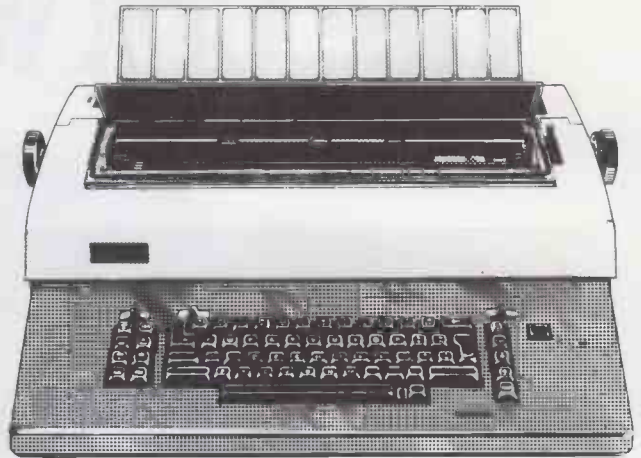
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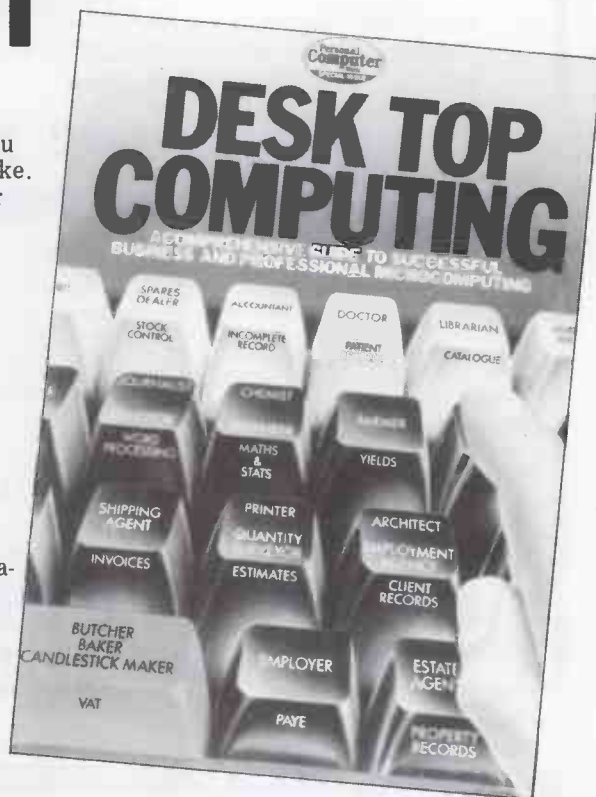
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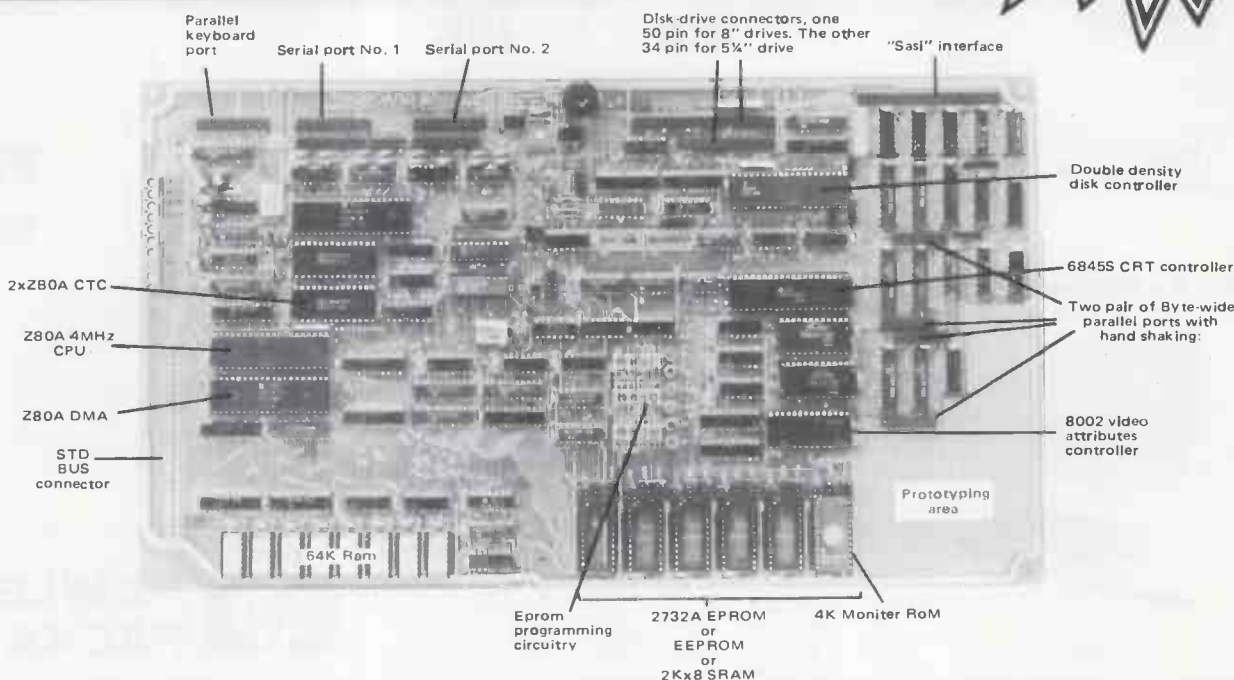
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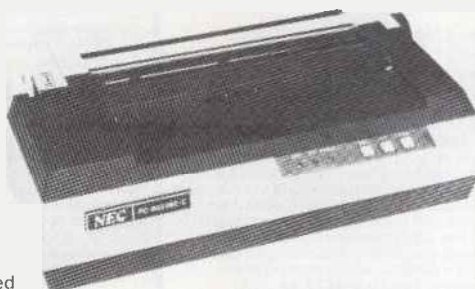
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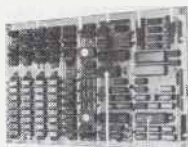
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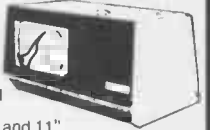


