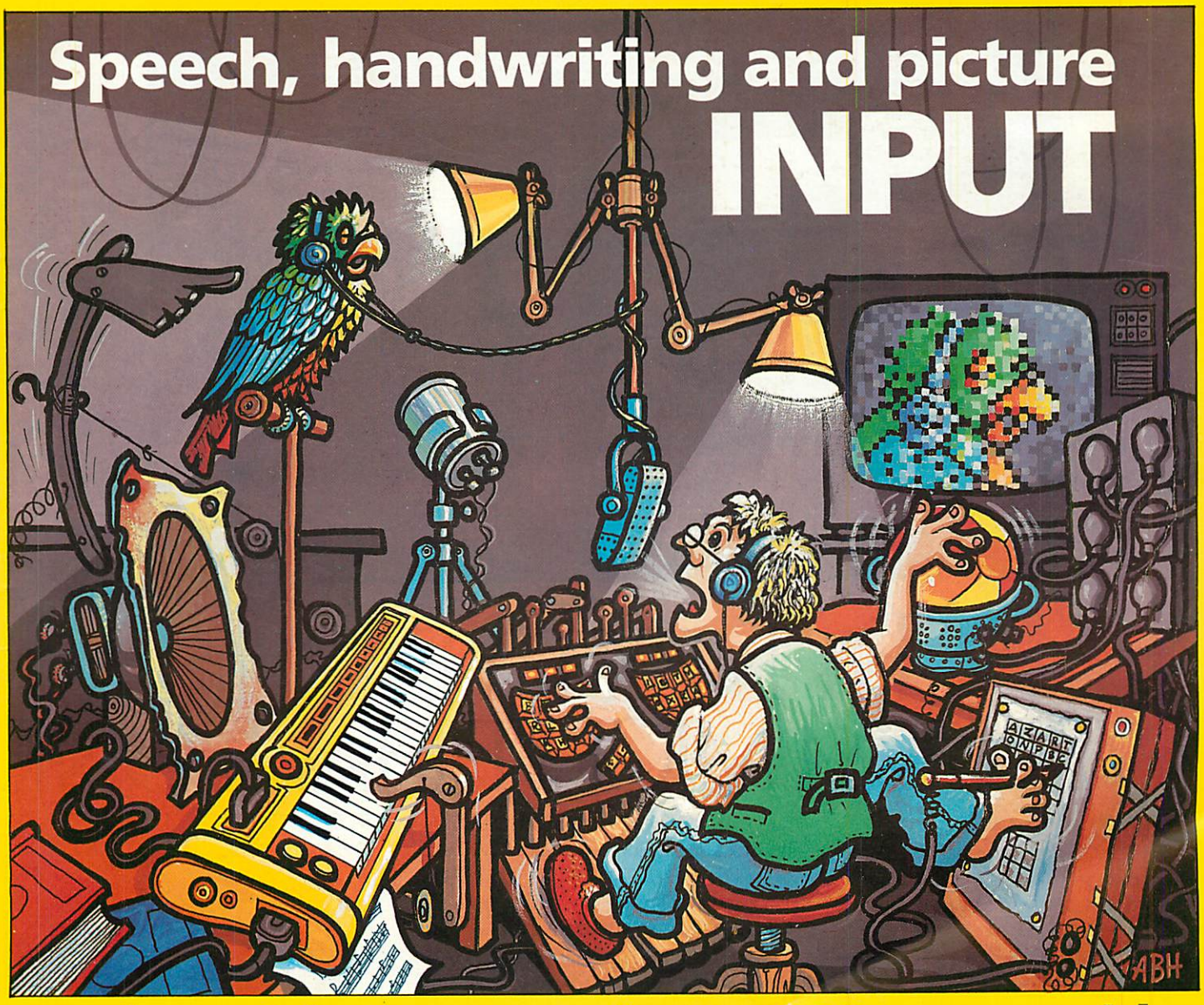
Practical Computing

90p September 1984
Volume 7 Issue 9



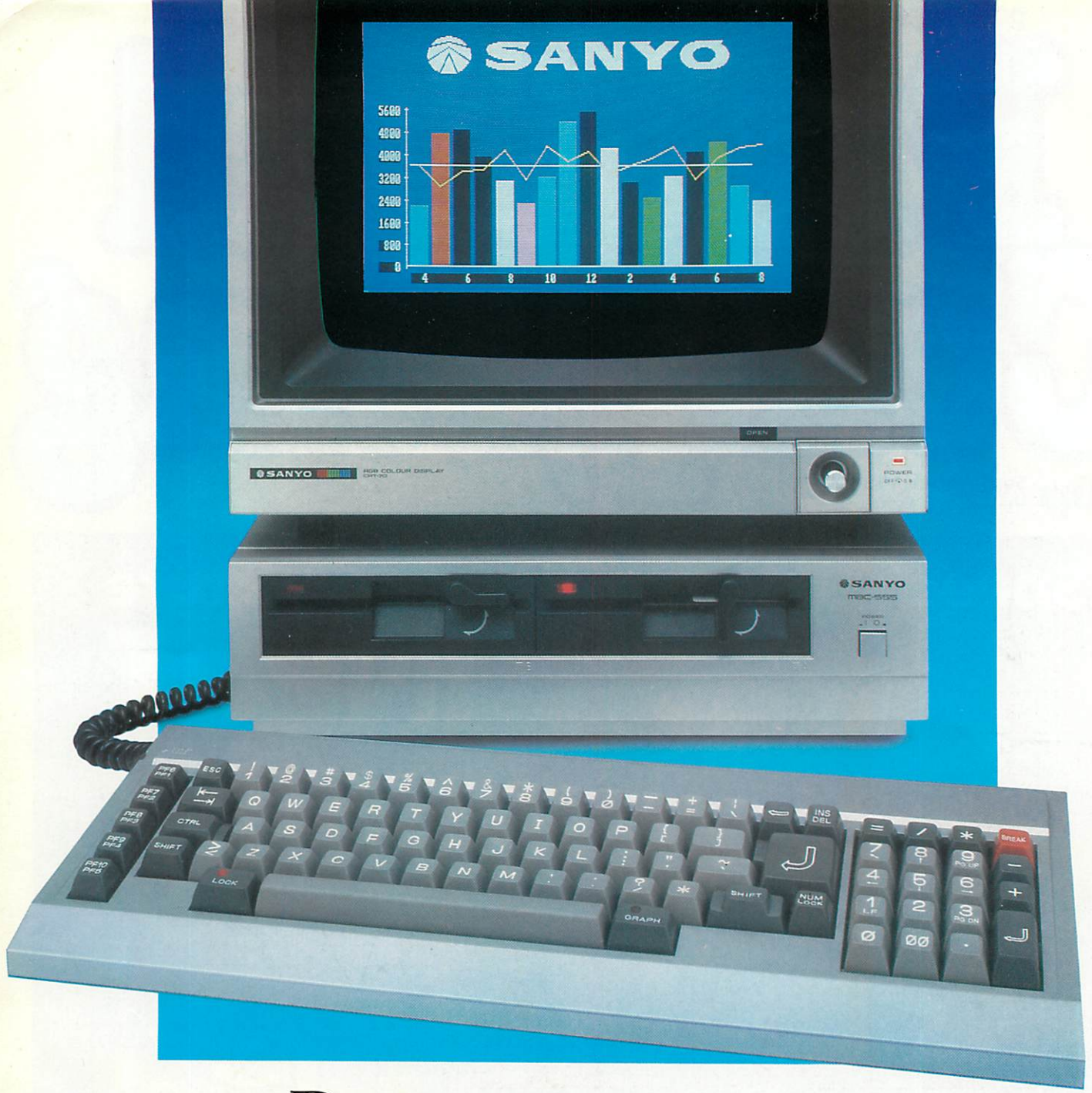
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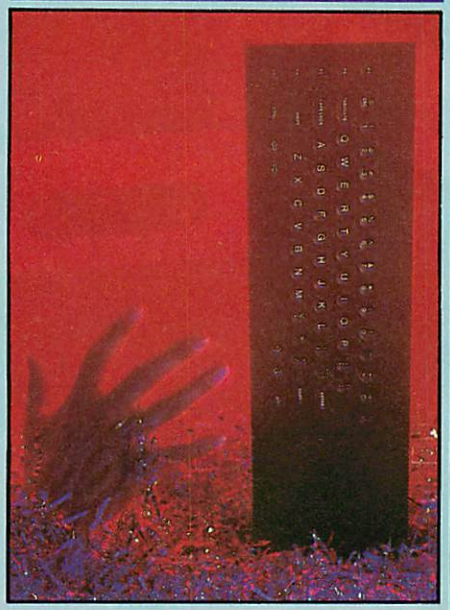
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Practical Computing

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Published by Electrical Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500. Telex/grams 892084 BISPRS G.

Distributed by Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Subscriptions: U.K. £13 per annum; Overseas £19 per annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscription Manager, Business Press International Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel: 0444 459188.

Printed in Great Britain for the proprietors Business Press International Ltd by Eden Fisher (Southend) Ltd, Southend-on-Sea. Typeset by Centrepoint Typesetters, London EC1.

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MSX invaders

SO FAR the Japanese have not made much impact in the microcomputer business. A great many people have bought Japanese cameras, audio equipment, motor bikes and other consumer goods. Very few have bought Japanese micros.

If you believe the hype, all this is about to change with the arrival of the MSX system. Before Christmas the shops will be flooded with standard MSX micros made by leading consumer-products companies such as Canon, Hitachi, Pioneer, Sony and Yamaha.

The main selling point of the MSX system is compatibility. All the machines will comply with a minimum hardware standard drawn up by Microsoft. Therefore, it is claimed, they will all be able to run the same software and use the same peripherals.

This is a very attractive idea. There is no doubt that the ready acceptance of microcomputing is being limited by the inability of one machine to run software designed for another. However, it is one thing to exploit an existing standard, such as the 35mm. film or the long-playing record; it is quite another to establish such a standard in a rapidly changing market.

One problem with having 15 or 20 micros that are essentially the same is that this is boring. When you've seen one MSX micro, you've seen them all. Goodness knows what the unfortunate editor of *What MSX?* magazine is going to write about — the position of the cursor control-keys, perhaps. Some MSX micros come in prettier colours than others. . . .

This is not like IBM PC compatibility, where different firms are competing to offer faster, cheaper, prettier and more powerful versions of the same machine but without infringing IBM's copyright. The MSX machines are not competitors, merely clones.

A second problem is that the MSX standard is woefully out of date. It is based on the eight-bit Zilog Z-80 microprocessor, while all the exciting developments are taking place in the 16-bit and 32-bit world. Basing the standard on the Z-80 rather than, say, the 8086/8 — favoured by the IBM PC and so many others — looks inept.

This is not to say there is no place for low-priced Z-80 micros like the Amstrad CPC-464, or for standard eight-bit CP/M business micros, and so on. But MSX is attempting something more dramatic. It is attempting to sweep the world and establish a new standard.

A third problem is that there is almost no software available for MSX micros, and what software there is looks very weak. This fact could undermine the whole operation. After all, there is no point in having access to standard software if the standard software is not worth having.

The MSX invaders may well be a success. They at least have a proper Microsoft Basic, and come fully equipped with joystick ports, a cartridge slot, a printer port and other things that U.K. manufacturers can sting you for as extras. They will undoubtedly — like other Japanese consumer products — prove to be well made and reliable. And they will be delivered on time. Again, the contrast with British and American products puts us to shame.

But if the MSX machines are not all-conquering, this does not mean the Japanese have been beaten. Look inside many British and American micros and you will see Japanese chips and Japanese disc drives. Attached to these micros you may find Japanese televisions or monitors, and Japanese printers — even Japanese portable computers.

We in the U.K. can be proud of our pioneering work in microcomputing. But let's not rest on our laurels. The real battle has hardly begun.

5 Years ago...

As the cost of chips continues to fall, the number of low-cost microcomputers available appears to rise in inverse proportion, and one recent addition to the market is the Acorn microcomputer.

It is a two-board unpackaged system from a company called, somewhat confusingly, Acorn Computer, for £81 assembled and £70 in kit form. The Acorn also requires a separate 5V power supply before it will blink into life.

In common with Apple, Pet, Kim and Aim-65 the Acorn uses the 6502 processor from MOS Technology. It is capable of addressing up to 65K of memory if all address lines are implemented on the processor board.

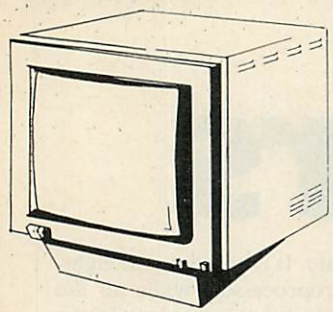
The Acorn, in fact, has just over 1K of RAM on the processor board. Additional RAM can be added using an expander board, together with one more 8K memory boards when they become available.

The two Acorn circuit boards are mounted one above the other and are connected by a 20-way cable. The lower board, which is also available separately as an industrial controller board, contains the CPU, 1K RAM, a 16-way RAM I/O chip used by the keyboard, the monitor RAMs and address decoding circuitry. Sockets for an additional RAM I/O and 2K of EPROM are also included.

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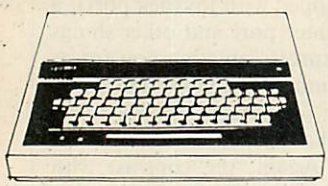
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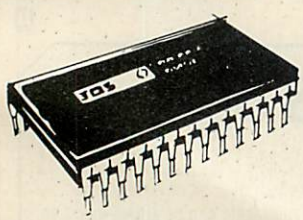
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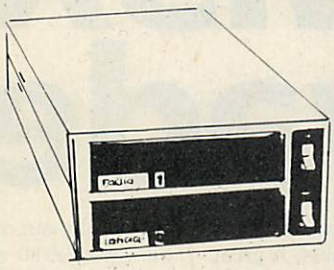
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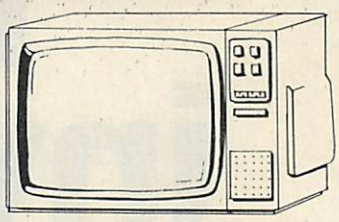
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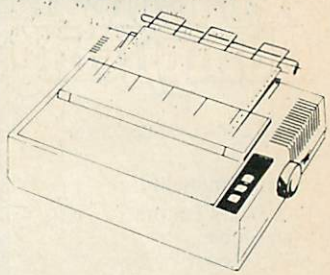
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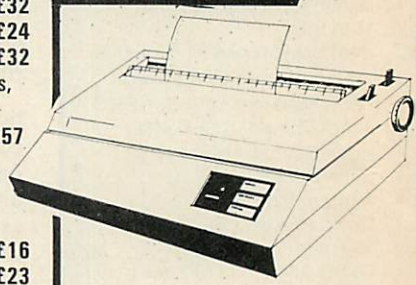
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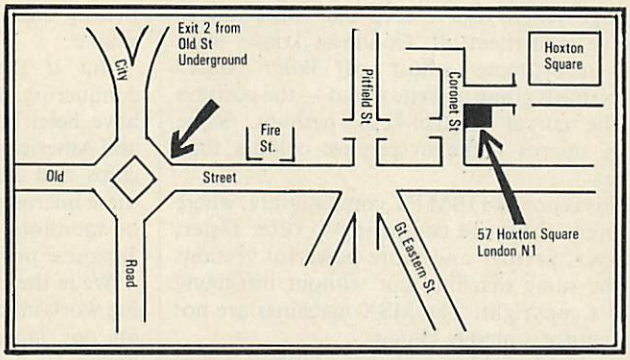
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THE EXPERTS

Fair deal?

IN YOUR EDITORIAL "A fair deal" in the June issue, I believe you have lapsed into a form of self-delusion over the issues at stake.

A microcomputer is a manufactured article and, like all such goods, has an economic selling price which depends upon volume throughput at every stage of construction, advertising and selling. The software has similarly calculated sales economics, and the value of after-sales support is proportional to the individual customer's needs, while maintenance is most decidedly a cost-plus exercise.

The cost of an unsupported sale must therefore be minimal, and any customer electing to take goods on this basis should be entitled to a minimal price structure for every part of the system purchased.

Any other arrangement is little different than being offered a piano at an artificially high price, supported by an added "free offer" of five years' piano tuning and free sheet music, when one owns a tuning fork and wants the instrument as support in composing one's own music.

With an increasing number of firms now offering micros with free software of an apparent value exceeding the cost of the hardware — Sinclair and Advance, for instance — overpriced services will eventually force a high proportion of the new High Street micro-sharks back out of the business. Meanwhile user over-friendly software will gradually minimise the need for advice and support to the level where an honest cottage industry can fulfill demand.

Nor is this the end of the game. Regardless of whether the IBM PC is considered advanced technology, it is probably true that its standardisation of hardware, operating system, disc format and Basic will bring stability to the market. It should also encourage look-alikes that will ensure every aspect of the system is subject to healthy competition and lower prices.

B A Martin,
Solihull,
West Midlands.

● **The editor adds:** The problem some dealers face is that they sell micros as though they were record players — just load the software and all your problems are over. Customers then find they have bought a piano they do not know how to play. So they go back to the dealer expecting free piano lessons.

Even today, dealers find that the knowledgeable "I only want a big discount" buyer often needs as much support as the self-confessed ignoramus.

Missing the 80-Bus

GLYN MOODY'S article on expandable systems was very disappointing. Has he never heard of Nasbus, also known as 80-Bus? It has existed since 1978, has over 28 cards available and is used in several different manufacturers' machines: Lucas-Nascom, Gemini and Quantum, to name but a few.

The amazing IO Research Pluto graphics system connects to 80-Bus machines. Cards are 8in. square, which is only just big enough for Gemini's 512K Ram disc board. In fact, I can't think of a better way to put together a really powerful, versatile system. Mine is a lot faster than the safe but boring heap IBM sells because you can even fit a 32-bit arithmetic processor if your applications need it.

Chris Blackmore,
Taunton,
Somerset.

Basic Truth

TWO ERRORS have been spotted in my article "Basic Truth", published December 1983. The first is rather small, and should not have caused any problems. Halfway down the third column, the GetA should have

```
GetA$
```

The second error, on the other hand, could well have been the cause of much grievance. Also in the third column, the alteration to transfer control to the paddle buttons was

```
PEEK(42949)>127 + (PEEK
(49250)>127)
```

It should have had an extra pair of brackets, so:

```
(PEEK(42949)>127)+(PEEK
(49250)>127)
```

Philip Musk,
Godalming,
Surrey.

Sharper than a QL

WHEN REPORTING the Benchmarks of the QL in your June hardware news, your writer says "the new machine emerges . . . faster than all eight-bits apart from the BBC Micro". Might I point out that the Sharp MZ-700 has the same average as the QL and in all but one test is considerably faster. It is also faster than the BBC B on Benchmarks 1 and 4.

B J Ford,
London NW10.

● **The editor replies:** We have not Benchmarked the Sharp MZ-700, but we will.

Spectravideo 328

WITH REGARD to Fin Fahey's review of Spectravideo's 328 personal computer in *Practical Computing*, June 1984, I would like to point out some rather glaring inaccuracies in this article.

In the first paragraph, Spectravideo is described as a subsidiary of Coleco. This statement is totally wrong. Spectravideo is Hong Kong based manufacturing company with its international marketing headquarters in New York. The company does manufacture an adaptor for its machine which enables users to play all of the Coleco games, but that is the only connection.

Spectravideo Ltd, the U.K. distributor of all Spectravideo products, is an independent organisation set up to market and distribute the complete range of Spectravideo products in Great Britain.

With regard to the comments made about software availability I would like to point out that there are at present 38 software titles available from Spectravideo itself, and many British software houses are converting existing programs or writing new titles for the Spectravideo computers. In addition, both the SV 318 and SV 328 are compatible with CP/M, the largest library of software in the world.

Keith Newman,
Spectravideo Ltd,
Morden,
Surrey.

Fixing notation

IN THE DISCUSSION of whether infix, prefix, or postfix notation should be used in Logo, I seem to remember — I think it was in the report of the Chiltern Schools Logo experiment — that children often said aloud "50 forward", which they had to change to Forward 50.

Consider the drawing of a square: in particular, consider the sequence of ideas involved. We have to move, and first of all we have to work out how far to move — say, 50. At the end of the move we turn through 90 degrees, right or left.

The sequence so far is

```
50 UNITS 90 DEGREESRIGHT
```

where Units replaces the Logo Forward, and it operates after the event, rather than before; Degreesright replaces Right. Units and Degreesright use postfix notation rather than Logo's prefix notation.

We have drawn a side and have made a turn, but to draw a square this sequence has to be

(continued on next page)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)
performed four times:

```
50 UNITS 90 DEGREESRIGHT 4
  TIMES
```

and the Times is a postfix Repeat. What is repeated is the portion from the beginning of the line, up to the parameter whose value is 4. If there are other commands to precede the repeated action sequence, then possibly we can use square brackets to delineate the extent of the repeated action. For example

```
35 DL (50 UNITS 90 DR) 4
  TIMES
```

where DL is short for degrees left: the names of actions are not chosen for ease of use, they are merely different to those of Logo for illustrative purposes.

To construct a procedure to draw a square

```
"SIDE USEDBY SQUARE
  :SIDE UNITS 90 DR 4 TIMES
  FINISH
```

and so to use square we

```
100 SQUARE
```

The ability of the postfix system to provide a coherent system is clear. Take the example of a child who is asked "You have five sweets, then somebody gives you one more. How many will you have?" We can write this as

```
5 1 MORE ANSWER
```

or, equivalently

```
5 1 + PRINT
```

Postfix notation is the logical notation to use: it matches children's thought patterns, and allows these thought patterns to be discussed; also it leads to greater efficiency on the computer because it is more logical. Postfix notation is used, for example, in Forth.

In prefix notation, the sweets example would be written in a manner somewhat like

```
PRINT ADD 5 1
```

which, I feel, does not have the same clarity. Prefix notation is not sequential; indeed, it is anti-sequential at times. Consider these three examples of infix

```
SQUARE (2 + 3) * (4 – 5)
```

prefix

```
SQUARE MULT ADD 2 3 SUB 4
  5
```

and postfix

```
2 3 MORE 4 5 LESS
  TIMESTOGETHER SQUARE
```

I prefer the first and third versions. The first is useful because that is the way conventional arithmethics works, and the third presents tasks in the order in which we solve them. The prefix form contravenes the task ordering: the last task to be performed is Square, yet it is the first task to be encountered.

Finally, consider the list 2 3 4, where we wish to add 1 on to the value of the first in the list, using postfix

```
2 3 4 FIRST 1 MORE ANSWER
```

It becomes a simple matter to extract the second element in the list, because we start by reducing the size of the list by one element using Butfirst:

```
2 3 4 BUT FIRST 1 MORE
  ANSWER
```

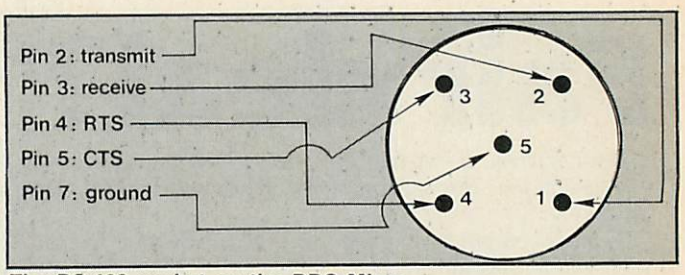
It is known that this task produces slight problems with infix notation, so look at how the task is expressed in a prefix notation

```
PRINT ADD FIRST BUTFIRST
  (2 3 4) 1
```

Boris Allan,
Stockport,
Cheshire.

BBC comms problems

WE RECENTLY had some difficulties trying to communicate between the BBC Micro and a Vax using a multiplexer, modem and the Sussex University Workstation chip. One problem was that the BBC's RS-423 socket is labelled incorrectly in the BBC *User Guide* and the RTS and CTS pins are sometimes transposed.



The RS-423 socket on the BBC Micro.

The Sussex University instructions are fine for a local micro but for a remote micro they are incorrect. The correct connections are show in the diagram; you do not need to short circuit RTS and CTS as directed.

The DIN sockets and plugs on some machines and on some cables allow the user to insert the plug into the socket in two different ways, thus potentially reversing the connections.

M S Brooks,
City & Guilds of
London Institute,
London WC1.

Home accounts

THREE LINES were not included with the Spectrum Home Accounts Budget program published in the June issue. They are:

```
32 let b = 0: let b$ = "0": let
  m$ = "last month"
33 DIM c(20): DIM y$(20,5):
  DIM p$ (20,8)
34 let u = 0
```

VDU 24

THE LETTER from S J Steward in the June issue of *PC*, purports to show a fault in the operation of VDU 24, which defines a graphics window, following the use of VDU 29 to define a new graphics origin. This fault does not exist, at least not with OS 1.2 and Basic 2.

Graphics windows must be defined relative to the current graphics origin, as can be seen by examination of the routine starting at &CA39 in OS 1.2. Attempts to define off-screen co-ordinates are always ignored, even when three out of four may be acceptable. VDU 29, however, works on the absolute screen, as can be seen in its routine starting at &CAA2.

Adrian Stevenson,
Oxford.

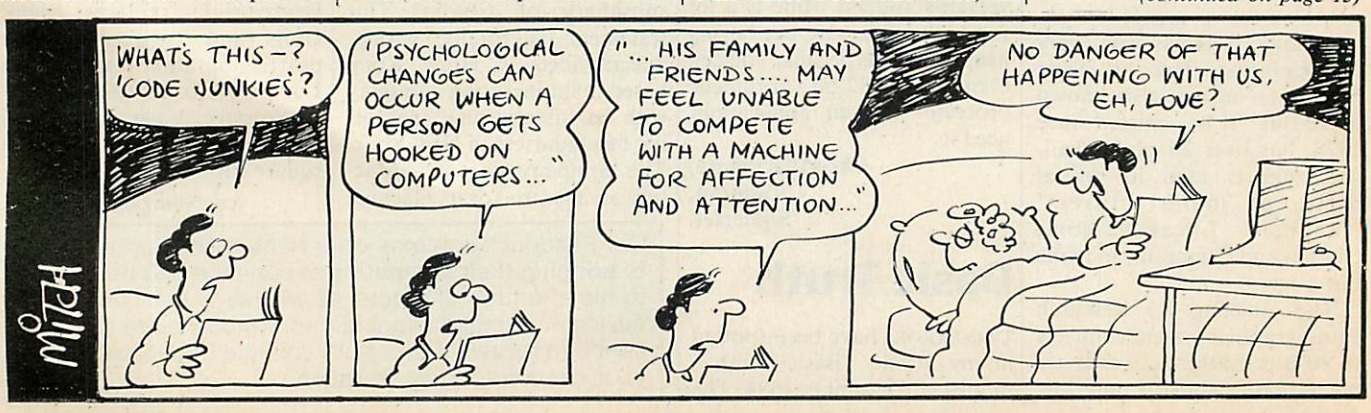
BBC word processing

WHEN YOU carry reviews of software you have a duty towards your readers, many of whom may rely on reviews in deciding which alternative to buy. I was therefore a little concerned to see Barbara Conway's conclusion on the Wordsworth word-processing software — *PC*, June 1984, saying — "domestic and light business users will not go wrong".

I bought Wordsworth for domestic use, and in so doing I went badly wrong. The system is cumbersome and virtually unworkable. It has some advance features, but since the basic system is so totally impracticable they are effectively valueless.

Even simple things like

(continued on page 13)



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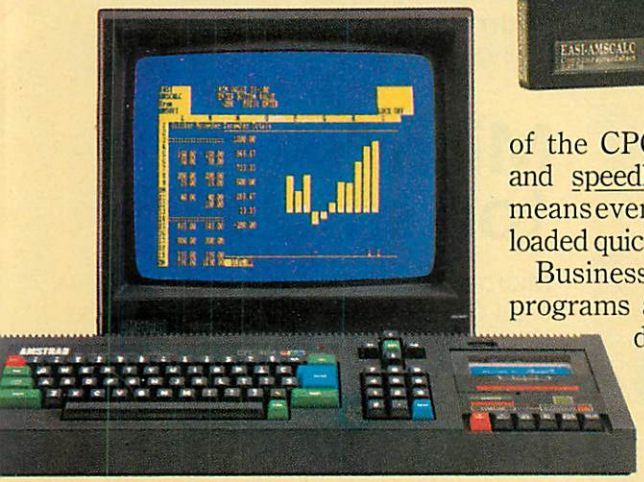
£239
Computer complete with green screen VDU (GT64)

£349
Computer complete with colour monitor (CTM640)

CPC 464 complete with monitor and datacorder

It's mouthwatering.

64K of RAM, 32K of ROM, a high resolution green screen VDU, integral cassette data recorder, typewriter style keyboard, numeric keypad and a very fast extended BASIC. All for £239. (The CPC464 is also available with a colour



CPC464 colour monitor (CTM640)

monitor instead of the green screen VDU for £349 complete).

You'd be hard pressed to find a comparable computer at that price let alone the monitor and recorder.

And the CPC464 comes complete and ready-to-go. Just plug it in.

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The low cost but powerful CPC464 is equally at home in business and educational applications as it is running the household budget or playing games.

With 42K RAM available to BASIC, the opportunities for sophisticated and complex programming are considerable.

80 column text display.

The green screen VDU is purpose designed with a bright, crisp, 80 column text display that compares favourably with systems costing several times as much.

You can program up to 8 text windows and there's a graphics window, too.

The CPC464 has a typewriter style keyboard, large ENTRY key, sensibly positioned cursor keys, numeric keypad for fast data entry and a full 8-bit character set.

If you think that sounds impressive, wait until you hear the 3-voice, 7-octave stereo output through a hi-fi amplifier and speakers.

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A wide range of programs is already available and we're expanding it rapidly. The software takes full advantage



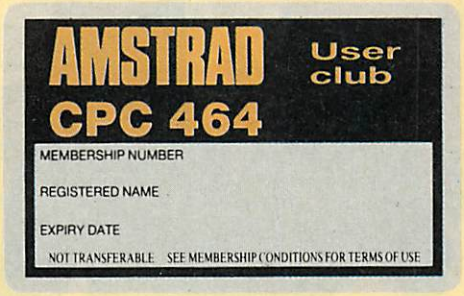
of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.

Business applications, educational programs and arcade games are all designed to make maximum use of CPC464's impressive graphics, stereo sound and processing abilities.

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Members enjoy immediate benefits like the privilege card, Club binder, regular magazine, competitions for valuable prizes and contact with other Amstrad users.

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Finally, a power supply and modulator (MP-1) allows you to connect your CPC464 green screen VDU system to a colour TV.



Optional disk drive DDI-1 including interface CP/M* and LOGO £199.95



Optional 80 column dot matrix printer DMP-1 operates at up to 50 characters per second. Combined with the CPC464, it offers a high performance text processing system for only £199.95.

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NOW WITH 16-BIT MASTER PROCESSOR

Mini's too expensive

For a multi-user business system expandable to 16 screens you used to need a sizeable mini, say from **DEC** or **Burroughs,** with a hefty price-tag for hardware and software, with long time-scales.



Micro's too small

Micros, like **Altos, Sage** and **Rair,** 8-bit or 16-bit, are doomed by CPU degradation, being based on the time-sharing principle. PCs, like **IBM** and **Apricot/Sirius,** just aren't in this league at all, networked or otherwise.









SuperStar multi-user system... ...is just right

SuperStar is a multi-processor system in which up to sixteen 16-bit processors, each with up to 1Mb RAM, are integrated in an attractive desk-top unit. All users can work at full speed in genuine multi-user, multi-tasking mode with full file/record locking and spooling.

At half the price of a mini and a give-away price for the world's largest selection of software, **SuperStar** is just right for any multi-user application.

£5975 buys a complete 2-user high-performance system, with 10Mb winchester and VDUs. Additional users for £995 each, including VDU and processor.

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SuperStar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. MS-DOS is a trade mark of MICROSOFT.

SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system). IMPOS supports CP/M, MS-DOS and shortly Xenix in slave processors in any combination and it is fully upward compatible with ACTION DPC/OS, Televideo MmmOST and TurboDOS.

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NEW GENERATION MULTI-PROCESSING SYSTEM

IMPOS® (Intermixed Multi-processing Operating System) is upwards compatible with TurboDOS, Televideo MmmOST, Action DPC/OS and MP/M + CP/NET software but with a difference. It is written in the highly transportable language C which runs in 16-bit and 32-bit master processors with a much higher degree of performance and sophistication.

Further, while others offer only CP/M80 or CP/M86 compatibility, IMPOS® supports a much wider choice of the most popular operating systems for the slave processors i.e. CP/M80, CP/M Plus, CP/M86, Concurrent CP/M86, MS-DOS and XENIX all working simultaneously sharing common resources.

GENUINE MULTI-USER ENVIRONMENT

Same generic operating system (i.e. Digital Research vs MicroSoft) within the same system have full genuine multi-user facilities e.g. record / file locking.

The fact that all previous generation multi-processing software written with the constraint of 8-bit instruction sets and, of course, a memory size of 64Kbyte of RAM makes them rate very poorly against IMPOS® which has been implemented with 16-bit and 32-bit instruction sets and 1Mbyte of memory space. Of course higher processing power is an added bonus. Wide ara networking over Ethernet is also supported.

SUPERSTAR 16™

BROMCOM® SuperStar 16™ is the first implementation of IMPOS®. Superstar ™ is a desk top system with integral winchester of up to 80Mbyte and a tape streamer of 40Mbyte. Slave processors are Z80A with up to 128Kbytes or iAPX186 with up to 1Mbyte RAM. A total of 16 Slave processors can be accommodated in any combination while the current Master processor is an 8086 with up to 1Mbyte of RAM.

For more information ring 01-697 8933 and ask for Bob Bartlett.

(continued from page 8)

laying out a letter, with an address at top-right roughly lined up with the right-hand edge of the text, can only be achieved by counting line lengths, subtracting from 80 and then tediously typing in 60 gaps before typing text.

After comparing it with Wordwise, which is simplicity itself to use, no truly conscientious reviewer could suggest that anyone should seriously consider Wordsworth. In fact, I should be interested to know if there are any satisfied users of Wordsworth around, apart from the writer of the program. I am so dissatisfied with my disc version of Wordsworth that I would give it to anyone willing to wrestle with it.

Rolf Clayton,
London NW7.

AS A USER of the Merlin Scribe word-processing package on my BBC Model B, I must take Barbara Conway to task for not being sufficiently enthusiastic about this excellent system. It is not merely idiot-proof, thank heavens, but also of limitless memory and easily updated. The latest utilities disc, version 1.31, permits automatic or manual page numbering, as well as headers and footers and easy changes to the printer instructions.

I would encourage anyone seeking a versatile first-time word-processing package to consider Merlin Scribe, which is very comprehensive despite its simplicity of use. The back-up from Merlin is excellent: I received a replacement updated utilites disc free of charge by return of post. The linked database system is due out shortly and will also be obtainable combined with Scribe on a single chip.

T G Williams,
London SW12.

Sorry!

WE APOLOGISE for the non-appearance of the August issue of *Practical Computing*, Volume 7 Issue 8. This was due to an industrial dispute.

Subscriptions will be extended by one month, so each subscriber will still receive 12 issues of the magazine.

Wren development

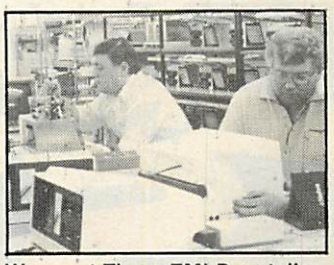
I READ Chris Bidmead's evaluation of the Wren Computer system in the June issue of *PC*, and would like to clear up a couple of points that have since come to light.

A cover to protect the screen in transit is supplied with the Wren and has been designed to house cables, discs and quick-reference guides. A carrying case is also available as an extra, which houses the complete machine. Some changes have been made to the sliding mechanism so that there is no difficulty sliding the keyboard in and out. The production model now has a fan fitted at the rear of the cabinet.

M-Tec (U.K.), which supplied BBC Basic (Z-80) for the Wren, is also producing a programming manual for the Basic, and is supplying it direct.

Gerald Perry,
M-Tec,
Reepham,
Norfolk.

THE REVIEW of our Wren Executive System in the June 1984 issue of *PC*, while very positive about the machine,



Wrens at Thorn EMI Dynatel's Treorchy plant.

does mention possible production delays. I am happy to tell you that production is now well under way, and we have no doubt that they will indeed sell "by the flock".

Terry Cartwright,
Prism Technology
Holdings Ltd,
London EC1.

Cardbox-Plus

NO, it's not Caxton's Cardbox-Plus in ROM on the Epson PX-8 — see *PC* July page 67. Cardbox is written by us and published by Caxton Software; Cardbox-Plus is written and published by us, and it is a special version of this that forms the Portable Cardbox-Plus on the PX-8.

Martin Kochanski,
Business Simulations Ltd,
Speldhurst,
Kent.

RML winner

WINNER of the RML 480Z languages competition which appeared in *PC* March and April issues is Peter McClean of Belfast. The prize is a disc-based 480Z computer system with peripherals and software donated by Research Machines Ltd. In accordance with Peter's wishes the prize goes to his school, the Christian Brothers' Grammar School, Glen Road, Belfast.

The correct answers to the questions about programming languages were, in order: E C B B D B A E C E . Among the many good sweatshirt slogans suggested in the tie-breaker were "I was a centrefold in *Practical Computing*", and many variations on the "Programmers do it logically", "Hackers do it bit by bit" theme.

Suggested new languages included Vocal — Voice Oriented CommAnd Language; Magic — Multi-purpose Animated Graphics Instruction Code; goal — Games Oriented Application Language, and Epilog — Education Programming In LOG, which was described as the last word in logic languages. However, Peter McClean's was the best entry, combining the right answers with a good sweatshirt slogan, "Take a peek inside *Practical Computing*" and a plausible language acronym.

The large number of entries we received for the competition has encouraged us to arrange more competitions for forthcoming issues. Meanwhile thanks to everyone who entered, and to Research Machines Ltd.

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The new Sanyo 16 BIT small business micros... with tremendous potential for businesses of all sizes.

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Full details of the new Sanyo micros on request.

ICARUS

ICARUS COMPUTER SYSTEMS LTD, 39-51 Highgate Road, London NW5. Tel: 01-267 0177. Telex: 264209

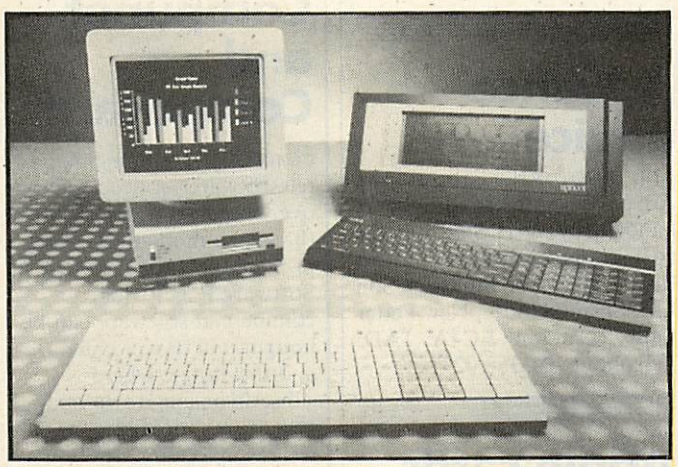
● **Circle No. 107**

Apricot abundance

ACT has launched two more models in its Apricot range. The Portable offers an 8086 processor, 256K RAM, a 3.5in. 720K floppy, 80- by 25-line LCD in a two-piece machine weighing 13lb. together with a voice recognition system. Bundled software includes MS-DOS, voice-driven applications and an icon-type graphics package. The price is £1,695.

The other machine is the F1, or the First One. This £1,000 micro has very similar specifications to the Portable excluding a screen. The colour video output will work with a variety of monitors or television.

In addition to RS-232 and Centronics ports, there is provision for a cordless



infrared mouse, which can double as a trackball, and is also available for the Portable. Bundled software includes MS-DOS, and three application packages from the Super range, including Supercalc.

Details of the machines and of two local area networks, Point 7 and Point 32, can be obtained from ACT on 021-454 8585.

Osborne again

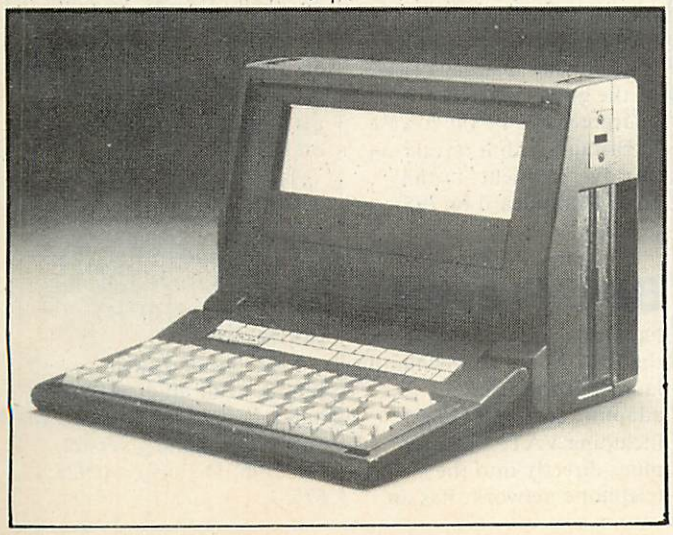
OSBORNE has optimistically named its new portable the Encore, obviously hoping to repeat the success of the Osborne 1.

The Encore is IBM compatible, with a CMOS 80C86 processor, 128K RAM and an integral 5.25in. floppy. First models incorporated a 16-line by 80-column LCD, but it is hoped to use a full 25 line by 80 columns in the final version. Including rechargeable batteries, the micro weighs about 10lb.

Other features include an integral autodial modem and a real-time clock with battery backup. The full-size keyboard has 10 function keys and four special utility keys. MS-DOS is supplied with a word-processing package called New Word. In addition to a battery recharger there is a mains power unit provided as standard.

Pricing is uncertain at the moment because of the fluctuations in the dollar exchange rate, but the standard model will be under £2,000. Upgrades with two floppies will be available later.

More information from Future Management (Portable Computers) Ltd, 38 Tanners Drive, Blakelands North, Milton Keynes, Buckinghamshire. MK14 5LL. Tel: (0908) 615274.



Commodore comes through

MORE DETAILS on the new Commodore home micros described in July's *Practical Computing* are available. The Commodore 16 offers 16K RAM, and 32K ROM with the new Basic 3.5, and costs £129.99, which includes a cassette unit and four games. A special Help key highlights errors in input lines.

The Commodore Plus 4 occupies the same middle ground between games and serious use as the QL. For £249, the 64K RAM machine comes with Basic 3.5. and the 3 Plus 1 suite of application packages.

The word-processing, spreadsheet, database and graphics packages are held on a 32K ROM, and can be accessed instantaneously. Windowing techniques allow information from two packages to be displayed simultaneously. Further details can be obtained from Commodore dealers.

ICL PC

ICL has added to its range of eight- and 16-bit micros with the launch of the Model 6. For

(continued on next page)

Shorts

- The Magnum lap-portable is an Australian micro running an 80186 processor, with 256K RAM and several ROM-based applications. Cost is about £2,000. More from the Australian Trade Commission on 01-438 8561.
- DEC has cut the cost of a Rainbow 100B by nearly 20 percent to £2,295. The price includes one year's maintenance. Details on (0734) 868711.
- A Centronics parallel interface for the QL has been produced by Cambridge Systems Technology. The Q-Pi uses the expansion port and costs £75 excluding VAT. Details on (0223) 323302.
- Dragon Data has been sold to the Spanish company Eurohard. Plans for the company's future development have not been released, but it seems likely that production of machines will be in Spain.
- Oric has gone against the current trend and increased the price of the Atmos by £20 to £189.95. Oric blames the worsening dollar exchange rate. Details on (0990) 27641.
- Disc-drive prices for the RML 480Z have been cut by 20 percent to £492, and for educational establishments to £399. Details on (0865) 249866.
- Inmac offers a serial to parallel converter, costing £125. More information on (09285) 67551.
- The Televideo 804 is a multi-tasking system with a 10Mbyte Winchester for £3,910. Details on (09327) 81266.
- A three-channel sound synthesiser for the Spectrum has been produced by DK'tronics. More on (0799) 26350.
- Two more MSX machines have been launched by Mitsubishi in Japan. The machines offer a basic 32K of ROM and RAM together with 16K of packages in ROM.

(continued from previous page)
£1,995, the Model 6 offers an 8088 running at 5MHz, with 256K RAM as standard expandable to 1Mbyte, two 782K discs, and two asynchronous serial ports.

Bundled in the price is Concurrent CP/M-86 and Personal Basic. The system can be upgraded to the Model 16 and Model 36.

Details from ICL, Bridge House, Putney Bridge, Fulham, London SW6 3JX. Telephone: 01-788 7272.

Acorns coming and going

ACORN has retained the BBC Micro contract for the next four years starting in September. It has announced that it will be concentrating on Model B production and that the BBC Model A will no longer be sold from September.

Acorn has also launched an expansion unit for the Electron, which adds a Centronics interface, joystick port and two slots from Acornsoft's new cartridge software. The Plus-1 costs £59.90 including VAT.

The first six ROM cartridges include Snapper, Starship Command, the educational Tree of Knowledge and Lisp. Cartridges cost £14.95, except for Lisp which costs £39.95. More information can be obtained from Vector Marketing, London Road, Denington Estate, Wellingborough, North Hampshire NN8 2RL. Telephone: (0933) 22895.

Epson OEM lap portable

EPSON is producing a lap-portable machine for OEMs only. In design it is similar to the PX-8 reviewed in *Practical Computing*, July 1984. End-user applications will incorporate options such as a micro-cassette, 16K RAM cartridge backed by a lithium battery, and a 64K ROM cartridge.

The LCD displays eight lines of 40 columns, but supports a virtual screen of 25 lines by 80 columns. End-user prices will depend on specific applications and bundled software.

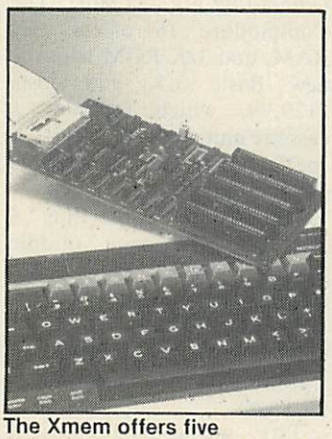
Advance advice

ALL ENQUIRIES about the Advance 86 micro are being handled by W H Smith at the following address: John Rowland, W H Smith & Son Ltd, Strand House, New Fetter Lane, London EC4A 1AD. Telephone: 01-358 0277.

Apple cards on the BBC

THE XMEM backplane for the BBC Micro allows up to five Apple expansion cards to be used. It also offers 64K of extra RAM. The unit plugs into the 1MHz bus port, and is run from Basic or a machine-code program.

The cost to end-users will be about £300. Details from Xcalibur Computers Ltd, Spencer House, 3 Spencer Parade, Northampton NN1 5AB. Telephone: (0604) 21051.



The Xmem offers five expansion slots and 64K RAM.

NEC office system

FOR £995 excluding VAT, NEC is offering its 64K eight-bit PC-8000, a 100cps matrix printer, two 350K disc drives, a colour monitor and CP/M. The previous price for this configuration was £1,600. Details from NEC dealers, or NEC on 01-388 6100.

Communications

Compunet and Compucard

COMMODORE is launching a telesoftware service available over standard telephone lines through a modem. Services provided include the Software Park, where commercial software can be bought and downloaded, and the Jungle where subscribers can download other users' programs as well as uploading their own in an attempt to sell it.

Other facilities include an electronic mailbox and software that enables viewdata servces to be accessed. After an introductory period, more retailing and information services will be offered. The modem costs £99.99 and initially the first year's subscription to Compunet is free.

Subscribers have free access in the evenings and at weekends, and many parts of the service are provided without charge. Connection is via the telephone network; there are 12 numbers, covering the whole of England. Further information can be obtained from Commodore Information Centre. Telephone: (0753) 79292.

Commodore hopes to add a Prestel-like shopping service, Compucard. It will also be available via a special modem for other micros. After an initial membership fee of £20 there is no further charge. Prices of the goods offered are guaranteed to be the lowest in Britain, with a refund on any overpayment. Details from Compucard on (95) 53553.

BBC Prestel

PRESTEL is now available on the BBC Micro following the launch of the Prestel adaptor, costing £113.85 including VAT. The unit plugs directly into the telephone network, has an autodial facility, and can download telesoftware from the Micronet 800 database.

The adaptor uses the RS-423 port and one of the sideways ROM sockets for the viewdata telecomms ROM. Further information can be obtained from Vector Marketing, London Road, Denington Estate, Wellingborough, North Hampshire NN8 2RL. Telephone: (0933) 22895.

Micronet for the 64

MICRONET will be available for the Commodore 64 from August. As well as supplying a modem, Micronet provides a special plug-in ROM cartridge for downloading software from the database of Commodore programs. The cartridge costs £43 excluding VAT. The standard price of £13 per quarter is charged for the Micronet service.

Micronet has also announced a bundled deal whereby for a rental of £11 per month you get Prestel subscription, a Prism VTX-5000 modem for the Spectrum and the appropriate software.

Details from Micronet 800, Telemap Limited, Scriptor Court, 155 Farringdon Road, London EC1R 3AD. Telephone: 01-278 3143.

More modems

MORE MODEMS are gaining BT approval. Oric has announced a modem for the Atmos and Oric 1, costing £100 including VAT. Details on (0990) 27641.

The Portman multi-speed modem from Interlekt offers a range of transmission rates from 75 baud to 1,200 baud. The price is £175 excluding VAT. More on (0734) 589551.

More up-market is Inmac's full duplex 1,200 baud modem for £565, or an automatic dialling version for £745. Details on (09285) 67551.

A COMPLETE COLOUR MICRO WITH NO HIDDEN EXTRAS FOR AROUND £499.



The title of 'genius' is not bestowed lightly on man or machine: those extraordinary qualities and powers of intellect are rare.

Einstein had them in full measure. And so now does the new micro computer from Tatung, designed and built in Britain and appropriately named – Einstein.

Einstein was created by Tatung, one of the world's leading electronic companies, and given the capacity and the remarkable capabilities to compete with computers costing far more.

Its simplicity of operation will appeal to the first time buyer and to businessmen who don't want to lose staff to expensive and time-consuming training courses. At the same time its operating system is both powerful and sophisticated to satisfy the most advanced requirements.

For those who have outgrown their existing primitive machine, the speed and capacity of the 500K built-in disc drive will make all the difference. And for the small businessman, the ability to store and retrieve all information in seconds will be as important as Einstein's built-in flexibility, which allows the system to grow as the business develops.

BUILT-IN 80K MEMORY
Total memory capacity 80K RAM divided into 64K 'user' memory and 16K for colour graphics production.



BUILT-IN DISC DRIVE
500K 3" compact floppy disc drive. Potential for massive extra storage with a second 500K disc drive internally.

BUILT-IN 16 COLOUR GRAPHICS High resolution graphic animation from 32 sprites (definable shapes), 16 vivid colours.

BUILT-IN EXPANSION PORTS
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BUILT-IN FLEXIBILITY
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Sound synthesiser facility includes chromatic music with three voices. Substantial speaker with volume control. Provision for speech synthesiser.

Einstein has them all. Feature for feature, it meets the needs of the novice and the experienced operator, both at home and in the office.

Einstein, designed and built in Britain, is a complete colour micro computer with no hidden extras.

And for under £500 is sheer genius.