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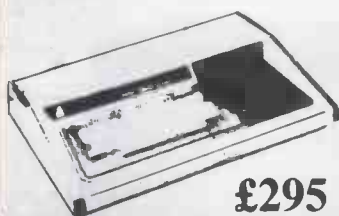
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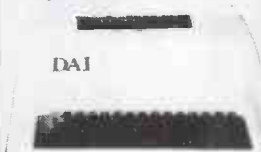
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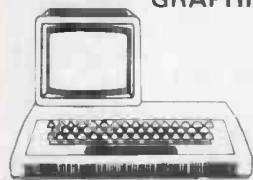
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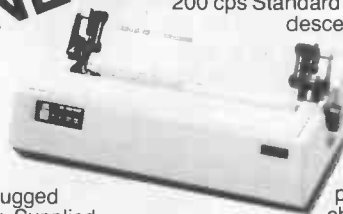
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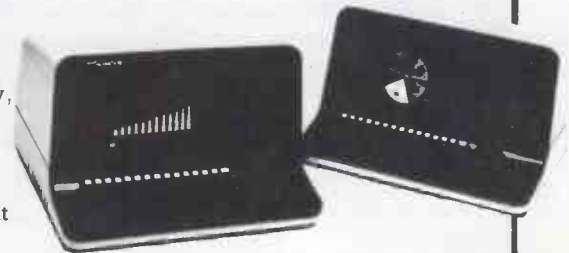


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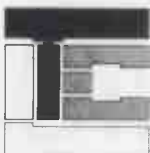
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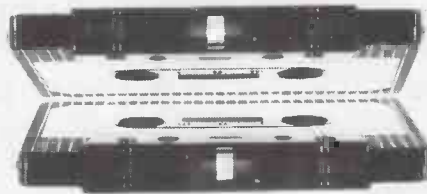
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We hear with immense mirth that ACT's multi-million pound TV advertising campaign, destined to assault our screens soon, has run foul of the Advertising Standards Authority on the grounds of gross sexism. The ad is now being re-shot with 'Squire' Allason, no less, taking the place of the offending scantily-clad female... Early morning Radio 4 listeners were treated to an hour of micro wisdom recently when David Tebbutt and Martin 'Voiceless' Banks starred on a phone-in together, answering the eager questions of the listening public. All went well until someone asked what grade 'A' levels are required to study computer science; turns out that both 'Voiceless' and 'Tebbo' are too old to have been through the 'A' level mill and could only advise about taking a clean rag into the exam to wipe the

slate off... Editor Rodwell has become quite insufferable since he bought himself a massive and totally ostentatious BMW motorcycle. He's taken to going around offering suitable young ladies a 'quick blast up the M4', so far without any of them being silly enough to accept. His enthusiasm was considerably dampened, though, when he tore a muscle trying to heave the megabike onto its centre stand for the first time, to the amusement of Dick 'Poison Pen' Pountain, who rides a Honda... In an effort to get this edition on sale at the PCW Show, your Editorial and art room teams worked their \*\*\*\*s off and managed to produce an entire issue in just a week and a half... The habit of certain publications (not PCW) of accepting 'financial remuneration' in exchange for front-cover publicity for whichever

machine they're reviewing seems now to be regarded as the norm by some companies in the micro business. A very large manufacturer, who really should know better, recently offered us such a bribe to get his machine onto our cover. And we thought we'd made it quite clear that this approach *never* works with us — in fact our immediate inclination is to drop the machine altogether... Have you ever wanted to work for PCW? You have? You must be mad! No, that's wrong, what we mean is that we're on the lookout for another person to join our editorial team. Essential qualifications are several years' experience in high-technology journalism, preferably in the micro industry, a good appreciation of the uses and applications of microcomputers and the problems faced by those