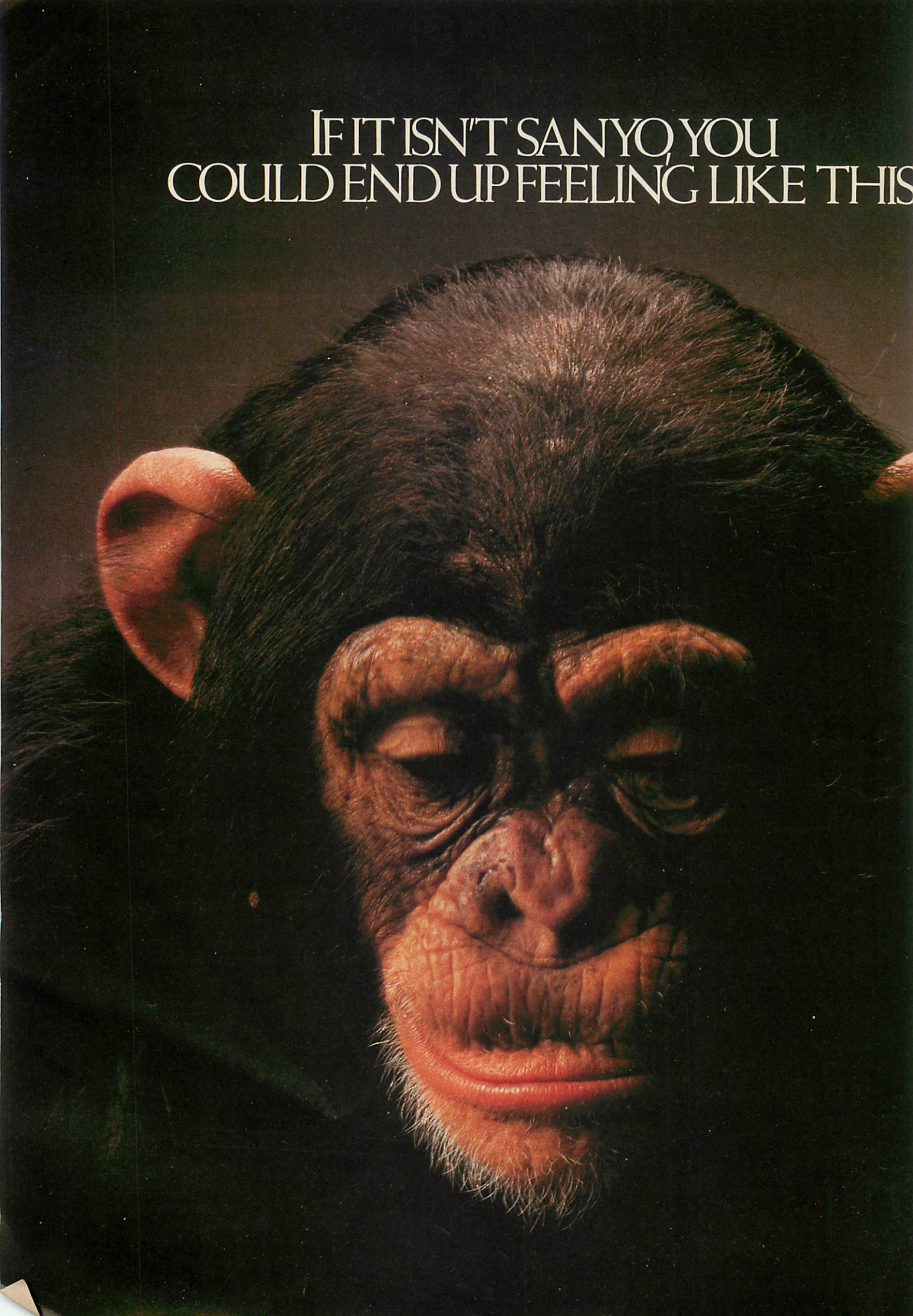
TATUNG
Einstein

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● **Circle No. 108** †CP/M is a trade mark of Digital Research Inc.

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They don't know about the huge range of standard application and specialist software available, let alone the powerful business systems package provided with every Sanyo micro.

They don't even take the time to fill in the coupon to find out the facts.

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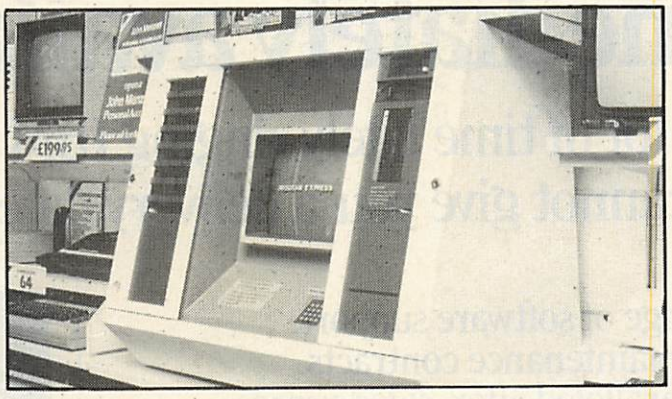
A British Company of ITT

● Circle No. 256

Software dispenser

THE Program Express EDOS terminal may soon replace the racks of software cassettes in stores like Menzies and Boots — EDOS standing for electronic distribution of software. Built around a dedicated 6809-based computer, the terminal can hold up to 1,000 programs locally on its built-in 40Mbyte hard disc.

When you go to buy a program the sales assistant will make a copy on the spot with the EDOS terminal, which is capable of producing cassettes, discs and cartridges in a wide range of formats. Every sale is carefully logged so the software house gets paid too.



Each EDOS terminal is linked by phone line to a central Hewlett-Packard system located in Edinburgh which keeps a record of each sale as well as regularly updating the range of programs held in the machine.

The retailer typically pays about £100 a week to rent the EDOS system. More details from Program Express Ltd, 23 Dalmeny Street, Edinburgh EH6 8PG. Telephone: 031-553 4709.

dBase III

ASHTON-TATE has announced dBase III. Rewritten in the C system programming language to take full advantage of the greater computing power offered by modern 16-bit machines, dBase III can handle much larger volumes of data than dBase II.

The dBase II language has been retained, but an interactive help facility called Assist is added to aid the first-time user. Running under MS-DOS 2, dBase III requires 256K of RAM and twin floppies or a hard-disc system.

IBM PC and XT versions should be available immediately, price £495. Existing users can upgrade from dBase II for £130. Details: Ashton-Tate U.K. Ltd, Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY. Telephone: (0908) 568866.

QL business software

BACKING UP Sir Clive Sinclair's claim that the QL is a business machine, Sinclair Research has concluded a deal to put Sagesoft's well-known accounts program on the machine. Sagesoft is now rewriting the package to work with the QL's Microdrives, and expect to have the product on sale sometime after Christmas. The price is still unannounced, but Sinclair Research has indicated that it will be under £100.

Meanwhile Datacaller has already released a specialist business package for the QL. Called Microquote, it is aimed at insurance brokers dealing in the private car market. Brokers type in the answers to 14 questions about their clients, and the system then displays a list of the lowest quotes calculated from policy details from over 60 insurers. Datacaller will be issuing monthly data updates on Microdrive.

Microquote costs £295 including VAT, with updates costing £43 per month. With a QL and monochrome monitor thrown in, the price works out at £795 including VAT. Contact: Datacaller Computer Services Ltd, Rodney House, King Street, Wigan, WN1 2BT. Telephone: (0942) 496429.

QL software for IBM

XCHANGE is Psion's full-blown version of its QL software, rewritten for the IBM PC and ACT Apricot. Scheduled for release in September, the four linked packages cover word processing, spreadsheet, database and graphics.

Psion has taken advantage of the extra memory and real disc drives of the PC and Apricot to improve on the functions offered by the original QL software. Xchange is priced at £495 excluding VAT, with the packages also available separately from £175.

Details from Psion Systems Ltd, 22 Dorset Square, London NW1 6QG, or telephone Teledata on 01-200 0200 and ask for Xchange.

Amstrad and MSX assembler

KUMA has released versions of its established Zen Z-80 assembler for the Amstrad and MSX home computers. Priced at £19.95 including VAT, the Zen package comprises assembler, disassembler, text editor and machine-code monitor, and is supplied on cassette. Kuma intends to release Zen for this year's other new Z-80 based machine, the Tatung Einstein.

Details of further Kuma releases, including games, for the Amstrad, MSX and Einstein from Kuma Computers Ltd, Unit 12, Horseshoe Park, Horseshoe Road, Pangbourne, Berkshire RG8 7JW. Telephone: (07357) 4335.

Shorts

● Top Spectrum game Football Manager is now available for the Commodore 64. Priced at £7.95 including VAT, the game puts you in the role of manager of a struggling fourth-division club. Can you escape relegation or win the F.A. cup? You make managerial decisions before each game and then watch animated highlights in wonderful Commodore graphics. Contact: Addictive, 7A Richmond Hill, Bournemouth, Dorset BH2 6EH. Telephone: (0202) 296404.

● Practicalc II is a low-cost integrated word processor/spreadsheet/database for the Apple IIe and IIc. It costs £69.95 including VAT. Details from Practicorp Ltd.

● Dulwich College is holding a second exhibition of educational software and equipment. To be held at Dulwich College on October 26 and 27, it is open only to teachers — no children. The main aim is to show teachers the best of the available products, and only selected companies have been invited to exhibit. Entry will cost £1 per person at the door or £2 per school in advance. Contact: Educomp 84, Dulwich College, London SE21 7LD.

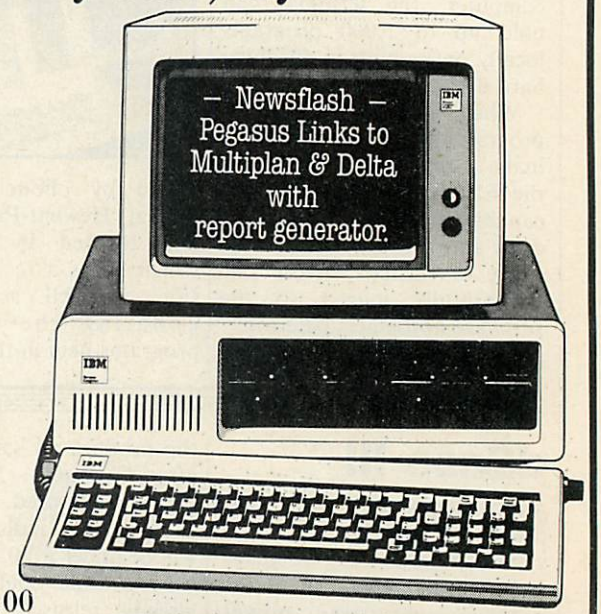
● The second *Your Computer* Christmas Fair is taking place at Olympia in London from November 30 to December 2. Sponsored by *Practical Computing*'s sister magazine *Your Computer*, the exhibition concentrates on home computers and is open to children. A large number of exhibitors will be showing off their latest games software, and on last year's evidence the fair will be a good place to pick up bargain peripherals. More details from Reed Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Telephone: 01-643 8040.

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- Multimate – £340.00
- Wordcraft – £340.00
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- Send telexes from IBM PC – £1750.00

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- Quadlink turns PC into Apple – £495.00

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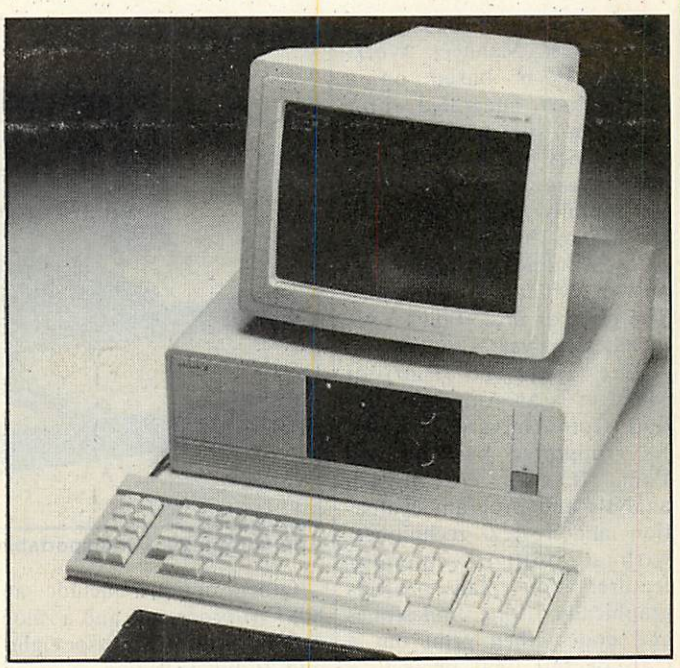
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Ericsson PC



ANOTHER new IBM PC look-alike is to be launched on September 10 by the £2.3 billion turn over Ericsson Group, best-known for IBM-compatible minicomputers and telecommunications. Again it is claimed there will be a full range of six models, with full operational compatibility with the IBM.

The Ericsson PC uses an Intel 8088 and has built-in 640- by 400-pixel graphics, plus special comms features yet to be announced. It is being built in Sweden to an Ericsson design, unlike the Step One, which was bought in from a Japanese manufacturer. Projected sales of the Ericsson PC run into hundreds of thousands.

Contact: Ericsson Information Systems, 7 Gresham Street, London EC2V 7BX. Tel: 01-606 0425.

Easy as Qed

A NEW British integrated software package designed for managers includes a diary, address book, day book, calculator, telex formatter, forms design and a project planner. The package is called Qed, for Quantec executive desktop.

The package is fully integrated, with entries being made via a day book and an events file. The diary is then updated automatically, and can be printed out. The address book allows the printing of address labels and, with a suitable modem, the automatic dialling of phone numbers. The filing system offers up to 1,000 filing categories. The project planner uses critical-path analysis, and can handle up to 150 separate activities.

Qed costs £195 plus VAT, but you do need a modem to make the best use of it.

Contact Quantec Systems, 230/236 Lavender Hill, London SW11 1LE. Telephone: 01-223 7672.

Mad-1

THE MAD-1 claims both to be fully compatible with the IBM PC, and to offer significant improvements. It uses the Intel 80186 chip instead of the 8088, and has a maximum graphics resolution of 720 by 350 pixels instead of 640 by 200.

The system can be supplied with 128K or 256K of RAM, expandable to 512K on the main board. Two 5.25in. 360K floppy-disc drives are supplied as standard, with a 10Mbyte hard disc option. The Mad-1 also includes built-in colour graphics, a clock/calendar, two RS-232C ports, Centronics parallel printer port, and a 12in. green or amber screen.

The Mad-1 comes in two flat boxes, with room for only one IBM expansion card to slot in sideways. A third expansion box can be added to provide a further four slots.

Mad comes geographically from Santa Clara, California, and acronymically from Modular Advanced Design. The exclusive importer for the U.K. and Eire is MBS Microtex. Prices start at £2,785 plus VAT for a twin-floppy system with 128K.

Contact MBS Microtex, 119-120 High Street, Eton, Windsor, Berkshire SL4 6AN. Telephone: (07535) 68171.

Practicorp's low-cost range

PRACTICORP has launched a range of three programs for the IBM PC at unusually low prices. Practiword, Practibase and Practicalc III cost only £99.95 each. You can buy all three together for £249.95. As they share a common command structure, it is claimed that the programs can be used as an integrated system.

Practiword and Practibase will read and convert WordStar and dBase II files respectively. Practicalc III, developed from the successful Commodore 64 package, offers a 999- by 225-cell spreadsheet with built-in colour graphic facilities and text processing, making it a very powerful package.

While the IBM PC versions have come first, Practicorp plans to make the range available for the Apricot and, later, other MS-DOS micros.

Contact Practicorp, Goddard Road, Whitehouse Industrial Estate, Ipswich IP1 5NP. Telephone: (0473) 462721.



Mad-1, the Intel 80186-based 16-bit micro from MBS Microtex.

PC project planning

MOST managers are involved with project planning and meeting deadlines, whether it be publishing a magazine or launching a new computer or simply completing a nuclear power station. So the absence of project management software is strange.

Now the IBM PC user has a choice of four new packages. The first three are project managers, available from Microsoft, Hoskyns, and Pete and Pam respectively. The fourth is the integrated package, Qed.

Microsoft Project is an attractive product, mainly because it looks and works just like the familiar Multiplan spreadsheet, but with a built-in calendar. It is intended for planning, scheduling and budgeting, and carries over Multiplan's valuable "what if?" facility. Data can be exchanged with Multisoft Chart for graphing. Microsoft Project requires a minimum of 128K of RAM and costs £199 plus VAT.

Hoskyns' offering is called

(continued on next page)

(continued from previous page)
the Project Manager Workbench. It is based on a Gannt chart, integrated with a resource spreadsheet and dependency network display. The screen can be scrolled horizontally or vertically to show up to 19 weeks or months of scheduling. It can also answer "what if?" questions. The price of £1,250 plus VAT includes one year's support.

The Harvard Project Manager is an American product from Harvard Software Inc., imported by Pete and Pam. It uses critical-path analysis and program evaluation and review techniques, with a built-in calendar feature. You plan projects graphically using milestones and nodes, then print out a map of the final project, a schedule, a detail report, and a status report including exceptions such as tasks likely to be late. The Harvard Project Manager costs £349 plus VAT.

Contact: Microsoft Ltd, Piper House, Hatch Lane, Windsor, Berkshire. Telephone: (07535) 59951. Hoskyns Group Ltd, Africa House, 64/78 Kingsway, London WC2B 6BL. Telephone: 01-242 1951. P&P Micro Distributors Ltd, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 217744.

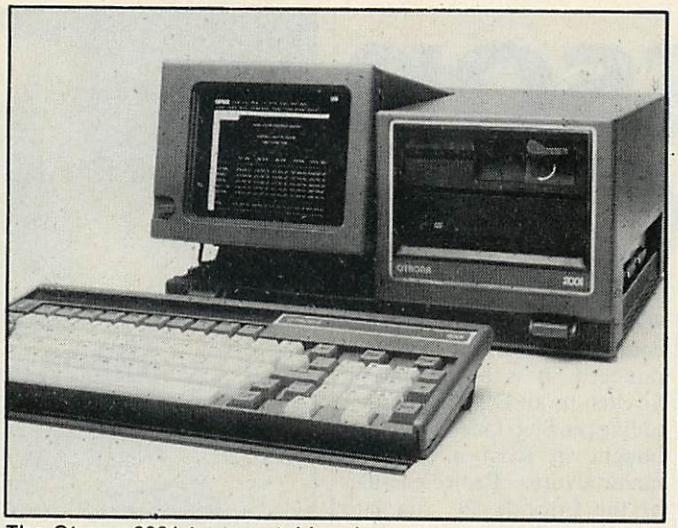
Otrona 2001

AFTER the portable and the transportable, Otrona has invented a new type of micro, the convertible.

The Otrona 2001 is a transportable micro that looks like no other, but claims full operational compatibility with the IBM PC. It features an Intel 8088, 128K of RAM expandable to 640K, and a tiltable built-in 7in. amber screen. Disc options include one or two half-height 5.25in. floppies or a 10Mbyte hard disc with shock mounting.

As a transportable, the Otrona measures 7in. by 15in. by 14in. and weighs about 19lb. with one drive.

When the built-in screen is flat and covered over, an optional 12in. mono or 13in. colour monitor can be stood on top of the system, providing a configuration resembling a standard desk-top machine.



The Otrona 2001 transportable micro.

Other options include an 8087 co-processor, and a Zilog Z-80B for dual processor eight- and 16-bit operation, a nylon carry-case and a 3.5lb. battery pack.

Otrona Advanced Systems earned a good reputation for its very small but expensive Attache portable, which was toted around by the likes of Gary Kildall but never sold officially in the U.K. The 2001 is being sold by a new U.K. company, Puma, at fairly attractive prices: £2,155 plus VAT for the floppy-disc system, and £3,3550 plus VAT with the hard disc.

Contact Puma Ltd, Westward House, Leigh Lane, Bramshall, Uttoxeter, Staffordshire. Telephone: (08893) 3082.

IBM portable

ONLY a few months after the U.S. launch, IBM's own portable version of the IBM PC has been announced in the U.K.

The Portable Personal Computer has a five-slot main board with an Intel 8088 processor and 256K of RAM, expandable to 512K. It has a built-in 9in. amber display, and one or two half-height 5.25in. 360K floppy-disc drives. It measures 20in. by 17in. by 8in., weighs 30lb., and comes with a carrying bag.

The switchable power supply means it can cope with 110/115V and 50Hz or 60Hz mains power.

Initial supplies of the PPC will be supplied from the U.S.A., until production samples start to flow from the IBM factory in Greenock, Scotland.

The entry-level price of the PPC is £1,704 plus VAT for a single-floppy model without keyboard. The keyboard, with it special recess for the connecting cable, clips on to the front of the PPC to form its base. Since it has a different connector from the standard PC keyboard, you can hardly avoid buying one for £185 plus VAT.



IBM's PPC is in part a response to the success of the Compaq transportable. Whether it can dent Compaq's sales at such prices remains to be seen.

Contact your local IBM-authorised dealer.

DR Starlink

DIGITAL RESEARCH has just launched Starlink in the U.S.A. It converts an IBM PC or XT into a multi-user system. It comprises an expansion card with its own 8088 CPU and 64K of RAM and the Concurrent DOS version of CP/M. The system requires 512K of main memory, and a hard disc is recommended.

Starlink enables up to five people to use the same PC, as long as each has their own terminal.

The U.S. price of Starlink is $1,650. European prices and availability will be announced this autumn.

Contact Digital Research (U.K.) Ltd, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Tel: (0635) 35304.

Hercules goes colour

THE HERCULES graphics card became popular because it enabled you to run monochrome graphics on the standard IBM monitor, and thus run Lotus 1-2-3 without buying a colour monitor. But if you want colour, Hercules now makes a board that supplies it.

Advantages of the Hercules Colour Card over the IBM equivalent are that it provides a parallel printer port, a light pen interface, and it takes up only a half slot rather than a full-size expansion slot. The price is £199 plus VAT.

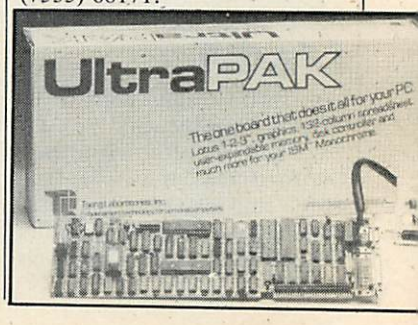
Contact Reflex Ltd, Wellington Industrial Estate, Basingstoke Road, Spencers Wood, Reading. Telephone: (0734) 884611.

Ultrapak

THE ULTRAPAK expansion board offers a 132-column by 44-character display, as well as the standard 80-column display, so you can see more of your Lotus 1-2-3 or Multiplan spreadsheet.

It also provides colour graphics, a Centronics parallel printer port, an RS-232C serial port, a clock calendar and VT-100 terminal emulation. The price is £575 plus VAT.

Contact MBS Plus, 119-120 High Street, Eton, Windsor, Berkshire SL4 6AN. Tel: (7535) 68171.



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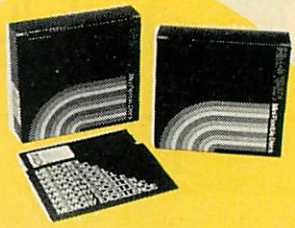
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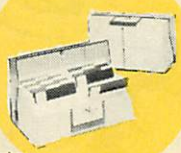
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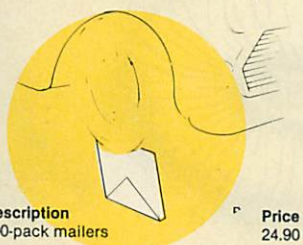
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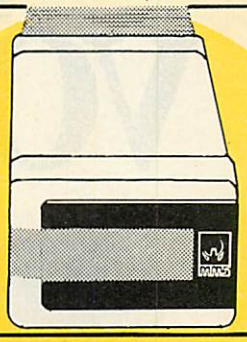
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● Circle No. 248

T4 still top mouse

John Billingsley reports on the British heats of the 1984 Euromouse contest.

IT SEEMED a good idea at the time. In Madrid, a slick mouse ran to the centre time after time in 31.4 seconds — until the judges decided that it had become boring. To make things more exciting, how about adding one second to the best time for each minute used of the 15 minutes allowed for repeat runs? In the Euromouse British finals at the Earls Court Computer Fair the problem became clear.

Professor John Coles and Thea Coles came to judge the novice finals. As a past President of the Institution of Electrical Engineers Professor Coles looked for a high standard in the mice. Alan Dibley added his experience as the creator of the greatest number of mice.

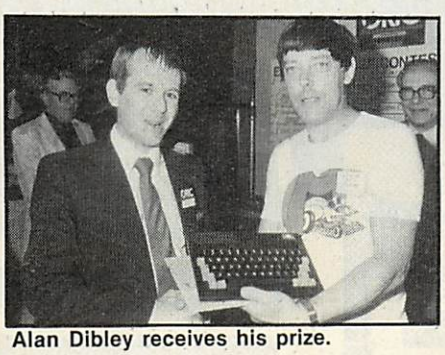
Tritac was the first mouse to run — but not very far. LEDs twinkled and motors whirred, but the first corner was too much for it. Fullyautomatix came next but had to be withdrawn early. Boris arrived, and departed in haste to perform running repairs under the three-minute rule.

Maze strategy

Now Jerry took to the maze. A small furry creature with mechanical sensors, it displayed a good grasp of control theory as it negotiated corners and straights with ease. Correction was performed by a brief reverse pulse on the appropriate motor, and the resulting performance holds great promise. Unfortunately, maze strategy was entirely lacking: having found a serious glitch in the processor, the team had disconnected it.

Bill Urmenyi's Gonzales — no longer Speedy but much more steady — turned in a time of 3min. 16s. during practice but was beset by indecision when its turn came. It performed an about-face moved a square or two, dithered and turned back again — and again, and again. Apparently locked into a bout of sentry duty, Gonzales was about to be lifted out for a restart when it set off in another direction. Alas, indecision won out in the end, and Gonzales failed to reach its goal.

Gonzales did, however, win the Acorn Electron first prize, together with the mounted piece of brass cheese. Jerry carried off the second prize of £50, donated by *Practical Computing* and its sister magazines, while Fullyautomatix took away the third prize of a Micro Pad programmable joystick interface.



Alan Dibley receives his prize.

On Sunday, Finals day, Dibley's T4 and T5 started limbering up against Dave Woodfield's Knownaim. All three are tricycles of various sorts, and all show a brisk turn of speed on corners. Mike Westbrook, Chairman of the Computing and Control Division of IEE, came to judge and was joined by Chris Hipwell, publisher of *Practical Computing*.

Thezeus now came in and plodded around, curtseying on the corners, to reach the centre in over nine minutes. It was still happily exploring the distant reaches of the maze when time ran out, and the 15-second penalty did not seem to make much difference to its achievement.

With Thezeus in the background, Dibley displayed the finer points of T5. In practice, T5 had not run quite staight. Some of the glue which fixed on the driveshaft had penetrated into the bearings and a strip-down was needed.

Thumper had overexerted itself in practice, having reached the centre of a simpler maze in 57 seconds. Now it behaved erratically with apparent battery trouble, announcing "Back to square one" as it slewed into a wall.

Its place was taken by Knownaim, David Woodfield's sleek tricycle with a forward-mounted sensor boom. Whenever it has reconnoitred a straight, it puts on a burst of speed. In 2min. 8s. it found the centre the first time, then on the next run in 57 seconds untouched.

Then the probelms started. Knownaim had found the shortest route, and covered it in a mere 40 seconds, but it needed help on one corner. Another run, and the same thing happened again. On each run, a valuable minute was lost, adding a second to the final score.

Should Woodfield persevere in the hope of a clear run, or should he cut his losses and hope that a score of 57 plus 7 seconds would beat T4? The strain was beginning to tell on Woodfield and on the mouse. Twice the mouse started by running askew into a corner, and he made a snap decision to retire with a score of 57 plus 8 seconds.

T4 set off, whipping around corners, led by its black paper sensor shade. Three times it ran foul of the walls and had to be restarted, though learning more of the maze all the time. On the fourth run it reached the centre in 50 seconds, with only five minutes spent. Dibley retired and the contest was over.

Next stop Japan?

Alan Dibley is now the proud owner of an Oric Atmos 48K computer with membership of the Oric club. He will also receive £300 from Oric towards his travelling expenses to represent Britain in the Copenhagen European Finals at the Euromicro conference in August. From there the next stop could be Japan.

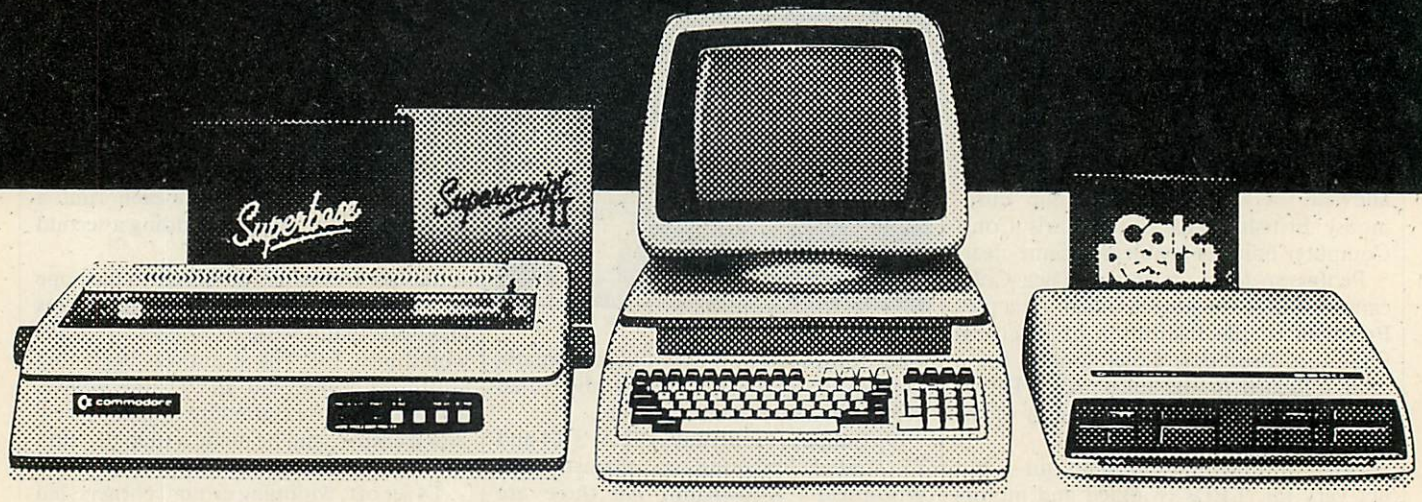
David Woodfield received £50 from *Practical Computing*, and the runner-up's brass cheese. Alan Dibley insisted on sharing with Bill Urmenyi the third prize of £30 worth of books from Sunshine Publications, while James Chidley and Derek Hall seemed pleased to carry off a copy each of my book, *DIY Robotics and Sensors*.

Now that it has been seen in action, the one-second-per-minute rule seems less successful than had been hoped. It would be a great pity to hazard the performance of a mouse representing months or even years of effort on a snap decision made under great pressure. The rule must go, and the judges relied on to throw off any mouse which has become boring.

If you are thinking of building a micromouse of your own, write to John Billingsley, Department of Electrical Engineering, Portsmouth Polytechnic, Portsmouth PO1 3DJ for a copy of the competition rules and dimensions of the mouse and the maze.

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>ARTIFICIAL INTELLIGENCE

ESP, machine intelligence, natural language, Lisp, Prolog, Logo... is AI a dream or a nightmare? In the October issue special section we look into the history of AI research, what's happening today in fields such as expert systems, and how it could affect tomorrow.

>REVIEWS

A new, powerful British 80186-based micro from Casu hits the benchtest. We'll also be catching up with ACT to provide an overview of the new machines. Plus, reviews of three IBM look-alikes, the Taiwanese-made Aviette PC-16, the Scottish-made PCi from Future Technologies, and the ITT Xtra. For BBC owners we'll be reviewing the languages available for this micro, plus Spectrum games and Atari books.

>AND MUCH MORE!

David Levy, fresh from his triumph against the Cray, starts an important new series with an article simulating human analysis with strategy games. For those who want to win friends and influence people, Andrew Brimble provides a program listing for personality testing, while for Commodore 64 programmers, Mike Hart presents a utility to facilitate structured programming.
Plus there will be our usual full range of features, news, regular columns, free software in Open File and much, much more.

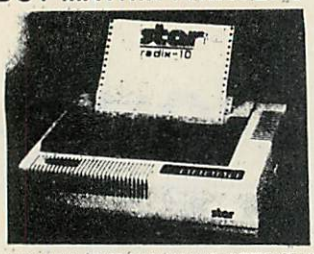
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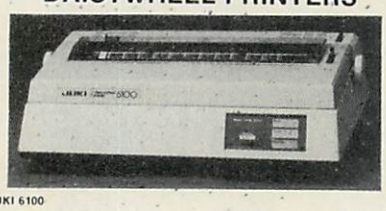


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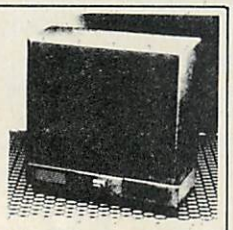


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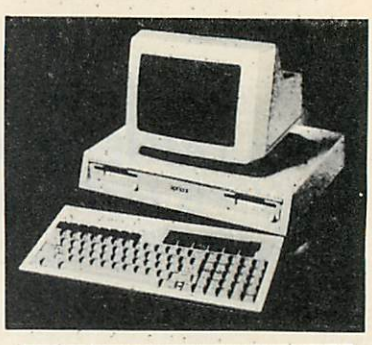
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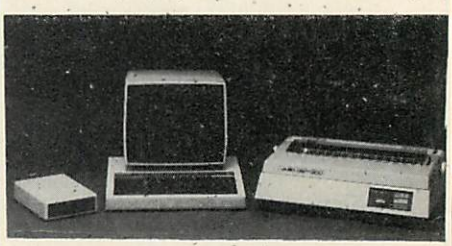
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DASH-80



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HARDWARE DESCRIPTION

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PROCESSOR BENCHMARKS

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
DASH-80	.73	2.4	6.6	6.5	7.0	12.7	20.2	34.3
IBM PC	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0
APRICOT	1.5	4.8	10.4	10.8	12.2	22.8	35.5	34.0
SIRIUS	1.7	5.4	11.1	11.5	13.6	26.2	40.1	29.0

DISK BENCHMARKS

DBM1	DBM2	DBM3	DBM4	DBM5
0.6	4.3	4.2	3.8	3.7
3.8	21.2	20.8	12.7	10.4
3.0	9.5	14.0	8.0	7.5
2.5	37.0	37.0	12.0	12.0

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by Ray Coles

Trouble at the chip shop

Booming demand for microprocessors spells trouble for the micro builders — but what about the manufacturers when the boom turns to bust?

SO FAR 1984 has been a bad year for all chip lovers. At the low-technology end of the market, Chancellor of the Exchequer Nigel Lawson attacked chip consumers by slapping a 15 percent VAT levy on the sale of hot takeaway food. At the high-technology end many well-known semiconductor chips are virtually unobtainable due to a drastic shortage of manufacturing capacity.

Economists are the only people to gain from the highly predictable boom and bust cycles which afflict the semiconductor market. But fortunately for all concerned, the yo-yoing demand variations are superimposed upon a steadily increasing underlying trend, so most manufacturers are happy to weather the occasional storm. Certainly there has been little clamour for any of the well-tried alternatives to a market free-for-all, like the heavy-handed bureaucratic control of the EEC's Common Agriculture Policy for example. In such a dynamic, innovative area of technology such market control is as unwelcome as it would be unworkable. So, for the moment at least, there will be no microprocessor mountains or 64K RAM lakes.

At present, things are marvellous for most semiconductor manufacturers. Demand is so high that they can sell everything they can make long before they have made it, with the added advantage that they can name their own price and then double it. The recession, such as it was in the electronics industry, ended sometime in 1983. Since then demand has been skyrocketing to such an extent that today a thriving black market exists for the supply of microprocessor and memory chips.

Desperate need

The situation is nice for the manufacturers, but every silver lining has a cloud. At the moment the cloud is suspended over the heads of the equipment manufacturers, who desperately need chips to feed their production lines. It is the manufacturers with all the muscle, such as IBM and Sinclair, which win through in times like these, because they deal directly with the semiconductor manufacturers and place orders for huge quantities, which all makes life easy for the likes of Intel and Motorola.

Equipment manufacturers with an appetite for chips measured in hundreds rather than thousands, and which are normally constrained to buy their microprocessors via a distributor, are having a rough time. In some cases their problem is simply late or patchy delivery, leading to half-completed circuit boards on the shelf, unfavourable production overheads and cash flow, plus lots of dissatisfied or disillusioned customers.

Black market

In the most severe cases, some devices — particularly microprocessors — are unobtainable by conventional routes. So equipment manufacturers are forced to buy key components at exorbitant prices on the black market or even to redesign their boards and their software to suit another microprocessor which is more readily available. Unfortunately the latter ploy could be self-defeating as well as expensive. Judging by the number of manufacturers switching from the Intel 8051 single-chip microcomputers to competing devices such as the Motorola 6801 and the Zilog A-8 which are currently less in demand, there may be some nasty shocks in store for some companies.

Intel currently heads the league of microprocessor manufacturers, and is therefore causing most of the trouble. Its 8088 eight/16-bit processor used in the IBM PC and, apparently, most other business microcomputer systems, is being shipped by the million. But Intel seems to be letting other less profitable production lines slip to satisfy the insatiable demand for it. It may be because the company makes most profit on 8088 sales, or may even be because it has high-volume guaranteed orders, negotiated before the boom, which might in some cases be subject to penalty clauses. Whatever the reason the effect is that the eight-bit 8085 is very difficult to obtain, and the 8051 virtually impossible, even at inflated prices.

The most recent casualty is the Intel 80186, an advanced version of the 8086 with many peripheral functions integrated on to the chip. Although fairly new, the 80186 has been an instant success with the designers of personal computers and engineering work stations. Following early yield problems, which reduced availability and profit margin, Intel is now unable to meet the exploding demand.

Even in 1984, demand is calculated at two or three million devices. Intel will be lucky if it can make one million. Next year demand may be up to eight million, and there is little hope of satisfying even half of that. One solution is a second source, and Intel has licensed AMD to built the 186 in its Texas plant, but production will not be on stream until towards the end of 1984. Meanwhile Intel itself is building new production lines in Israel and in New Mexico.

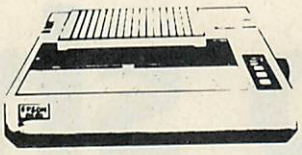
Manufacturers committed to the 80186 are understandably not too pleased with the situation, particularly as Intel had been considered to be a reasonably safe bet in the past. Early users of the chip are being protected by Intel, which supplies their needs first, but all new orders for the 186 are being refused until 1985 and distributors are having a lean time with only a trickle of devices going their way. Many manufacturers which have designed systems around the 186 are currently redesigning to use the older 8086, or swapping to the even newer 80286, which for some unfathomable reason is easier to obtain at the moment.

Glut looming

One thing is certain though; before too long, in perhaps two or three years, the get-rich-quick merchants attracted by the highly profitable market situation will have their new plants on stream, a glut will occur, and prices will drop through the floor. By that time, of course, wise old Intel will have a new whizz-bang product available, leaving the second division to squabble over the leftovers.

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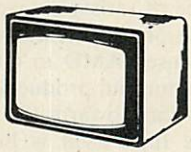
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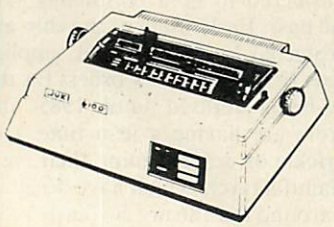
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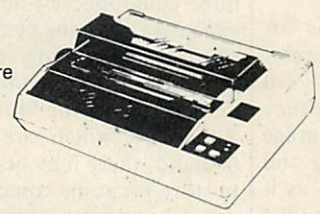
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● Circle No. 112



by John Hooper

How to bar key problems

Another look at recent advances in computer technology which are disclosed in British Patent Specifications.

SHARP has been in the forefront of the move to smaller and smaller computer devices, witnessed by its PC series of truly pocket computers. However, the company has often been slated for the inconvenience of its keyboards, which are either too small for easy use or too big for a real pocket machine. But in its U.K. Specification 2,125,199 Sharp proposes a completely different type of keyboard.

The keyboard has no separate keys. Instead it has one or more long bar switches, each of which is associated with several characters. Which character you set when you press the bar depends where along the bar you apply pressure. A suggested embodiment has two bars, one giving the 26 letters of the alphabet, the second giving numerals, punctuation and graphics characters.

In case you press in the wrong place, so inputting the wrong character, Sharp has thoughtfully provided two extra keys that you can press to obtain the next character to the left or right as appropriate.

Corruption

IBM, in Specification 2,125,590, is concerned with the problem of data corruption. In big computers it is common to split a data word into its separate bits, and store the bits in a row of bit locations in a corresponding row of different storage devices — RAM chips, for instance. This enables very fast input/output, for at a given signal the storage row inputs or outputs a whole data word on to the data bus in the time it takes to send or receive one bit.

Of course, if one of the control devices providing the I/O signal fails, then several bits in a word can be lost, possibly beyond the capacity of any error-correcting coding in use.

IBM suggests a very simple solution to such a problem. For any arrangement employing an error-correcting system that can cope with n bit errors per word, it is proposed that the I/O control signals are fed to the stores by a sufficient number of separate devices so that no one device controls more stores than contain n bits of the same word.

John Hooper is a Chartered Patent Agent who works in the electronics industry

Instant replay

A problem with most simple calculators is that once a sequence of numbers and operators has been keyed in it is lost for ever, only the result being available. Casio, in Specification 2,125,588, proposes a new type of calculator that can retain the key-press sequence for instant display, replay and simultaneous recalculation. As the key sequence is replayed, so it can be modified to add either new numbers or operators, or to correct or delete the old ones.

Each key sequence can be as long as memory permits, and is scrolled forwards or backwards past a nine-character second display window, while the primary display shows the related result of the calculation so far.

Hello, world

Nam Tai, of Hong Kong, suggests in Specification 2,125,996 that pocket calculators and computers could incorporate one or several transducers enabling them to measure outside, real-world parameters, and then perform calculations with the measured values.

(continued on next page)

What you get for your money

The British Patent System, like those of the other major industrial countries, is intended to stimulate manufacture and encourage research and the dissemination of the results. It does this by holding out the promise of a form of monopoly in return for the full disclosure of ideas which might otherwise be kept secret. However, there are some conditions.

First, the monopoly on offer is rather limited, both in scope and in time. As regards scope, what the patentee gets is the right to be the sole user of the patented idea. Really it is the right to try, by action in the courts, to stop others from using the idea.

The difference, which may seem rather slight, is significant. It is for the patent owner to take action, and to sue the guilty party for infringement. The Crown will not initiate any enforcement.

As concerns time, under the present Patents Act the monopoly on offer can last, at the very longest, only for 20 years from the date on which the Application was made, and the Patent may well not be granted until three or four years after that date.

However, the authorities believe that all monopolies, even patents, are a bad thing. So they have decreed that a patent will lapse, never to be recovered, unless they are paid annual renewal fees starting at the beginning of the fifth year to keep it in force. The current fees roughly range from £75 to £300 and are a great incentive to let patents die.

The second main type of condition is that the idea must meet four basic criteria. First, it must be the sort of invention for which patents can be granted, which means no mere theories, aesthetic creations or schemes, and no computer programs. Secondly, it must be new, never used or written about anywhere in the world — you may well reinvent the wheel, but they will not give you a patent for it. Thirdly, it must be inventive, more than just some clearly obvious development of an old idea. For example, four- and six-legged tables are known, you are unlikely to get a patent for a five-legged table, even if it is strictly novel. Fourthly, it must be capable of being put into effect. You may dream up some super computer, but unless it is technically feasible you will not get a patent.



(continued from previous page)

Transducer possibilities include wheels to provide the means to record distance; photocells, so the device becomes a light meter; and strain gauges, thereby making the combination into a weighing machine.

The big picture

Teleram Specification 2,126,387 discloses a part solution to the problems of getting a decent display on a small computer with, for example, a 4 by 80 LCD screen. Conventionally part of the machine's memory is configured like a full 24 by 80 CRT display, with the LCD screen acting as a shallow window into that memory. Teleram now suggests that the computer should be connectable to a proper CRT display, and that the LCD and CRT should operate in co-ordinated unison.

Touch and go

In Specification 2,126,388 RCA proposes a novel type of touch-plate input device. One example described is a rigid three by three square plate with nine touch areas supported at is corners by four two-position push switches.

RCA says that, depending on where the touch-plate is pushed, so the plate tilts. Then the force is transmitted appropriately to the switches, operating them in such a way as to indicate the particular plate area pressed. Thus, pressing in the area at row 1 column 2 should activate both the top switches, but leave the bottom two off. The switch outputs are fed to a simple decoding circuit, and this then transmits the signal defining the touched area.

On a grander scale, RCA suggests that its touch-plate could overlay a CRT screen to provide it with a cheap form of touch sensitivity.

Planemaker's AI

Artificial intelligence now crops up everywhere, including in the avionics industry. As Marconi points out in Specification 2,126,762, the intricacies of modern avionics design are so complicated that it can be impossible to test whether an aircraft's entire electronics system will perform satisfactorily under all permutations of events. To avoid potentially disastrous results, Marconi proposes that the creation of such a complex design be overseen by data-handling soft/hardware using natural language input.

As a design progresses, the computer is fed all the data as a logical series of statements defining the requirements of the design so far, starting with the most general. For example, the avionics will automatically navigate the aircraft but must allow the pilot a manual override. Gradually the more and more detailed situations are considered, such as how to deal with wind velocity changes, or respond to course alterations requested by a subsidiary targeting computer. All along the way each new item of information is logically tested against those other items it affects together with the overall system parameters.

The soft/hardware combination must be able to deal with natural — that is human — language inputs so that untrained technicians can instruct the computer as to what is happening. It must also generate hypotheses about the structure of the entity relationship model representing the meaning of the available design data.

Notatron

Iain Sinclair discloses in Specification 2,126,764, an electronic notepad.

Basically a calcultor-style object, his idea is to have a multi-line liquid crystal display with one full alphanumeric set of keys to write each line, and to have a second set of keys, one per line, to enable any line to be deleted and the gap closed up if required. Additionally, Sinclair suggests a priority key, so that each line can be assigned a priority value, the lines then being reordered accordingly.

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● Circle No. 116



by Mike Lewis

Bit maps for faster files

Most popular computer applications involve a sequential search of disc files. We look at one way of speeding up this inherently slow process.

YOU WOULD USE bit mapping if you wanted to carry out frequent searches of a file, based wholly or partly on fields that have a single binary value: yes/no flags, for example. The bit map is simply a string of binary digits, each of which corresponds to one record in the file. The bit is set to 1 if the relevant field in the corresponding record contains a specified value, or 0 if it contains the opposite value.

Frequent searches

Suppose that an estate agent has a property file which shows, among other things, whether a property has a garden and/or a garage, and whether it is close to shops. Each record would include three fields, for garden, garage and shops respectively. These fields might contain Y if the requirement can be met, N if it cannot. Suppose, too, that the agent is called on to make frequent searches based on some or all of these three criteria, among others.

The first step is to build up three separate bit maps, one each for garden, garage and shops. This can be done in a single pass of the file, as the sample program shows. Although this initial step will be fairly time-consuming, it need only be done once, at the start of the session, rather than each time that the phone rings with a call from an anxious house buyer.

Storage

A simple way of storing the bit map in RAM is to use an array of 16-bit integers. The top two bits of each integer can be ignored in order to simplify the coding and allow the use of a mask that takes the value of successive powers of 2. The most efficient way of generating powers of 2 is to start the mask at 1 and to add it repeatedly to itself. But the highest signed integer that can be generated by a Basic arithmetic expression is $2^{15}-1$. Restricting the range to the bottom 14 bits of each integer avoids any problems caused by arithmetic overflow.

Of course, this use of 14-bit integers is a limitation imposed by the language, rather than a part of the fundamental algorithm.

(continued on next page)

```
1000 '  This is a skeleton program to demonstrate loading and using      '
1010 '  bit maps to speed up file searching.                              '
1020 '                                                                    '
1030 '  An estate agent's file contains property records which include    '
1040 '  (character) flags to indicate a garden, garage, and proximity     '
1050 '  to shops. We want to carry out searches for properties that       '
1060 '  meet these, and other, criteria.                                  '
1070 '                                                                    '
1100 '  Assume NREC% is the number of records in the file                 '
1120 '
1130    SIZE%=(NREC%+13)\14                 'This is the size of each bit map
                                             (in 14-bit words)
1140    DIM MAP1%(SIZE%), MAP2%(SIZE%), MAP3%(SIZE%)
                                            'These arrays will hold the three
                                             bit maps
1150 '
            At this point, open the file and perform any other
            initialisation
1160 '
1170 '          Now we can load the bit maps
1200    MASK%=1: J1%=1: J2%=1: J3%=1
1240    FOR COUNT%=1 TO NREC%
            'read the next record (whose record number is <COUNT%>)
             and unpack the relevant fields

1250            IF GARDEN$="Y" THEN
                        MAP1%(J1%)=MAP1%(J1%) OR MASK%
                                            'Set a bit if there is a garden
1260            IF GARAGE$="Y" THEN
                        MAP2%(J2%)=MAP2%(J2%) OR MASK%
                                            'or a garage
1270            IF SHOPS$="Y" THEN
                        MAP3%(J3%)=MAP3%(J3%) OR MASK%
                                            'or if close to shops
1280            IF MASK% = &H4000 THEN
                        J1%=J1%+1: J2%=J2%+1: J3%=J3%+1: MASK%=1
                ELSE
                        MASK%=MASK%+MASK%
1290                                        'This sets the mask to successive
                                             powers of two until it reaches 2^14,
                                             at which point it is reset and we
                                             move on to the next array entries
1300    NEXT COUNT%
2000 '
            Now let us search for a property with (garden OR garage) AND
            close to shops, possibly along with other criteria.
2010    MASK%=1: J%=1
2020    FOR COUNT%=1 TO NREC%:
            IF ((MAP1%(J%) OR MAP2%(J%)) AND MAP3%(J%)) AND MASK% THEN
                ' ...
                at this point we have a possible hit; you can read
                the record and perform further tests on it
2030            IF MASK%=&H4000 THEN
                        J%=J%+1: MASK%=1
                ELSE
                        MASK%=MASK%+MASK%
2040                                        'set mask to next power of two or reset
                                             it when it reaches 2^14
2050    NEXT COUNT%
```



Bit maps

(continued from previous page)

In other languages the problem might not arise. In any case, you can use the full 16 bits by assigning actual hex values to the mask, but there would be no point in doing this unless storage space were very tight.

Speeded up

Once the bit maps have been created they are held in RAM throughout the session. From now on, searches that involve the three yes/no fields can be speeded up by examining the bit maps first. Since the bits have a one-for-one correspondence with the records it is necessary only to access those records that meet the yes/no criteria. This will save a great deal of physical accessing, even if further tests have to be performed on those records that are actually read. The lower the hit rate based on yes/no fields, the greater the time saving.

The technique is also a good exercise in using the logical operators And or Or. The Or operator is used in conjunction with a mask to set any bit within an integer. To set bit 0 the mask has the value 1; for bit 1 it is 2, for bit 2 it is 4, and for bit n it is 2^n. For this purpose I am taking bit 0 as the least significant bit. Hence the powers of 2 referred to earlier.

Similarly, the And operator is used to test the setting of any bit within an integer. If

(integer And mask)

is true, then the bit is set to 1, otherwise it is 0. You can also use And and Or — and Not — to link separate bit maps together, as the example program shows. Here you are looking for a property that has

garden Or garage And shops

You only need to And the final result of this logical operation with the mask to determine whether or not you have a hit, thus saving a lot of nested Ifs.

A variation that you might like to consider is to store the bit maps on disc, rather than to build them up by sequentially passing the file at the start of each session. This would complicate the program that maintains the file, and you would run the risk of the bit maps and the file becoming out of step. But it would cut down the time needed to initialise the searches, and in some applications this might be worth the extra programming needed.

List inversion

Bit mapping is a special case of a technique known as list inversion. A normal data file is a list of records, each of which has certain characteristics. An inverted list, by contrast, is a list of characteristics, each of which has pointers to the records that possess the characteristics. List inversion is a powerful programming tool, and I shall be returning to the subject in a future column in this series.