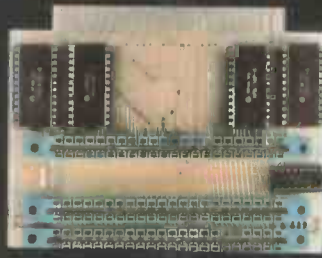
trying to use them, and a good working knowledge of currently available micro systems, both hardware and software. You also need a high tolerance to bad language, a liking for black coffee (real), unless you're prepared to buy your own milk, and a willingness to get stuck into all the boring bits — like reading galleys, answering readers' letters and phone calls, fending off over-eager PR persons and helping out with mundane admin-type work as and when required. We want you to write (*don't ring*) with a full CV and examples of recent work to: The Editor, *Personal Computer World*, 62 Oxford Street, London W1A 2HG, before the end of September. We're an equal opportunities employer, which means we'd prefer applications from nubile young... (*All right, that'll do — Ed.*)

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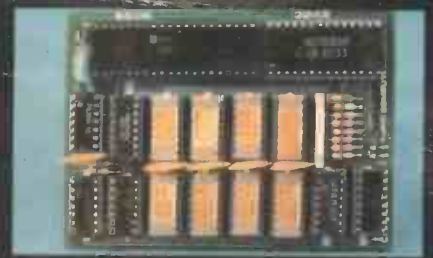
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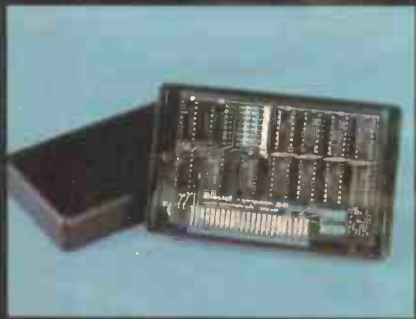
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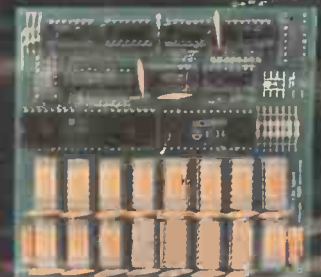
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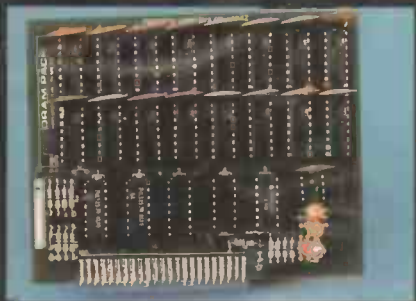


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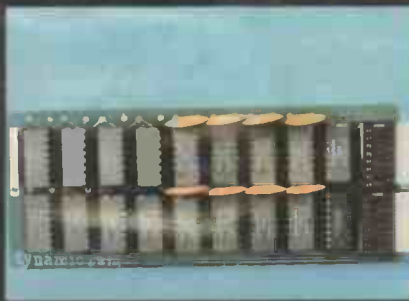
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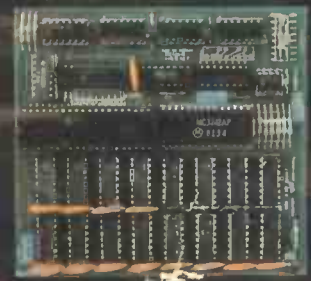
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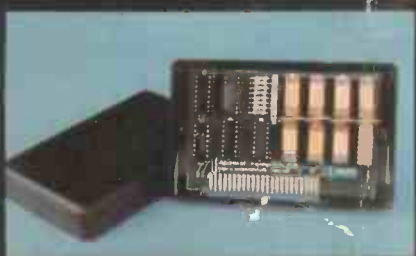


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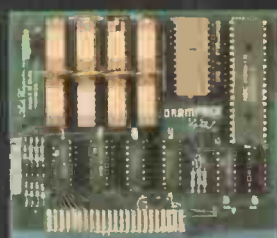


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