WordStar corner

I GET A LOT of letters from readers of this column, especially on the quirks and deficiencies of Micropro's WordStar. One problem that several correspondents have raised is the difficulty of printing both double-spaced drafts and single-spaced final copies of the same document, without having to reform every paragraph in edit mode between the two printings. This is an easy matter if you have a precision printer. You simply put

.LH 16

at the top of the document for double-spaced printing, and take it out again for single spacing. For other types of printers there is no easy solution, but here are some possible methods:

- Set the DIP switch or front panel control, if any, on your printer that says "Carriage Return implies Linefeed", or something similar. Normally, this switch would be set Off, to tell the printer that the software will explicitly send a Linefeed at the start of each line. Switching to On causes the printer to insert an extra Linefeed, thus double-spacing the text. Most printers only read DIP swiches on power-up, so you might need to switch the machine off and on again each time you alter the switch.
- Patch an extra Linefeed character into the WordStar end-of-line sequence, found at location PSCRLF: in most versions. Check the installation manual for more details. The main drawback is that you will need to keep two WordStars: a patched version for double-spacing and a normal version for single-spacing.
- Write a program to send an escape sequence to the printer for altering the vertical line spacing. For Epson printers, you would need to send Escape, capital A, and decimal 24. This sets the spacing to 24/72 inches, which is double-spacing. Run this program just before starting to print, making sure the printer is switched on. To revert to single spacing, just switch the printer off and on again. Unfortunately, this method is not available for all printers.
- The most elegant solution is the one suggested by Richard Collings of North London. It involves placing the commands .PF ON and .LS 2 at the start of the text, which is then printed with Mailmerge rather than the normal print function. These commands tell Mailmerge to override the line-spacing that was used during editing, and to assume double-spacing instead. The technique will work equally well with all printers, and has the added advantage that it will automatically take care of page breaks, which the other methods do not. The one snag is that it does not produce extra blank lines between paragraphs — but you can't have everything.

dBase department

ONE OF the great weaknesses of Ashton-Tate's dBase II is its inability to handle arrays. If you have ever wanted to check the validity of an input value against a pre-defined list you will appreciate the problem.

Suppose your operator input includes a three-letter geographical code, such as Ldn, Man, Gla, etc. You would like to check the entered value against a list of valid codes before you write it to disc. One possibility is to use the following construct, assuming Testcode contains the value to be checked:

```
STOR "LDN MAN GLA BHM YRK EDN"
    TO OKCODES
IF @ (TESTCODE, OKCODES) = 0
     error
ELSE
     ok
ENDIF
```

Unfortunately, this would fail to throw out any incomplete codes, like Ld or Ma, as well as such combinations as A B and M Y.

But there is a better way. Start by assigning variable names that include each of the valid codes. This is simply a matter of storing any value to the appropriate variables:

```
SORT " " TO TEST:LDN, TEST:MAN,
TEST:GLA, TEST:BHM, TEST:YRK,
TEST:EDN
```

You can now use Type( ) to carry out the test. This handy function, which is only available in dBase version 2.4. and above, returns a flag to indicate a variable's type, or the letter U for undefined.

```
STOR "TEST:" + TESTCODE TO
   THIS:ONE
IF TYPE (&THIS:ONE) = "C"
     ok
ELSE
     error
ENDIF
```

Still a little clumsy perhaps, but it will do the trick.

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cross-record calculations.	13 interrogation question types
'Jump-to' any record in 12 files.	short filing output/audit trails.
User-define files/field words/sizes.	"sale-mail-shots"; "production-process-"purchase/sales-analysis", "personnel-file"

DBMS III 7 new switch mode facility enables you to cross up to 12 different files (32000 records per file) pre-selecting *any* of up to 20 fields per record/file for display/print output (240 fields) in all. One massive enquiry can pass through 384,000 records

You might have two files whose records are directly related to each other, so that the first file (say containing names and addresses) refers to the second file (say financial and other information relating to the same record numbers in the first file) directly. Then you can simply choose that in file 1 you are interested in just the name and telephone numbers, whereas in file two, you are interested in the income, trading period and number of branches, information. Your enquiry can then pass through both files highlighting that information only. Actually there doesn't need to be a strict correlation between the same record numbers in different files. and you can also just on JUMP command go to any record in any of the 32000 records in any one of the twelve files and carry on cross-referencing from there onwards

DBMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER

Simply design your file, give its fields your words, set up your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the program to fulfil, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disc will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports", "stock-valuation reports", analysis, "patient history analysis", "research-analysis", "budgeting", "plus more?"

Not only does this program surpass most of its kind that you might buy elsewhere, but if you buy the hardware from us, then you get it — FREE . . . DBMS II (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) AND MS-DOS (tm) ie: < SIRIUS/VICTOR/IBM > DBMS II IS 395.00 (or 250.00 by mail order ex. training). DBMS II is 575.00 (or 295.00 by mail order ex. training).

Contains the highest state of the art software available today

FORMS/TEXT/CALC/DBMS IV — ALL IN ONE PROGRAM THE —"KEY" — @ 575.00.

When you budget for a complete system of software you eventually end up with a host of packages like, Sales, Purchases, Nominal Data, Text, Calc, Mailshot, invoice, Order, Workflow, Personnel, and so on. The list is endless and the outlay several thousands of pounds.

Features	Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left, delete right, tab right-left-up-down'. Paint your form as you like directly on the screen.
Text.	Write a letter as you see it on the screen, edit it then simply enter P to print.
Calc.	Set into the form, your data fields, "# # # # # #" and specific file-related activities, formulae and validation checks, Enter values and see the spread-sheet calculate itself.
Database.	Search files for data to be inserted to fields specified. All the features of DBMS III. explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery . . . . You could design you own spreadsheet, order form, statement, wage docket, or any other kind of form that is required to fit your existing stationery.

```
                                  INVOICE                <0>##############
To  #<1>##############                        From: G. W. Ltd
    #<2>####################                        55 Bedford Court Mans.
    #<3>####################                        Bedford Avenue
    #<4>##############                          London W.C.1.
    #<5>########                              Tel: 01-636-8210

  Date<6>##,##          Tax point<7>##,##          Agent<8>###

 Quantity  Description                          Cost      Tax       Total
 <9>###  <10>################                 <11>##    <12>##    <13>##,##
 <14>##  <15>################                 <16>##    <17>##    <18>##,##
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
and so on
          Total. . . . <19>#######                  Tax. . . . <20>####
```

<??> items <1> to <5> internal command to request name, input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> item <9> request quantity, validate range.
<??> item <10> request description, search file, accept, and calculate fields <11> <12> <13>. if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility. You can provide the 'FORM' with file-related instructions, not only to request a 'console' input for file search against names, and stock, but after the invoice is finished, the fields you have selected may be passed to related files.

EG: Send fields <0>, <1>, <06>, <07>, <11>, <12>, <13>, <19>, <20>, to a sales ledger.
Then send fields <9> , <10> , <11> to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file.
Then send fields <10> , <11>, <12>, <13> to Nominal ledger. Do you see?

Telephones
01-636 8210
01-631 4818

Telex
892031 TWC G.

G.W.Computers incorporated in Boston. Mass. USA.
Grama (Winter) Ltd. 55 Bedford Court Mans, Bedford Avenue, London WC1
G.W. Computers present the first unique "ASSM"
The [A-Z] Automated System Master Menu

[?]	Program	Application
[A]	DB	General database
[B]	DB	Names/addresses
[C]	DB	Stock records
[D]	KEY	Ledger records
[E]	KEY	Invoicing
[F]	KEY	Circular letters
[G]	CRT	Create forms/text
[H]	SC3	spreadsheet
[I.]	WS	Word-processing
[J]	TLK	Tele'communication
[K]	XENO	Read Nonhost disks
[L]	BASIC	Interpreter
[M]	GAMES	Selections

[?]	Program	Application
[N]	SYS	System utility menu
[O]	BASCOM	Basic compiler
[P]	RBBS	! Remote bulletin
[Q]	DIAG	Diagnostics
[R]	SPOOL	Print spooler
[S]	QD	Ramdrive
[T]	LEARN	Learn PC-dos 2
[U]	OVER	Overview of system
[V]	VOC	! Voice synthesis
[W]	TELEX	! Telex system
[X]	MNGMT	# Management account
[Y]	PAY	# Payroll
[Z]	***	Other specification

>>>> [?] <<<<

The menu system is subject to change. Please note that items marked "#" are NOT supported directly by us NOR Included in the price. Items marked "!" ARE available through us but involve extra hardware. The main menu display can be changed by you to suit particular needs, you only edit the PROGRAM name and APPLICATION to match that of the file on your system.
The system menu functions in tree structured ms-dos sub-directories so that each application is self contained on one hard disk in the computer Minimum hardware specification (Any PC compatible computer with 320k ram and 1/2 floppy disks plus one internal 10 megabyte hard disk and any suitable printer of your choice. It is possible to acquire a system that runs the entire suite of packages on an IBM (tm) for under 6000.00.
It's the best there is available at the price, so why not ask for a system brochure 'infopack'. You can leave your address on our 24 hour answerphones.
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● **Circle No. 117**

ARE YOU THE COMPUTER DEALER OF THE YEAR? 1984



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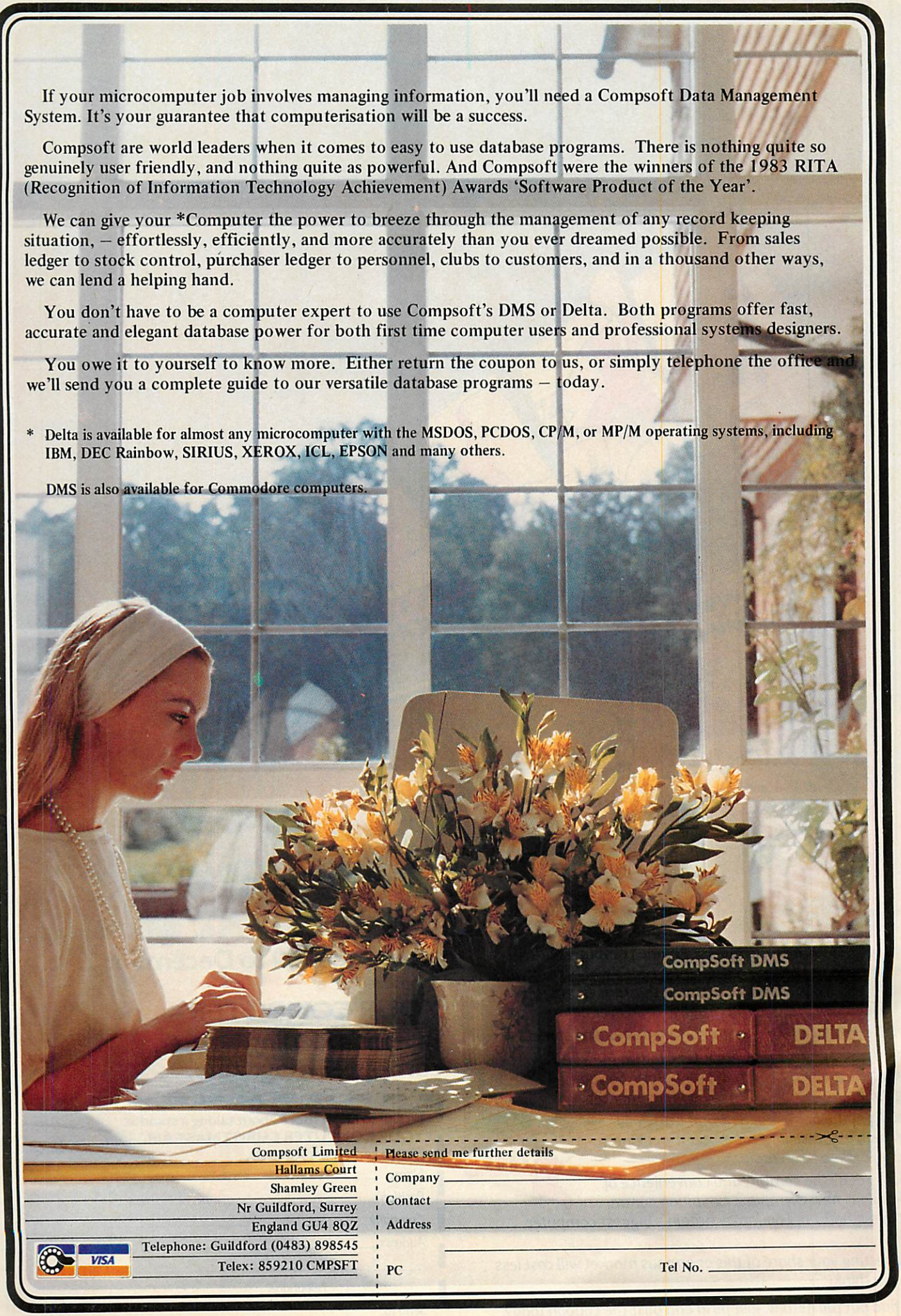
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DMS is also available for Commodore computers.

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Company _____

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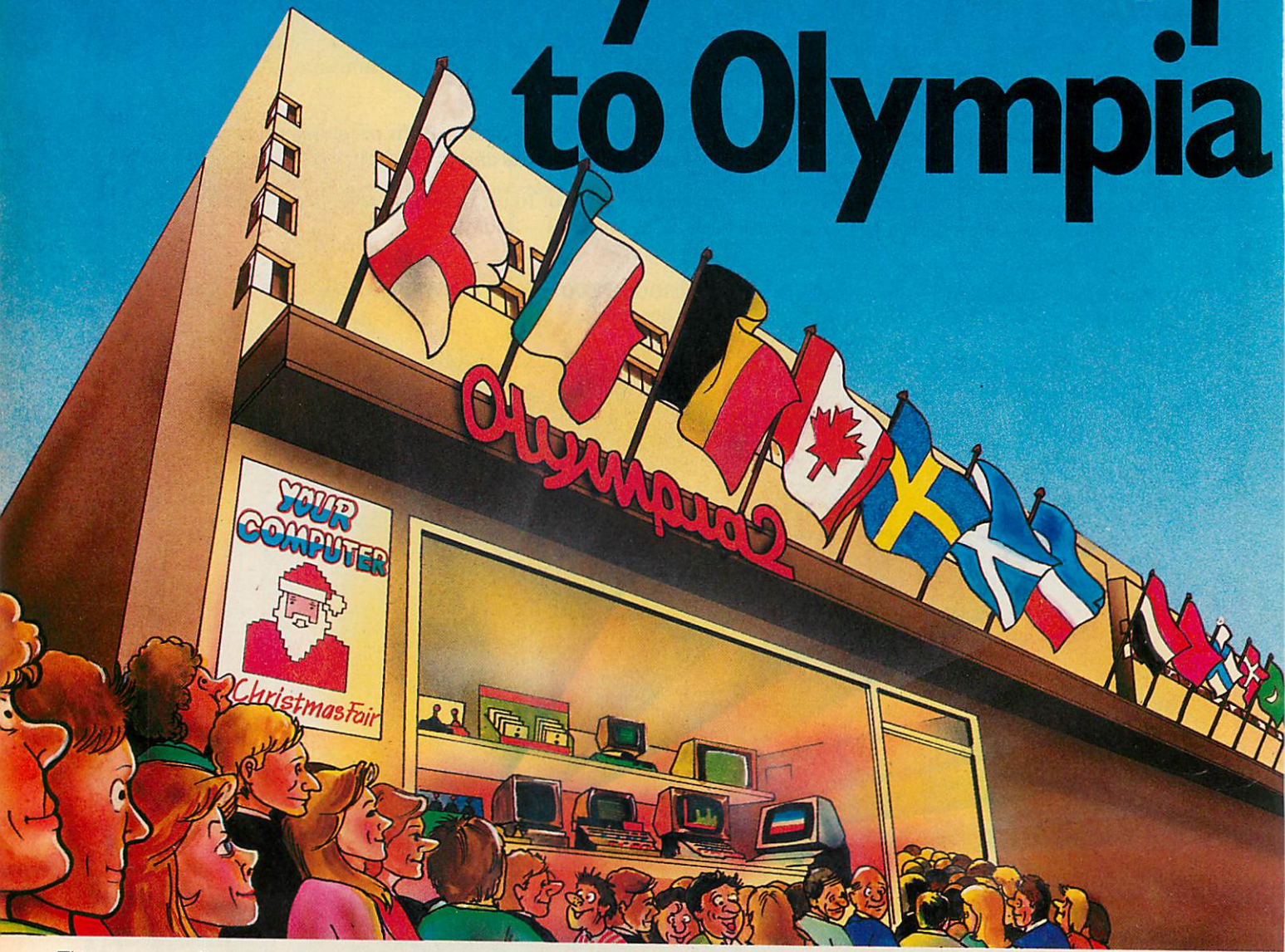
Address _____

_____

PC _____ Tel No. _____

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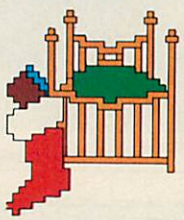
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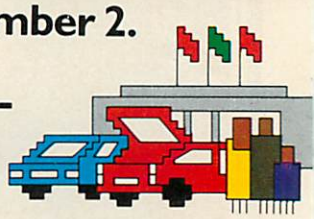
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PC

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(To be fair to the opposition, their £3000+ package includes a disc drive. But a similar BBC Micro set-up with the 6502 Second Processor will cost you less than a third!)

The 6502 greatly expands the Micro's usable memory. Its 64K of RAM combines with the BBC Micro's 32K, for a total of 96K.

It is supplied with its own special version of BBC BASIC, called Hi-BASIC, which allows the maximum amount of this memory to be used for BASIC programs and variables. Other languages allow some or all of this memory to be used for programs, and many will automatically adjust themselves to make maximum use of available space.

What's more, the 6502 uses the same microprocessor as the BBC Micro, but at a much higher speed. Which means programs can run up to 50% faster.

The 6502's extra power enables it to run more powerful software, such as that provided with the Acorn Bitstick, which turns the BBC Micro into a versatile computer graphics station. In fact, it has a variety of features usually found only on much larger systems.

It can also exploit the full potential of local area networking through the Econet system, with Level 2-File Serving.

So to get the most from your BBC Micro, get the 6502 Second Processor.

The 6502 Second Processor is available from your BBC stockist. For the address of your nearest supplier, ring 01-200 0200.

If you wish to order by credit card, phone 0993 79300 during office hours.



6502 Development Programs
(available seperately)

MASM: A 6502 macro-assembler. A full range of macro facilities are provided, including looping recursive calls and conditional assembly.

XREF: A cross-referencer to be used in conjunction with MASM.

ViewEdit: A full screen editor based on the VIEW word processor.

TRACE: A 6502 trace package for de-bugging all types of program.

PRINT: A program to produce formatted assembly listings without using MASM.

The package is provided with a 250-page manual describing all the facilities provided by the system.

Technical Specifications

The Second Processor operates at a clock rate of 3MHz. A version 1.2 MOS will need to be fitted into the BBC Micro before operating the 6502.

Integral power supply

Measurements: 205mm x 345mm

Weight: 2.1 kg

Colour: BBC Computer cream

Construction: Moulded top and bottom to match BBC Computer profile. ABS injection moulded plastic.

Power in: 240v, 50Hz, 3w.

The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.

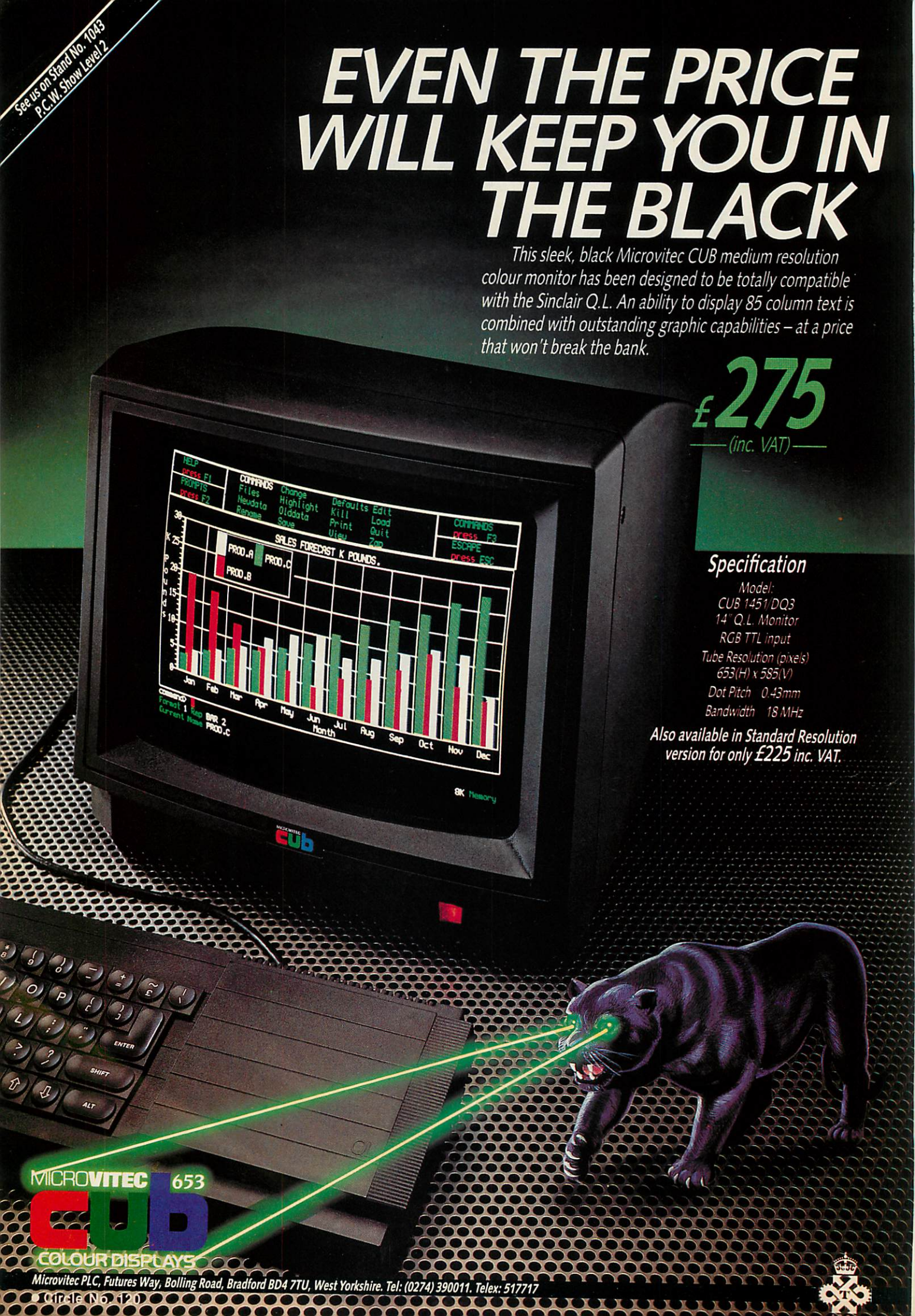
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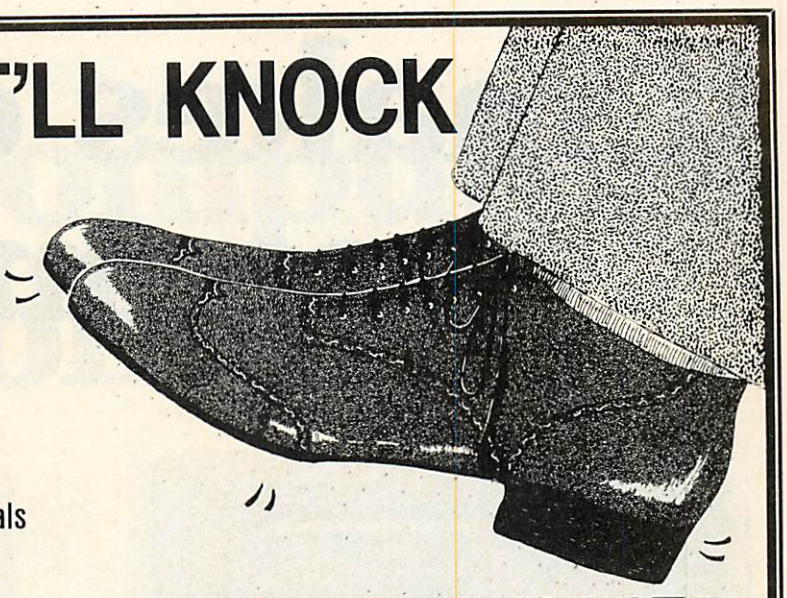
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PRACTICAL COMPUTING *September 1984*

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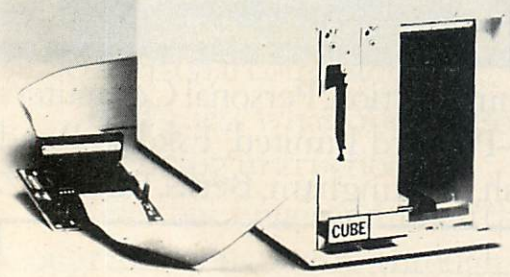
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● **Circle No. 124**

CUBE BeebFLEX – 6809 Second Processor for the BBC Microcomputer

Now available in quantity



CUBE BeebFLEX adds a 6809 second processor to the BBC Microcomputer running FLEX, the international standard 6809 disk operating system. It is supplied complete with 6809 CPU, 64kB DRAM, CUBE BeebFLEX 'sideways' ROM and supporting monitor ROM. CUBE BeebFLEX is housed in a self-powered beige metal enclosure. Two CUBE bus sockets are spare for extra analog or digital i/o, hi-res colour video, or EPROM programming. Larger CUBE Euroracks are available. The unit runs industry-standard 40 or 80 track 5.25" FLEX disks via the BBC Microcomputer. Connection to the BBC Micro is via the TUBE. It uses the standard BBC Micro disk interface and disk drives, which remain valid for standard BBC Micro purposes:

CUBE BeebFLEX can run a wide variety of FLEX programs – including macro-assemblers and cross-assemblers, compilers and cross-compilers, and high-level languages, including PL/9, 'C' and Extended BASIC. CUBE BeebFLEX is particularly suitable for machine code assembly both to 6809 and, via cross-assembly, to other microprocessors – including 68000.

The 6809 microprocessor has more instructions, more registers and more addressing modes than the 6502. It also generates relocatable code. As a result FLEX is particularly suitable for development applications.

CUU0990	CUBE BeebFLEX 6809 Second Processor Unit	£359.00 ex. VAT
FLX0920	FLEX operating system disk, with manual, for CUBE BeebFLEX	£65.00 ex. VAT

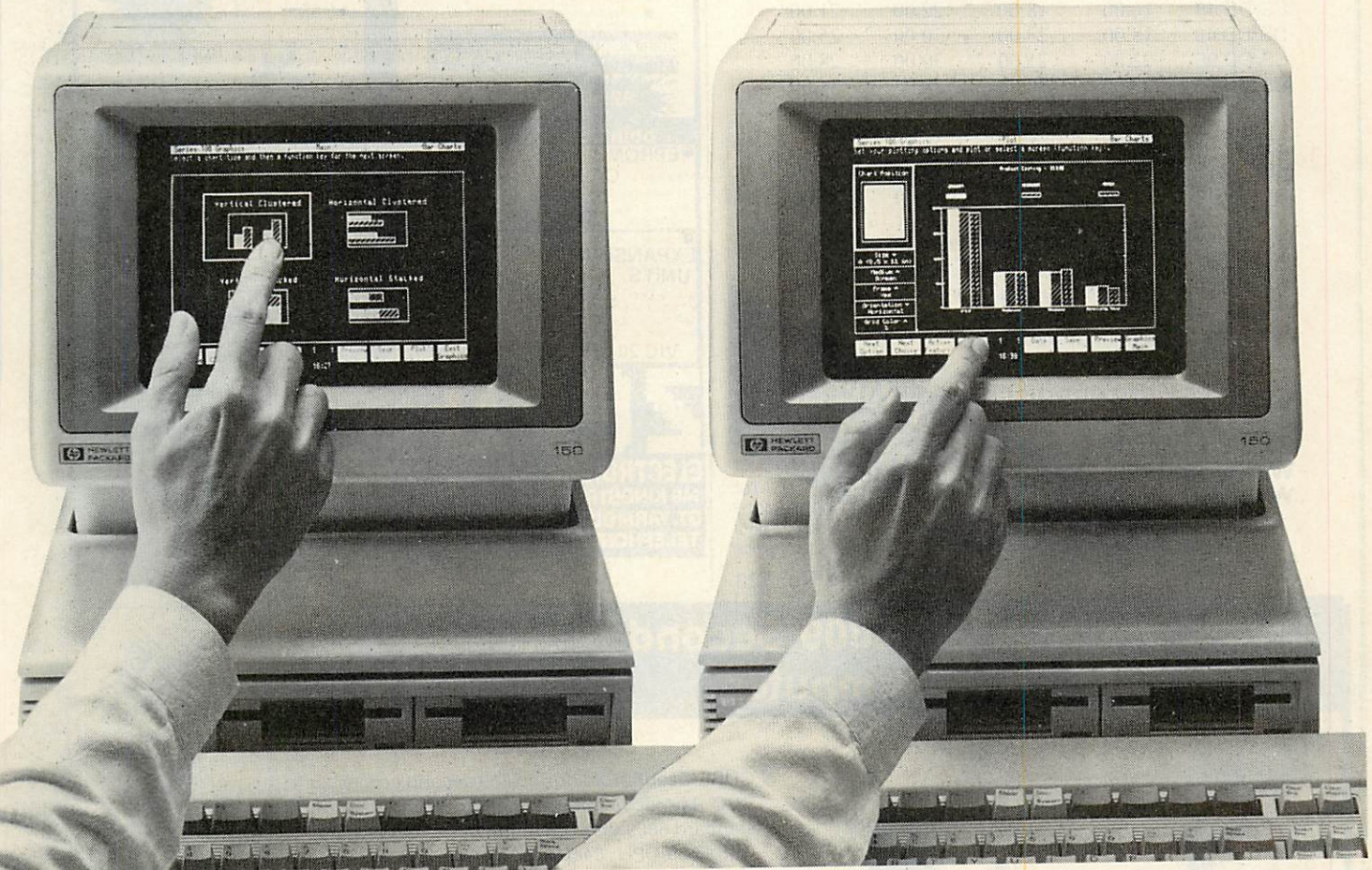
All enquiries, via telephone, letter or magazine reply service, will receive our catalogue and associated sales literature.

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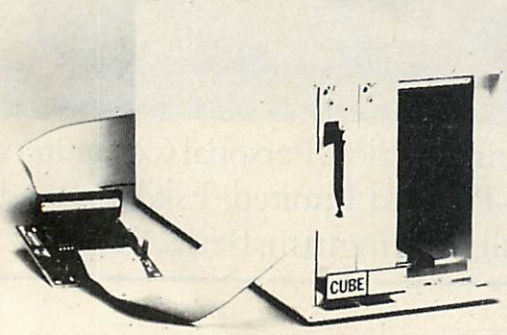
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SINCLAIR QL

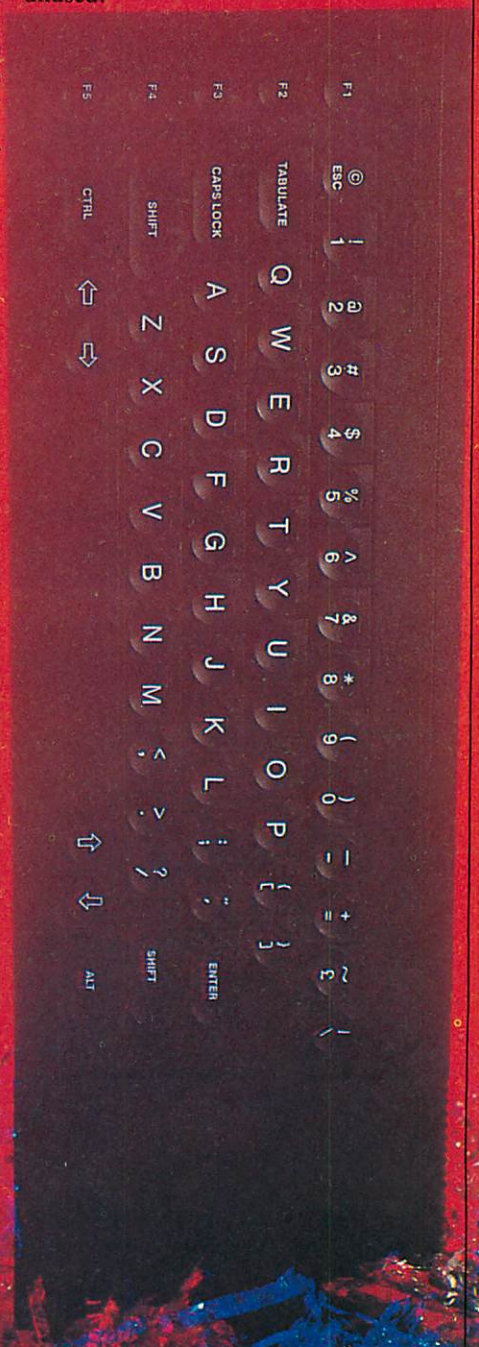
With the QL at last in the hands of eager buyers, Glyn Moody reports on his sessions with a production machine and on how well it lives up to its maker's enticing promises.

WHEN SIR CLIVE SINCLAIR launched his latest wonder micro in January this year he dubbed it the QL or Quantum Leap. Since then, the only leap that those waiting for their QL have been aware of is the leap of faith that it will eventually arrive. The first machines went out in April — sometime after the "delivery within 28 days" initially promised. The backlog was still nowhere near being cleared in June.

Ironically, it was just around this time that Sinclair Research and Sir Clive personally gave written assurances under Part III of the Fair Trading Act 1973 that they would not advertise delivery times of goods which could not be kept. This followed complaints arising out of ads for the Spectrum, ZX-81 and even ZX-80 up to four years ago.

Allowing April as the month of first deliveries is being slightly generous. The machines that went out — the so-called FB version — had their sleek good looks rather spoilt by the presence of a vulnerable-looking plug-in to the ROM expansion port at the top of the machine. The kludge, as it came to be known, was part of the operating system that did not fit on to the EPROMs sitting inside the machine. This, along with the unfinished documentation, was the most obvious sign that the QLs were not final versions. The first of these, the AH model, started arriving at the end of May.

The QL is elegantly styled in matt black plastic, very slightly textured and with various "go faster" stripes etched into its surface. For the first time on a Sinclair machine, a Reset button is provided, located on the right side of the machine. There is still no on/off switch. Also on the right are the two Microdrive units with their openings facing forwards. On the left of the machine are a small power-on light and the main peripheral add-on slot, as yet unused.



Benchmarks

The table shows the time in seconds taken to run eight standard routines. For a 68000-family machine running at 7.5MHz the QL seems very slow.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
QL/AH — 68008	1.9	5.4	9.3	9.1	11.8	24.0	42.4	20.7	15.6
HP Series 200									
Model 16 — 68000	0.2	0.6	1.4	1.6	1.7	2.8	4.3	15.0	3.5
BBC Model B — 6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52.0	14.8
Spectrum — Z-80	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253.0	58.5

At the back there are two local area network ports for use with QLAN, the power socket, and ports for a high-resolution colour monitor or colour TV. Four sockets, identical to those now used by BT for telephone jacks, provide two RS-232 connections and two joystick ports. The last slot, for plug-in ROMs, is the one used on FB-version machines for part of the operating system. The power socket connects to a rather heavy external power-supply unit, styled in a similar black plastic.

Spartan layout

Inside the QL the layout has a spare appearance. Apart from the ULAs that allow so much to be packed into relatively few chips, the main chip is the 68008 at the far left of the motherboard. The 68000 family of microprocessors has recently been completed by Motorola's launch of the top of the range 68020 model, sporting the full 32-bit structure throughout. The 68008 is not so much sawn-off as corseted: the processing is carried out with the full 32 bits, but all data transfers are limited to eight bits. Clearly some of the processing power is lost as conversions of data length take place.

An Intel 8049 handles the keyboard and sound generation, and acts as an RS-232 receiver. One of the ULAs controls display and memory and the other deals with the Microdrives, the local area network, RS-232 transmission and the real-time clock. Unfortunately, there is no on-board battery backup to the clock, so it is real-time only when the machine is running.

The Microdrives use precisely the same technology as those of the Spectrum but are functionally incompatible with them. The cartridge itself contains about five metres of thin video tape, joined up into a continuous loop and specially lubricated to allow the tape to slip from the middle of the wound spool. The continuous form allows faster access to files, without the need for rewinding. But obviously the nature of the technology means that the risk of physical failure is higher than with discs.

Sinclair claims a minimum capacity of 85K. The exact figure varies from tape to tape, and depends partly on the extent to which the tape has been stretched and generally massaged by the formatting process. After formatting is complete, the number of usable sectors and the total number of sectors is displayed: 213/216 seems a popular ratio. Unfortunately, successful formatting is no guarantee that the Microdrives will copy perfectly.

In addition to the Psion application programs supplied on four Microdrive cartridges, Sinclair supplies eight further blank cartridges — four for backing up the bundled software and four spares. Of our eight, four formatted without problems but threw up the message

Bad or changed medium

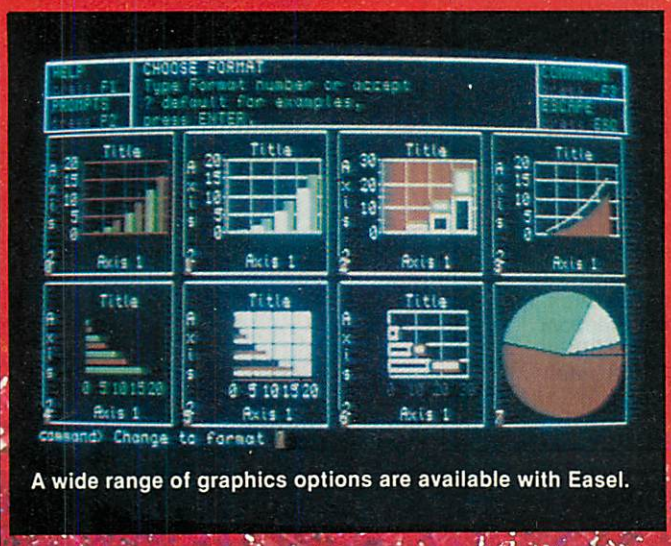
when used for copying the Psion programs. A 50 percent failure rate does not augur well for the new medium.

Lack of RAM?

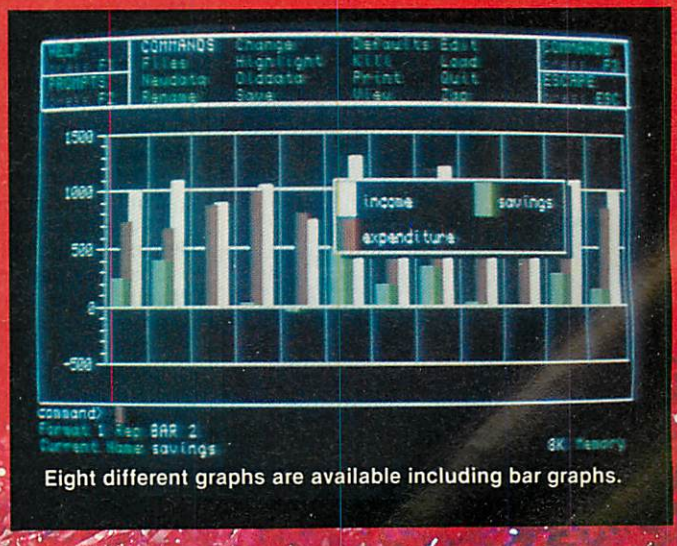
In use, the Microdrives seem to find the relevant sectors reasonably fast, though some of the operations can take minutes. It is hard to disentangle the extent to which this is caused by software problems, lack of RAM and so on. The worst example we found during this review was the 10 minutes it took to copy the Easel business graphics across from the master to a blank cartridge. Other Psion packages took several minutes.

It is hard to know quite what is causing the hold-ups until more details about QDOS and the tape format used are forthcoming. It may well prove possible to bypass whatever problems there are. But

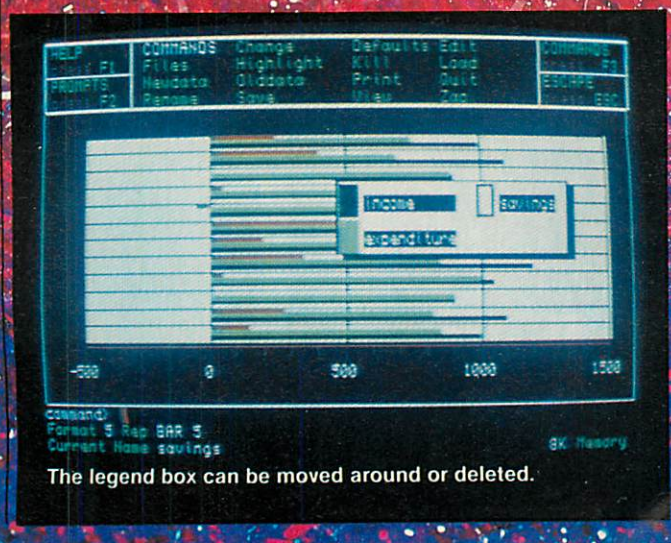
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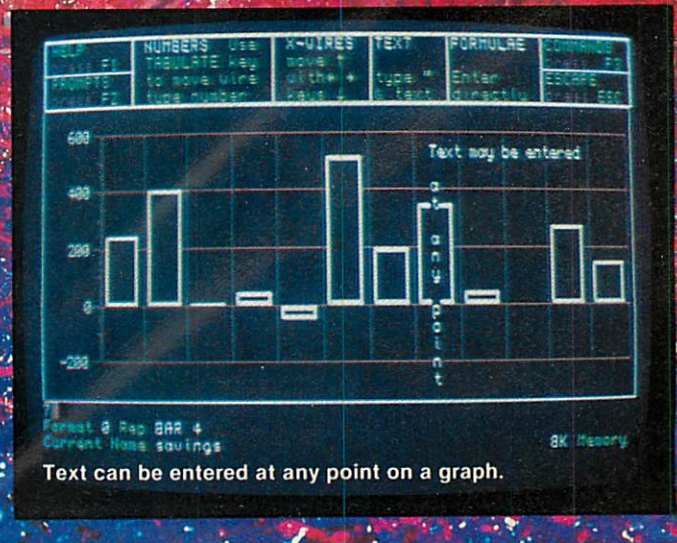
A wide range of graphics options are available with Easel.



Eight different graphs are available including bar graphs.



The legend box can be moved around or deleted.



Text can be entered at any point on a graph.

SINCLAIR QL

(continued from previous page)

in their present form, such access times cast doubts over the Microdrives.

Equally worrying is the pricing structure being adopted by Sinclair. The quoted price for end-users is £4.95: way over the comparable figure for cassettes. The situation is just as bad for software houses, which may well be inhibited from plunging into Microdrive cartridge production of their programs.

The consequences of any resulting software starvation would be dire. The QL is already backing a lot of outsiders, and it cannot risk falling down with its software base. The QL is particularly vulnerable to this because Sinclair has chosen not to include a cassette port, presumably for fear of spoiling its professional image.

The keyboard is another aspect of the up-market approach adopted by Sinclair with its new machine, and the company claims to have spent £100,000 on designing it. Inevitably a membrane design is used, but the individually moulded rigid plastic key tops represent a huge improvement over Sinclair's previous efforts. Opinions differ widely over its suitability for word-processing: I found it quite usable for touch typing, but a colleague likened it to plunging your hand in a bowl of cold porridge. As ever, the only way to decide is to try it yourself, which is rather problematical with a mail-order machine.

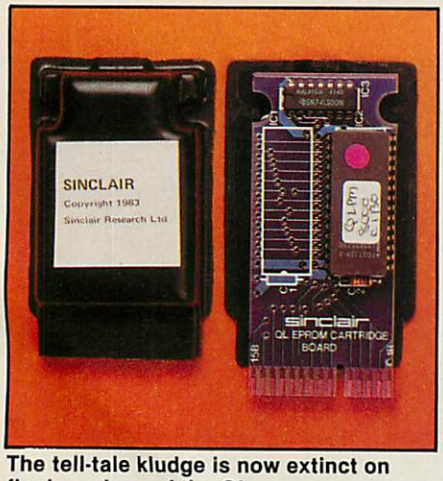
In addition to the standard QWERTY keys and five function keys there is a proper space bar — the first to appear on a Sinclair machine — two Shift keys, Control, Alt, Tab, Escape and Enter. One problem with the layout is that the Shift and Control are adjacent on one side, and Shift and Enter on the other. It is all too easy to mistake Enter for Shift, which can have dire consequences. The cursor keys are split rather awkwardly across the central space bar. On the plus side, back-space deletion, obtained by holding down Control and the Cursor Left key, is easily managed by one hand.

On power-up the opening screen presents you with a choice of monitor or screen, selected by F1 and F2 respectively. The monitor mode divides the screen into three areas. The bottom screen, labelled 0, is used for entering commands; the left-hand upper screen displays a listing of the program entered and the right-hand portion shows the output. For some reason best known to Sinclair, they are labelled 2 and 1 respectively.

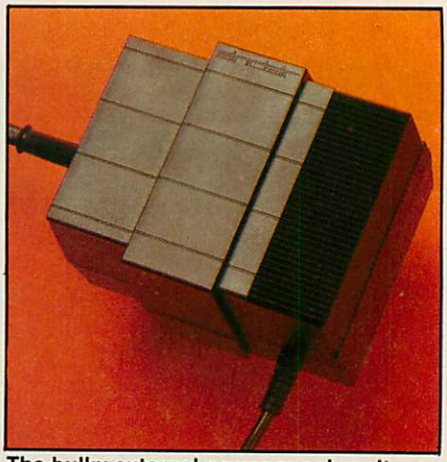
The Television display mode combines the listing and output screens in one. The listing appears in bright blue and is over-written in red by output. Two basic modes are available: eight colours with 256 by 256 pixels, allowing 37 characters across, and four colours and 512 by 256 pixels with 74 characters. In the Monitor display mode 83 characters are available, of which the first four are lost on a TV set.

Specification

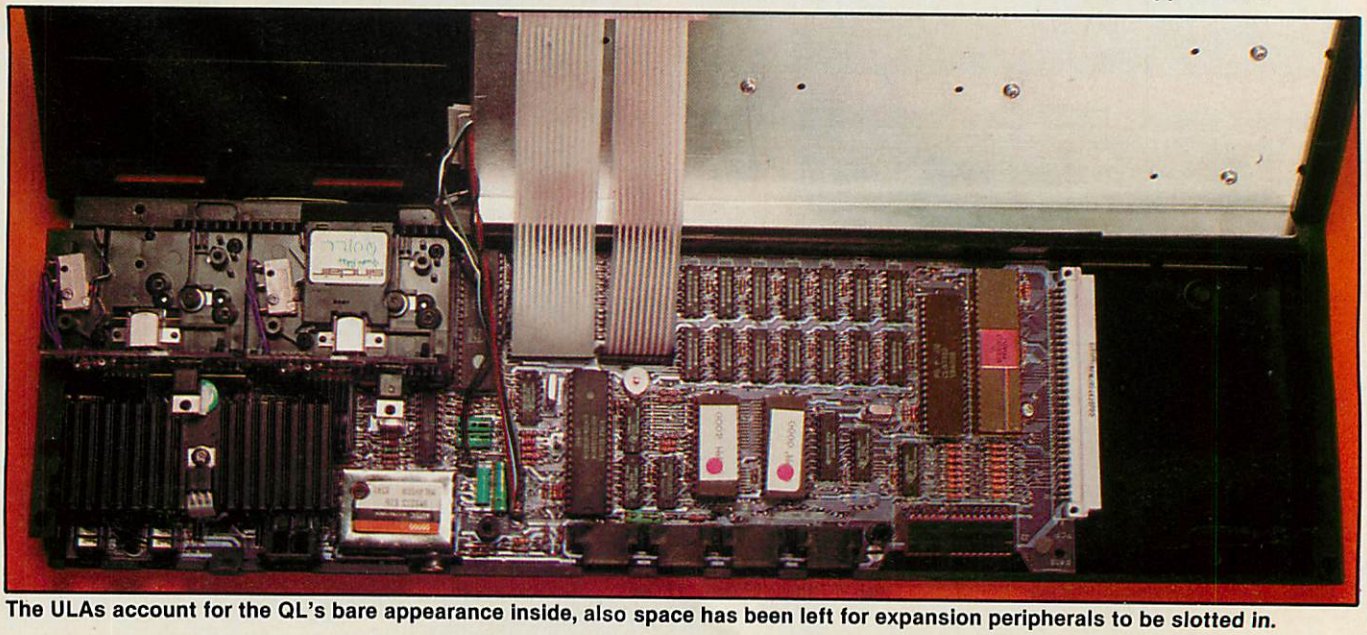
CPU: Motorola 68008 running at 7.5MHz
RAM: 128K standard including 32K video RAM; promised expansion to 640K
ROM: 48K with 16K externally in FB version, containing QDOS and SuperBasic
Weight: 1.388kg. excluding power supply
Dimensions: 138mm. (5.4in.) by 46mm. (1.8in.); separate power supply
Keyboard: full-size 67-key QWERTY layout plus five function keys; membrane-pad switching operated by rigid plastic keys
Mass storage: two built-in Microdrives; typical cartridge capacity 85K
Interfaces: two RS-232s; two QLAN local area network sockets; monitor and TV ports; two joystick ports; ROM slot; main expansion slot
Software in price: system software in ROM: Psion application packages Quill, Abacus, Easel and Archive on Microdrive cartridges.
Price: £399 including VAT, plus £7.95 post and packing
Manufacturer: Sinclair Research. Mail-order purchases from Freepost, Camberley, Surrey GU15 3BR; telephone: (0276) 686100; retail distribution due to begin in September



The tell-tale kludge is now extinct on final versions of the QL.



The bulky external power-supply unit mars the QL's sleek appearance.



The ULAs account for the QL's bare appearance inside, also space has been left for expansion peripherals to be slotted in.

The display is one of the least successful aspects of the QL. In the TV mode there is a lot of pulsing of the background and general lack of stability, lending a sub-aqua effect to the image. The characters are very difficult to read in the four-colour mode, and more so in black and white where problems of definition seem greater.

Since SuperBasic is resident in ROM, the command line responds automatically to this language. QDOS, the proprietary operating system, remains essentially invisible to the end-user. Until Sinclair releases documentation it is hard to make any useful comments on the system.

One disappointment is that it turns out that the much-vaunted multi-tasking will be available only from machine-code programs. Windows are offered, but there seems little you can do with them without the multi-tasking capability.

Slow SuperBasic

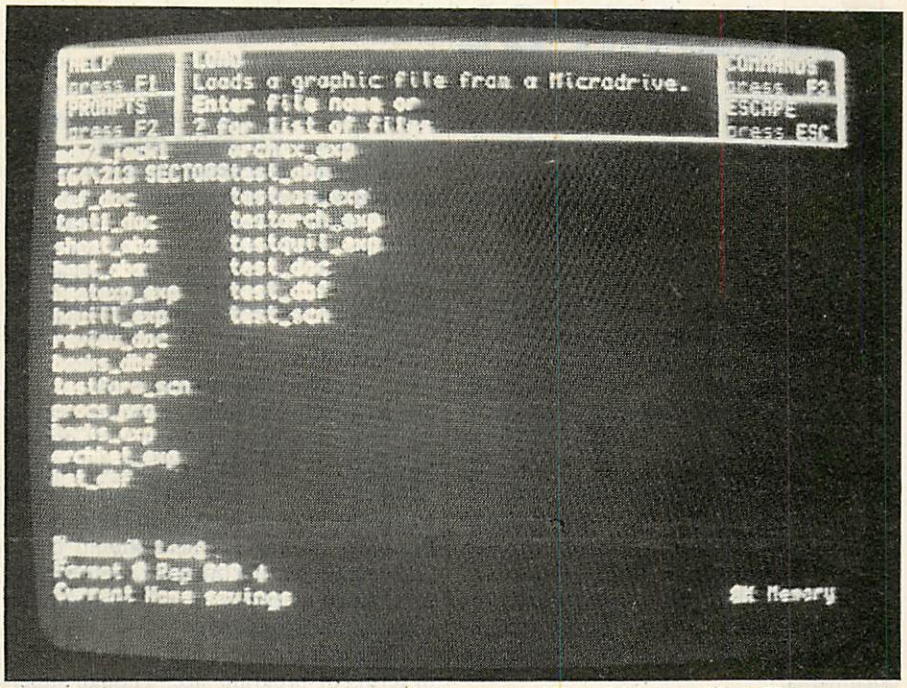
As the Benchmarks show, SuperBasic is slow for a 68000-based machine. Since the 68008 is inherently a fast processor, even with its eight-bit data bus, it has been suggested that the problem lies in the interpreter. It is certainly quite instructive to note the changes in the SuperBasic manual that have occurred since January as commands have come and gone or have been renamed, providing some indication of difficulties or second thoughts.

Sinclair's new Basic is incompatible with the Spectrum's ZX Basic. It lays claim to its "Super" on the grounds of being structured. Programs have the ordered form characteristic of Pascal and other structured languages, with neatly matched For and End commands, and Procedures and Functions tucked away at the end of the listing. Other goodies on offer include a Select, which allows a range of command options dependent on particular conditions, like Case in Pascal; an If that has now acquired an Else in addition to the Then; and an automatic line-numbering command, Auto.

Graphics

A wide range of graphics commands are included. Paper and Ink select the colours for each of the two modes available. Pixels, lines, arcs, circles and ellipses can all be drawn using single commands, and there is a Fill command to colour-in closed shapes in a swift and efficient way. Scroll and Pan allow the screen to be scrolled a specified number of pixels up, down, left or right. This command can also be applied to any windows that have been created.

The Window command permits a portion of the screen to be defined as an independent area, which may be scrolled and also display data directed towards it. Much of the power of the facility depends on a full implementation of the multi-tasking, and as such will only be available to machine-code programmers.



The QDOS command lists the files available on the Microdrive cartridge. The amount of free storage space left on tape is displayed in proportion to that used.

Other modish graphics commands include some for a pseudo-turtle — that is, one that exists purely in terms of movements on the screen, rather than as a physical robot. Standard commands include Pendown, Move, Turn and Turnto. A Beep command can be invoked with two, five, six, seven or eight parameters allowing various levels of envelope specification. As with the BBC's Envelope command, much experimentation will be needed to work out the consequences of small parameter changes. Only one sound channel is provided.

Windows, like all input/output commands, are handled using the concept of a stream. Any device, such as the keyboard, Microdrives, Windows and Printer, can be hooked up to a stream to accept data flow and, where appropriate, provide input. It is therefore theoretically possible to redirect printer output to a Microdrive. Streams will also be important in accessing peripherals when they eventually appear, and for sending out information over the QLAN network.

All the standard maths functions are included, as well as an impressive floating-point range of -10^{615} to 10^{615} with eight significant figures. Even though structured programming is supposed to avoid them, old favourites like Goto and Gosub are still available.

In fact, there is a contradiction between the whole logical structured approach and some of SuperBasic's facilities. For example, it is very tolerant of mixed data types. You can enter something as horrendous as

```
LET X% = 1.4 + "4"
```

and SuperBasic will do its best to make sense of it. First it translates the string

```
"4"
```

into the number 4.0, adds it to 1.4, then ignores the decimal fraction so that it can be assigned to an integer variable X%.

So the QL saves you from having to worry about all those little details that make programming so tiresome. Unfortunately, it also encourages you to be sloppy and even incomprehensible in your programming habits, which is precisely the thing that structured languages were designed to avoid.

A definitive assessment of SuperBasic will have to wait for a definitive version; at the moment it has a number of worrying bugs and bumps. Still, it is clear that Sinclair is aiming high, and the eventual possibilities could be very exciting.

The Psion software bundled with QL has settled down to a slightly more stable state. It was discussed in some detail in the May issue of *Practical Computing*, though at that time the programs were only running from ROM boards.

Data exchange

The four packages offer word-processing, spreadsheet, graphics and database applications. Each comes on a separate Microdrive cartridge and their size is such that only one at a time can be resident in memory on the standard machine. Consequently the exchange of data between programs is not entirely straightforward, and certainly not instantaneous.

The Quill word-processing package offers all the standard features, and is fully WYSIWYG. As a result, the response time is often very slow as the machine struggles to reformat the text's

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SINCLAIR QL

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on-screen appearance: perhaps the worst offenders are the Replace mode and backspace deletion. One problem with deletion is that you run too far ahead of the plodding cursor and so blot out some of the previous word too.

As part of the general policy of command integration, editing throughout the packages is carried out using the keystrokes used by the SuperBasic line editor, which is limited but serviceable. Help screens, called up by pressing F1, have to be pulled in off a Microdrive cartridge and, as with all Microdrive operations, longish waits are involved. Even straightforward text entry can cause frenzied accessing, and this only serves to slow down the system's response time even further. Loading new documents is similarly frustrating: load times of minutes are not uncommon even for small documents.

Two major omissions are a mail-merge facility and any capability for print spooling — a shame when you remember that the QL is billed as a multi-tasking machine. Generally, Quill is best regarded as a slow but usable word processor, offering most of the facilities looked for in a package but not ideally suited to extensive use by good typists. For the two-finger beginner or for occasional use in the home it should suffice.

The spreadsheet program can be recommended with fewer reservations. It is quite fast, again offers all the standard facilities, and adds a few of its own. Particularly useful is the ability to manipulate whole rows and columns using only the first entry as a label. Thus, formulae like

costs = sales *0.43 + 169

are legal. One slightly annoying feature for those of us brought up on VisiCalc and its clones is the necessity of entering a number before using the cursor keys, where the latter will serve on their own in the older packages. There should be no problems in putting this package to serious uses, and it measures up well against other stand-alone programs.

The Easel graphics package is the largest in terms of program size. Though superficially the most impressive it is ultimately probably the least useful. Graphs can be created at the keyboard by directly inputting data, or data can be imported for other applications.

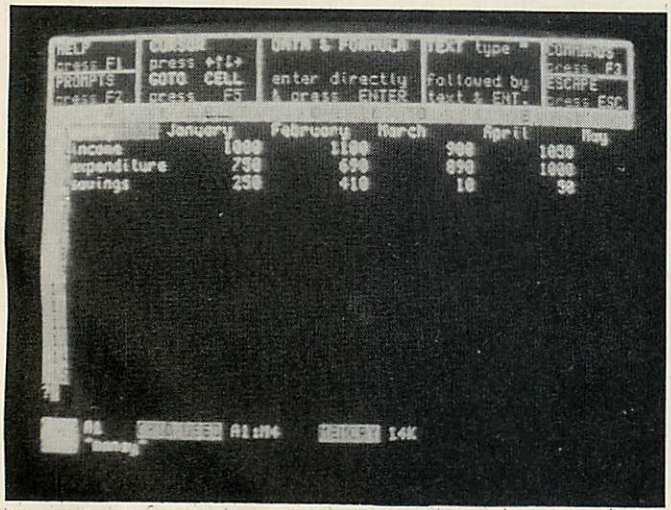
Although there are some eight different kinds of graph available, and colours can be changed for particular parts of them, the overall variation is really quite small. Otherwise Easel is easy to use, well implemented and fast, considering the graphic manipulations. A nice touch is the ability to add text at any point on a graph.

Perhaps the most interesting of the Psion packages is Archive, the programmable database. Databases have traditionally been heavy business applications rather than for the home user, but Archive could well change all that.

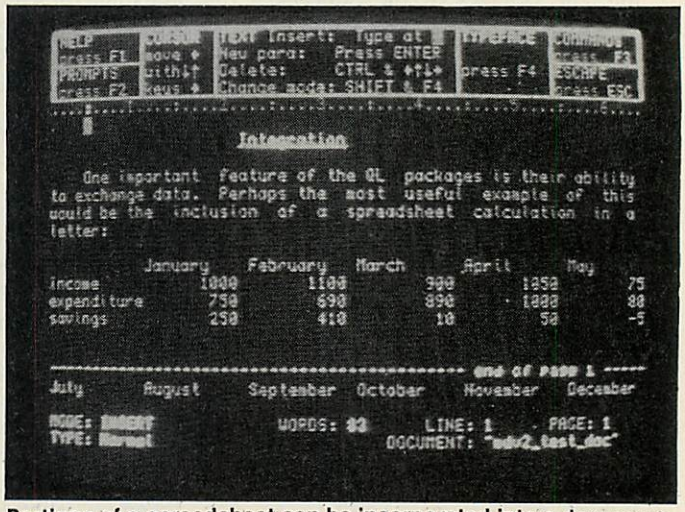
A default record format is available on which each field can be set up as required. New records can be added by using the Insert command, which allows the fields to be filled in one by one, or Append, where Let commands are used to assign values to particular fields. The command line generally interprets input as a command; where input is required, a second cursor appears in the upper part of the screen representing the record.

Once a file has been set up, its contents can be scanned using First, Next, Before and Last to pass from record to record. Records with a particular field can be found using the Select command. A file

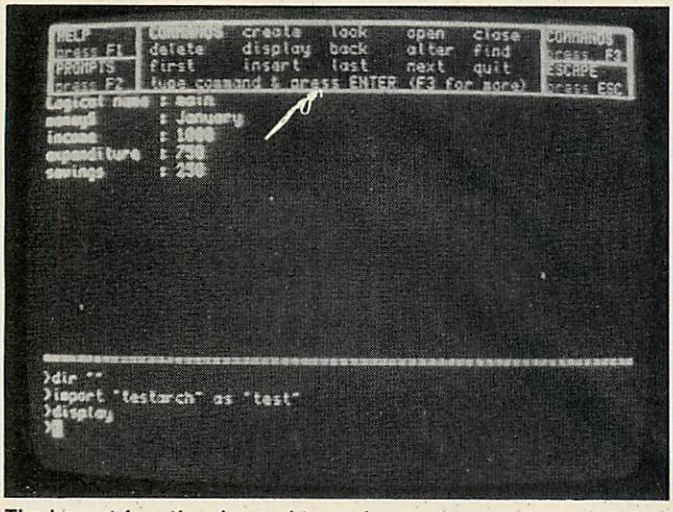
(continued on page 64)



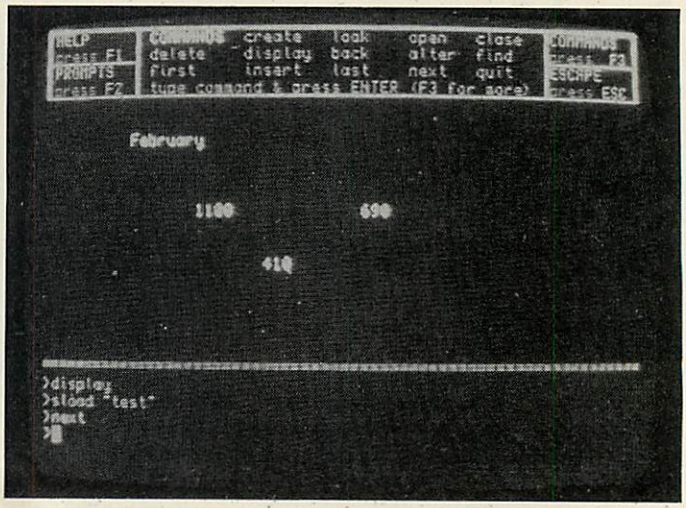
Abacus has a standard spreadsheet format.



Portions of a spreadsheet can be incorporated into a document.



The Import function is used to exchange data.



Data can be displayed in a user-defined format.

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SINCLAIR QL

(continued from page 62)

can also be sorted on any of its fields in ascending or descending alphabetical or numerical order; it is possible to sort on two fields. The Locate command can then be used to search on part of a string, for example Sm, to find all names beginning with these letters. This allows a kind of wild-card facility.

As well as using the default display — invoked, reasonably enough, by the command Display — it is possible to design alternative screen formats using the screen editor Sedit. Formats can be saved and loaded from Microdrives.

Perhaps the most powerful feature of Archive is its ability to run procedures. These structured programs look very similar to a SuperBasic listing, but without the line numbers. Using them you can run routines to search through files, print out mailing lists, merge, reorder and delete — in short, everything you would expect from a fully programmable database.

Most of the SuperBasic commands like Getkey( ) and While are available, and the program handles procedure layout as in SuperBasic. Procedures may call other procedures and can use local parameters. Multiple files may be accessed by assigning them distinct logical names. They are defined when a file is Opened — which allows alterations — or Looked at, which is limited to read only. It is important to Close files at the end of a session.

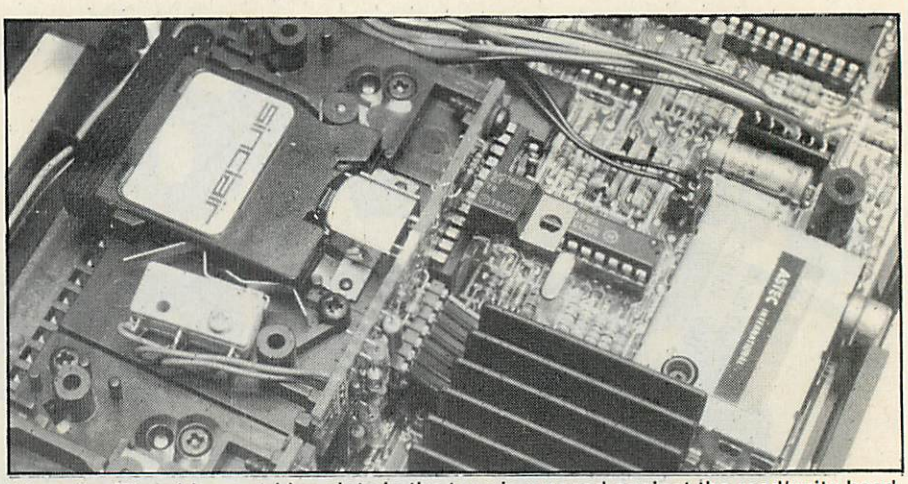
Initial impressions are that Archive is a powerful program. Its sorts and searches on small files were fast, but how it would cope with larger files that exceed RAM space might well be another matter. The procedural language is very powerful, if slightly daunting for the beginner.

Integration

One of the key features of the Psion suite is its claim to integration. Command integration, or the appearance of the screens and the use of the function keys in a consistent fashion, is superficially quite complete. However, Archive is substantially different in approach. All input is treated initially as command, which must be entered in full, whereas in the other three packages first letters suffice.

In Archive, all the command menus are called up by successive presses of F3; in Quill, there is a command Other which takes you down to a further nested list of commands. Matters are complicated by the fact that there are two commands beginning with F, namely Footer on the main list and Files on the subsidiary one.

More crucial is the level of data integration. Again, matters vary from package to package. The Export function allows data to be passed from Abacus to the other three packages relatively easily. A file with the extension name of _EXP is created, and can then be called up using the Import command from the other applications. On the other hand, passage of data from Archive to Quill is not so straightforward. Given that it is not possible to hold all packages in memory simultaneously, this awkwardness is not so critical; the main transfers are possible and relatively easy. Perhaps things ought to be kept in context since the Psion programs are being bundled with a machine for a total of £400 and it would be unreasonable to expect perfection.



When the Microdrive cartridge slots in the tape is pressed against the read/write head.

The manuals are quite comprehensive, with plenty of screen dumps and examples. The Introduction and SuperBasic sections have been touched up slightly between the FB and AH versions, but unfortunately some errors have been corrected only to be replaced by others. In particular, the line numbers of the example programs have been changed, but not consistently. The Keywords section explaining SuperBasic is useful but could be fuller.

With the present so dubious, it may seem a little premature to consider the future, but there can be little doubt that after a few more months' tidying up the QL will be a serviceable machine. Add-ons promised from Sinclair are the 512K RAM — guaranteed non-wobble — a Winchester, modem and terminal emulator, Centronics port and a non-thermal printer. There is also the possibility that an upgraded Microdrive with a capacity of 1Mbyte will be released; unfortunately this will yet again be incompatible with everything else.

The Psion packages are being slimmed down further so that they can be crammed on to a 128K ROM. This will improve performance and free far more RAM. At the moment the 32K video RAM, together with the large programs, leaves precious little user space. Psion has recently started marketing the QL packages for other machines like the IBM PC and Sirius under the name Xchange. As well as concurrency, they have additional features like mail-merge and print spooling — some of which may filter back to the QL one day.

Despite all the delays and problems, Sinclair is confident that the QL is going to be a winner on the scale of its previous machines. Sales targets are 250,000 this year and 750,000 next year. New manufacturers are due to be announced soon, and the American launch is planned for the autumn.

Conclusions

- **This one will run and run. When the bumps have been ironed out the QL will represent unbeatable value.**
- **The Microdrives are overpriced underperformers. It will not be long before third-party suppliers offer disc drives that really will be a leap for the machine.**
- **The Psion programs are eminently usable for most home applications. Only Quill lets the side down with its rather sedate response.**
- **SuperBasic seems to be a little wobbly at present. The potential is there, especially with the structuring and wide range of commands. It is also slow, which could be a problem for Basic games. The lack of multi-tasking at this level is also disappointing.**
- **Initially there will be a shortage of software, but the indications are that software writers are beavering away to cater for what will be a huge market.**
- **It is only too easy to knock aspects of the QL, but the fact remains that for about £400 you are getting a micro with potential, and four usable application programs here and now. Despite claims to the contrary, it is no low-end business machine but an up-market home micro.**

QLangers

Practical Computing is monitoring the state of the QL. If you find any bugs or bumps in the software, please send details to QLangers, Practical Computing, Room L307, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

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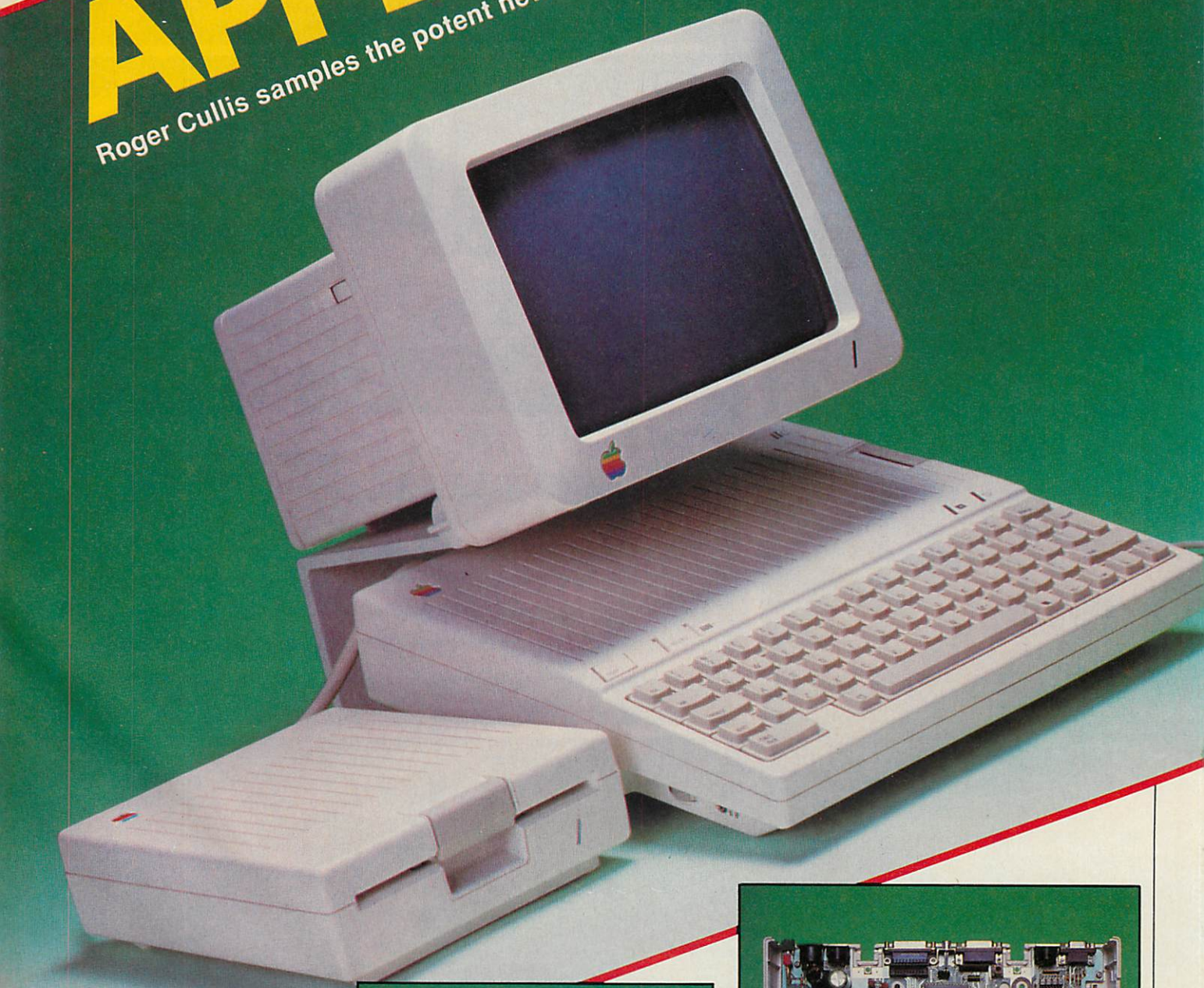
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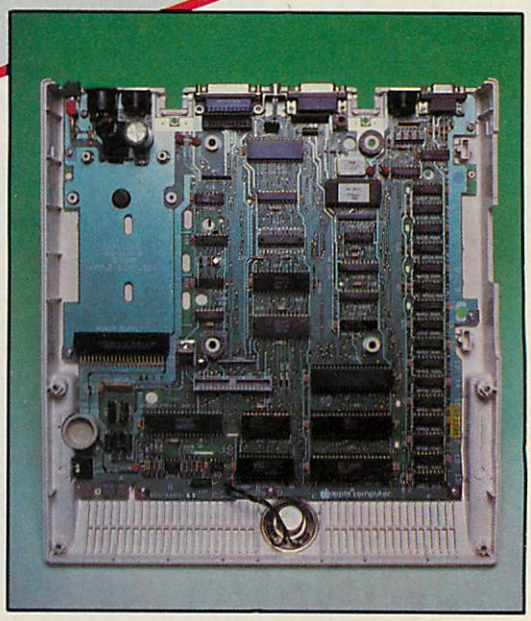
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APPLE IIc

Roger Cullis samples the potent new drug for Apple addicts.







Above: The IIc and additional external 143K disc drive. Right: A rare view of the machine's innards reveals its compact design.

OVER THE LAST four or five years I have been developing increasingly close links with a succession of Apple computers. At first, with one of the original Apple II machines, it was an hour a day of borrowed time during the lunch hour. Then a II+ arrived to occupy my evenings. Next I acquired a IIe which took, on average, 10 hours of each day and rather more at weekends.

All these computers had a number of merits in common: they were bulky, they beeped and their disc drives clattered. This meant that they were relegated to another room, and switched off from time to time.

The newly introduced IIc, however, does not enjoy such advantages. It is light and compact, it possesses an almost silent built-in disc drive and it has a volume control which can turn the beep down to a level which is acceptable in the average living room. Couple this with a neat monitor which perches comfortably on a coffee table beside an armchair, and the excuse for not working an 18- or 20-hour day is completely removed. It should carry a government health warning.

The IIc is the next stage in the evolution of the Apple II from the prototype originally produced by Mark Jobs and Steve Wozniak back in 1976. It represents a major step towards the realisation of the goal of making the Apple II a viable computer throughout the 1980s. With 128K of built-in RAM, the computer is ahead of the accepted rule that price/performance ratio decreases by 25 percent per annum.

Unlike its predecessors the IIc is intended as a non-expandable computer and does not possess any of the familiar expansion slots. Reinforcing this philosophy is the design of the case, which cannot be readily opened; the *User Guide* warns that the warranty is invalidated if the user does manage to get inside. As compensation for the non-expandibility, Apple has provided a comprehensive range of interfaces which take the place of the cards that users have previously had to plug in to implement such basic functions as connecting a printer.

A look inside

With the blessing of Apple we did open up our review machine. On the right-hand side of the motherboard are 16 64K RAM chips, constituting the 128K of read-write memory. The processor itself is at the front edge, flanked by ROMs which contain the monitor, the Basic interpreter, keyboard decoder and the display-control routines. The audio amplifier is contained in a single chip in the front left-hand corner and the interface circuits are arranged on a bus situated in the centre of the machine.

Contrary to previous Apple practice only the processor and the ROMs are socketed: all the other chips are soldered directly to the board. This reflects not only the increased reliability now expected from semiconductor devices, but also the desire to make a portable machine more robust and able to withstand the shocks it will experience as it is carried about.

The keyboard layout is identical with that of the Apple IIe. There are 63 keys to implement fully the ASCII character set, as well as Open Apple and Closed Apple keys which serve a variety of functions. The Reset key is away from the main keyboard and operates only in conjunction with the Control key. Next to Reset are two switches, one for selecting 40- or 80-column display, the other for selecting an alternative character set. On American machines this is a Dvorak keyboard layout, while on European versions it is a national language character set, which in the U.K. version merely replaces the # with a £ sign. A ribbon connector links the keyboard printed-circuit board to a 34-pin connector on the motherboard.

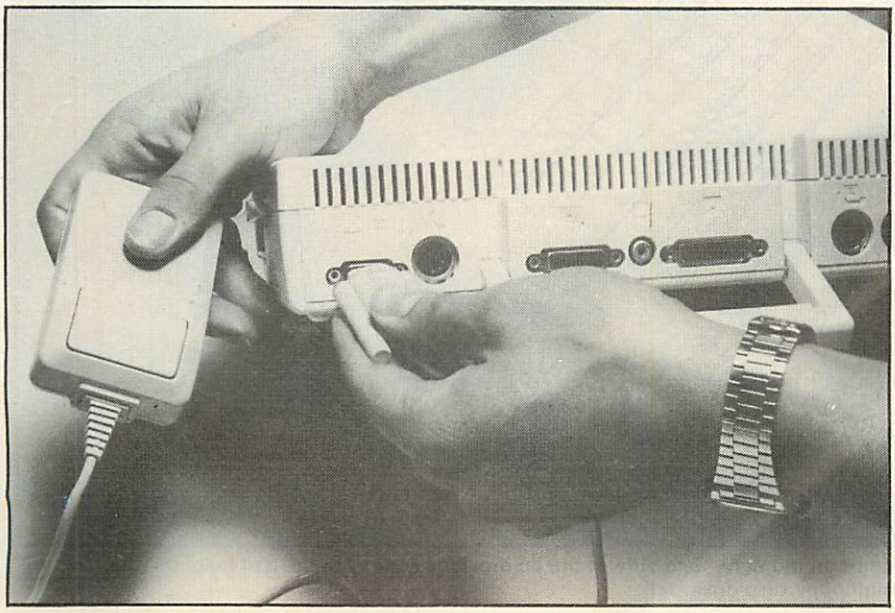
The power supply also reflects the portable nature of the computer. An external unit, housed in a plastic box styled to match the computer, converts a.c. mains into 12V d.c. and plugs into a seven-pin DIN connector at the rear. The various voltages required by the individual chips are derived by a switching power supply which plugs into the motherboard.

As well as the power-supply connector, the rear of the case carries sockets for the peripherals supported by the IIc. There are identical five-pin DIN sockets for serial printer and modem, an RCA socket for the monitor and three D-type sockets — nine-pin for the mouse and game input, 25-pin for a second disc drive and 15-pin for video connection. The video socket provides comprehensive access to the display signals, together with sound and d.c. power supply. An on/off switch is also provided.

Benchmarks

The table shows the time in seconds to run eight standard Basic routines. Our Benchmark routines test out various typical tasks, each repeating an appropriate set of Basic statements 1,000 times. Timings for the Apple IIc are virtually identical to those obtained with our IIe, despite the CMOS circuitry the IIc uses. The Basic interpreter used was Applesoft.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Apple IIc — CMOS 65C02	12.7	8.8	16.2	18.0	19.8	29.2	45.4	105	31.9
Apple IIe — 6502	12.7	8.8	16.2	18.1	19.7	29.2	45.6	105	31.9
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30	16.8
Kaypro 10 — Z-80B	1.2	3.8	9.5	9.7	10.5	19.0	29.5	51	16.9
Epson PX-8 — CMOS Z-80 clone	3.5	7.1	18.3	18.0	20.7	39.0	61	88	32.0



Ribbon connector

The remaining major component inside the main case is a half-height Alps 5.25in. minifloppy disc-drive unit, accessed through a slot on the right-hand side. Like the keyboard, it is connected to the motherboard through a ribbon cable.

There is very little free space inside the case, though great care has been taken to ensure that heat can be dissipated freely. The carrying handle latches in a downward position to serve as a stand which holds the underside clear of the surface on which the computer is standing. The IIc uses CMOS chips, so one of the major sources of heat is friction between the floppy disc and its sleeve.

(continued on next page)

Left: An acquisition from the Lisa and Mac, the mouse plugs into the rear.

APPLE IIc

(continued from previous page)

The memory map follows standard Apple II practice, with the proviso that the standard operating system is Prodos, which has slightly different memory requirements from DOS 3.3.

Slot assignments, which were available for any peripheral on earlier Apple II machines are now taken up by dedicated I/O circuits. As with the IIe, slot 0 has been given to extra RAM — 16K of the 64K, equivalent to the old language card. Slots 1 and 2 contain RS-232 serial interfaces for printer and model respectively. Each implements a subset of the Apple Super Serial interface card but with different default conditions.

Slot 3 corresponds to the built-in 80-column routines. Functionally, the circuit is equivalent to the Apple IIe extended 80-column card, providing an extra 64K of memory mapped into the same address space as the main memory. Slot 4 contains interface circuits for a mouse which can be plugged into a DB-9 connector at the rear.

Slot 6 is the disc interface, provided in the IIc by a single chip known as the IWM or Integrated Woz Machine — Steve Wozniak designed the orginal Disk II interface. To booting from an external disc drive you perform a PR # 7 command, the equivalent of initialising a slot 7 device.

As with other Apple II machines, the firmware controlling these I/O functions is contained within the address space $C100 to $C7FF, and this is dedicated to 80-column routines.

Major drawback

Astute mathematicians will have noticed the omission of a reference to slot 5 functions. The section of the *Technical Reference Manual* which describes the firmware routines merely allocates address $C500 as "reserved". I am sure that the universally accepted view outside Apple Computer Inc. will be that this space should have been used to provide an Apple expansion bus connector, accessible from the rear of the case. This would have overcome the major drawback of the IIc, which is lack of an easy way of connecting a Z-80 to provide access to CP/M. Third-party suppliers are having to resort to methods such as using the RS-232 ports and video connector.

Probing more deeply into the circuit of the IIc, another way in which it differs from its predecessors is that a 65C02 has replaced the 6502 as processor. The 65C02 is a redesigned, CMOS version of the earlier chip, and has several significant functional differences. There are 27 new instructions, new addressing modes and, for some functions, a different execution scheme. With the 6502 there were some undocumented instructions which could be used for illegal programming. These instructions are not present in the 65C02, so software which relies on them will not run.

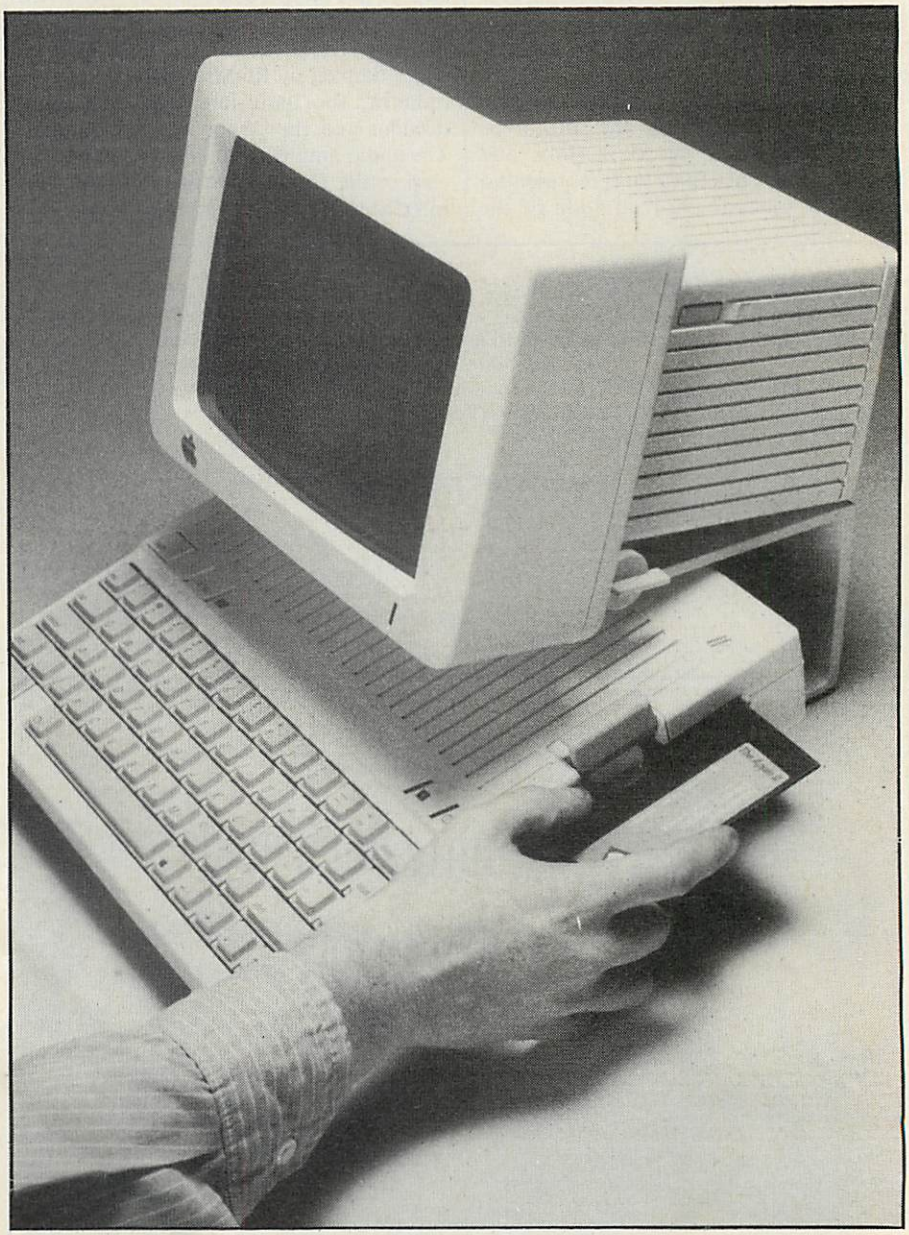
The complete list of 65C02 op codes is shown in table 1. Using the amended instruction set, it is possible to save the X and Y registers directly to the stack, using PHX and PHY, and by using STZ to zero different locations without an intermediate LDA #$00. This produces much more compact code, which Apple has taken advantage of to rewrite the monitor routines.

To maintain compatibility with existing software, the old entry points have been preserved, and the routines are now liberally sprinkled with the new command BRA — Branch Relative Always. It is possible to upgrade the Apple IIe by replacing the 6502A processor with a 65C02, but timing constraints prevent this being done in an Apple II or II+.

Like the IIe, the Apple IIc provides for upper- and lower-case text. An interesting innovation is that the Basic interpreter will accept keywords typed in lower case, though when listed they appear in upper case. The IIc does not support Pascal 1.0 firmware protocols, so any user who has not upgraded will have to do so. Integer Basic, if required, will have to be loaded from a DOS 3.3 System Master disc — but hurry if you want it, because the IIc is shipped with Prodos and Apple will not be supporting DOS 3.3 much longer.

Casualties

Built-in diagnostics are not provided. Another casualty is the cassette interface and commands, whose memory allocation has been given to the 80-column routines. It is also not possible to write to the annunciator outputs. On the plus side, double high-resolution graphics of 560 by 192 pixels in 16 colours are now possible. The Applesoft interpreter does not support this mode, which has to be implemented by



A slot on the right-hand side of the IIc provides access to the half-height 5.25in. minifloppy disc-drive unit.

machine-language routines assembled at $6000 and called by ampersand commands &DG, &Pen, &Brush, &HColor=n, &Bckgnd, &Dot At X,Y, and &Line To X,Y.

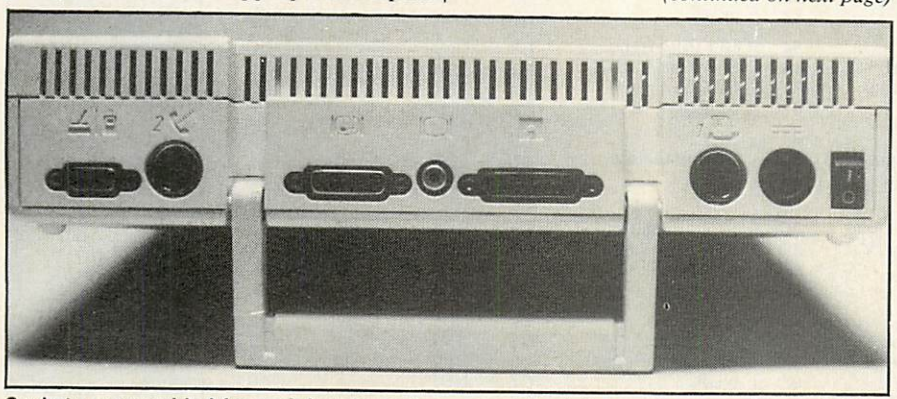
Spin-off

One exciting spin-off from Apple's development work on the Lisa and Macintosh is to be found in the character generator ROM. In the original IIe character-generator ROM there are two sets of inverse upper-case characters, character codes 0 to 31 and 64 to 95. In the new ROM, used in both the IIc and in new IIe machines, the upper set has been replaced by 32 graphics characters or icons. These icons can be displayed using a simple procedure from Basic by Poking 49162 with any value, followed by a PR # 3 to turn on 80-coumn firmware. Use the Inverse command to set the inverse mode. Then you just Print the appropriate capital letter to display the corresponding icon.

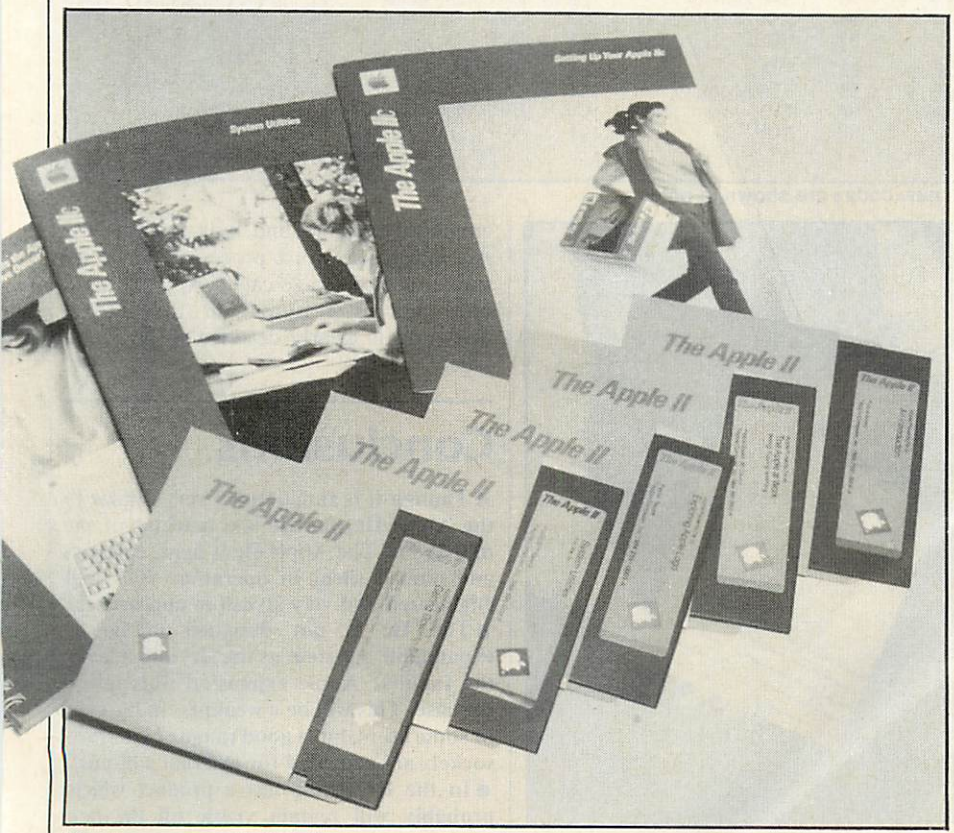
The main application of the icons is in conjunction with a mouse, another acquisition from the Lisa and Mac. The mouse is intended as a user-friendly input device for what is basically menu-driven software. Moving the mouse over a surface causes a captive ball within the mouse's body to roll, which in turn rotates two discs on axes which are at right angles to one another. This rotation is detected by photocells, and translated by the mouse firmware in the IIc into movements of a pointer on a graphics screen. A microswitch in the mouse is used to trigger specific actions such as the selection of a particular option in a menu.

The Apple IIc comes with a comprehensive set of manuals, and great pains have been taken to provide an easy introduction for the absolute newcomer to computing. Experienced users will find that they can bypass most of the instructions

(continued on next page)



Sockets are provided for peripherals such as a serial printer, modem, monitor and video.



The IIc comes with training programs on disc and a comprehensive set of manuals.

Specification

CPU: eight-bit 65C02, a CMOS variant of the 6502, running at 1MHz

Memory: 128K RAM; 16K ROM containing monitor program and Applesoft Basic

Display: both 24-line by 40-column and 24-line by 80-column text modes; graphics modes — 40 by 48, 280 by 192, and 560 by 192; while preserving Apple IIe compatibility, the IIc has 16-colour rather than eight-colour graphics; the IIc outputs display through a domestic TV, a monitor or the promised LCD panel; standard system comes with TV adaptor

Keyboard: full-size QWERTY layout keyboard with 63 keys

Discs: built-in 143K 5.25in. floppy-disc drive, fully Apple II compatible; additional external 143K drive costs £230; third-party 10Mbyte hard-disc unit available from Symbiotic Computer Systems

Interfaces: mouse/joystick port, two RS-232C interfaces configured for modem and printer respectively, external disc interface, video-monitor jack socket, RGB output, audio socket

Portability: IIc main unit weighs 3.4kg., (7.5lb.) and is mains-powered via a power adaptor supplied with the system; main unit dimensions 305mm. (12in.) x 292mm. (11.5in.) x 64mm. (2.5in.) optional Apple IIc monitor weighs 5.5kg., (11lb.), optional flat-screen display panel about 1.4kg. (3lb.)

U.K. price: £925 plus VAT for IIc with 128K and one built-in disc drive, TV adaptor, power adaptor, Prodos and utilities, manual plus five tutorial and demo discs

Hardware options: Apple IIc 9in. green screen monitor, £140; monitor stand, £27; flat-panel liquid crystal display is promised for September 1984, price about £500, showing full 24 lines by 80 columns and high-resolution graphics; IIc mouse costs £70 including Mousepaint drawing package; rechargeable battery pack has been announced by third-party supplier in the U.S.

Software: IIc comes with the Prodos operating system, utilities, and six training programs on disc, and Applesoft Basic in ROM; the IIc runs Prodos software, and also most existing DOS 3.3 and Apple UCSD Pascal software without alteration; example products making full use of IIc graphics and memory include Appleworks, £175, integrated word processing/spreadsheet/database; Apple Logo II, £75; Microsoft Multiplan, £159

Manufacturer: Apple Computer Inc., U.S.A.; Apple makes the IIc at its plant in Ireland for the U.K. and European markets

U.K. distribution: Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244. Available now.

00	BRK	**34**	**BIT Zero Page, X**	68	PLA	**9C**	**STZ**	D0	BNE
01	ORA (Indirect, X)	35	AND Zero Page, X	69	ADC Immediate	9D	STA Absolute, X	D1	CMP (Indirect), Y
02	NOP	36	ROL Zero Page, X	6A	ROR	**9E**	**STZ Indirect, X**	**D2**	**CMP (Zero Page)**
03	NOP	37	NOP	6B	NOP	9F	NOP	D3	NOP
04	**TSB Zero Page**	38	SEC	6C	JMP Indirect	A0	LDY Immediate	D4	NOP
05	ORA Zero Page	39	AND Absolute, Y	6D	ADC Absolute	A1	LDA (Indirect, X)	D5	CMP Zero Page, X
06	ASL Zero Page	**3A**	**DEA**	6E	ROR Absolute	A2	LDX Immediate	D6	DEC Zero Page, X
07	NOP	3B	NOP	6F	NOP	A3	NOP	D7	NOP
08	PHP	**3C**	**BIT Absolute, X**	70	BVS	A4	LDY Zero Page	D8	CLD
09	ORA Immediate	3D	AND Absolute, X	71	ADC (Indirect), Y	A5	LDA Zero Page	D9	CMP Absolute, Y
0A	ASL	3E	ROL Absolute, X	**72**	**ADC Zero Page**	A6	LDX Zero Page	**DA**	**PHX**
0B	NOP	3F	NOP	73	NOP	A7	NOP	DB	NOP
0C	**TSB Absolute**	40	RTI	**74**	**STZ Zero Page, X**	A8	TAY	DC	NOP
0D	ORA Absolute	41	EOR (Indirect, X)	75	ADC Zero Page, X	A9	LDA Immediate	**DD**	**CMP Absolute, X**
0E	ASL Absolute	42	NOP	76	ROR Zero Page, X	AA	TAX	DE	DEC Absolute, X
0F	NOP	43	NOP	77	NOP	AB	NOP	DF	NOP
10	BPL	44	NOP	78	SEI	AC	LDY Absolute	E0	CPX Immediate
11	ORA (Indirect), Y	45	EOR Zero Page	79	ADC Absolute, Y	AD	LDA Absolute	E1	SBC (Indirect), X
12	**ORA (Zero Page)**	46	LSR Zero Page	**7A**	**PLY**	AE	LDX Absolute	E2	NOP
13	NOP	47	NOP	7B	NOP	AF	NOP	E3	NOP
14	**TRB Zero Page**	48	PHA	**7C**	**JMP Absolute (X)**	B0	BCS	E4	CPX Zero Page
15	ORA Zero Page, X	49	EOR Immediate	7D	ADC Absolute, X	B1	LDA (Indirect), Y	E5	SBC Zero Page
16	ASL Zero Page, X	4A	LSR	7E	ROR Absolute, X	**B2**	**LDA (Zero Page)**	E6	INC Zero Page
17	NOP	4B	NOP	7F	NOP	B3	NOP	E7	NOP
18	CLC	4C	JMP Absolute	**80**	**BRA**	B4	LDY Zero Page, X	E8	INX
19	ORA Absolute, Y	4D	EOR Absolute	81	STA (Indirect, X)	B5	LDA Zero Page, X	E9	SBC Immediate
1A	**INA**	4E	LSR Absolute	82	NOP	B6	LDX Zero Page, Y	EA	NOP
1B	NOP	4F	NOP	83	NOP	B7	NOP	EB	NOP
1C	**TRB Absolute**	50	BVC	84	STY Zero Page	B8	CLV	EC	CPX Absolute
1D	ORA Absolute, X	51	EOR (Indirect), Y	85	STA Zero Page	B9	LDA Absolute, Y	ED	SBC Absolute
1E	ASL Absolute, X	**52**	**EOR (Zero Page)**	86	STX Zero Page	BA	TSX	EE	INC Absolute
1F	NOP	53	NOP	87	NOP	BB	NOP	EF	NOP
20	JSR Absolute	54	NOP	88	DEY	BC	LDY Absolute, X	F0	BEQ
21	AND (Indirect, X)	55	EOR Zero Page, X	**89**	**BIT Immediate**	BD	LDA Absolute, X	F1	SBC (Indirect), Y
22	NOP	56	LSR Zero Page, X	8A	TXA	BE	LDX Absolute, Y	**F2**	**SBC (Zero Page)**
23	NOP	57	NOP	8B	NOP	BF	NOP	F3	NOP
24	BIT Zero Page	58	CLI	8C	STY Absolute	C0	CPY Immediate	F4	NOP
25	AND Zero Page	59	EOR Absolute, Y	8D	STA Absolute	C1	CMP (Indirect, X)	F5	SBC Zero Page, X
26	ROL Zero Page	**5A**	**PHY**	8E	STX Absolute	C2	NOP	F6	INC Zero Page, X
27	NOP	5B	NOP	8F	NOP	C3	NOP	F7	NOP
28	PLP	5C	NOP	90	BCC	C4	CPY Zero Page	F8	SED
29	AND Immediate	5D	EOR Absolute, X	91	STA (Indirect), Y	C5	CMP Zero Page	F9	SBC Absolute, Y
2A	ROL	5E	LSR Absolute, X	**92**	**STA (Zero Page)**	C6	DEC Zero Page	**FA**	**PLX**
2B	NOP	5F	NOP	93	NOP	C7	NOP	FB	NOP
2C	BIT Absolute	60	RTS	**94**	**STY Zero Page, X**	C8	INY	FC	NOP
2D	AND Absolute	61	ADC (Indirect, X)	95	STA Zero Page, X	C9	CMP Immediate	FD	SBC Absolute, X
2E	ROL Absolute	62	NOP	96	STX Zero Page, Y	CA	DEX	FE	INC Absolute, X
2F	NOP	63	NOP	97	NOP	CB	NOP	FF	NOP
30	BMI	**64**	**STZ Zero Page**	98	TYA	CC	CPY Absolute		
31	AND (Indirect), Y	65	ADC Zero Page	99	STA Absolute, Y	CD	CMP Absolute		
32	**AND Zero Page**	66	ROR Zero Page	9A	TXS	CE	DEC Absolute		
33	NOP	67	NOP	9B	NOP	CF	NOP		

Table 1. Hexadecimal op codes for the 65C02: new codes are shown in bold

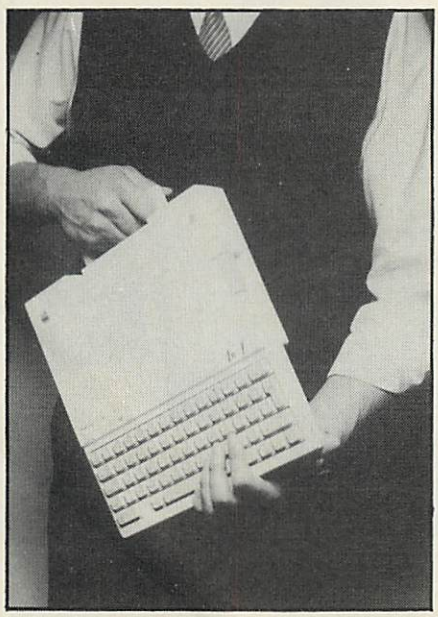
APPLE IIc

(continued from previous page)

and get down to serious applications straightaway, a process which is aided by the set of tutorial discs accompanying the machine.

The Apple II's huge software base has always been one of its principal strengths and Apple has gone to great lengths to ensure that virtually all existing software will run on the IIc. The exceptions are those programs which do not use standard Apple entry points to the monitor and Basic interpreter routines, or have special protection methods such as use of the undocumented 6502 op codes. The Benchmark tests display no significant differences from those of the IIe, which in turn are identical to those of the II+.

In conjunction with the launch of the IIc, Apple has released several software packages to take advantage of the enhanced memory and built-in firmware. An integrated word processor/database/spreadsheet package called Appleworks is one, and is featured on the tutorial discs and is clearly destined to be a best seller.



At 3.4kg., the IIc is light and compact.

Conclusions

● Though it is functionally very similar to the Apple IIe, the IIc is a machine of the mid-1980s. The Apple IIc is light, compact and almost silent in operation; it is well engineered and very stylish in appearance.

● The IIc is not designed to be as expandable a system as the IIe, and it lacks the familiar Apple expansion slots inside the case. This will be a weakness in the eyes of some users, but a good range of interface sockets are provided for external add-ons.

● In the IIc Apple has a product which probably will remain viable till the late 1980s.



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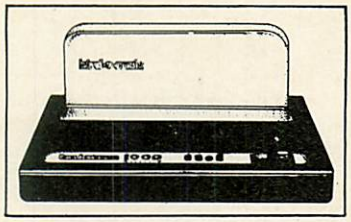
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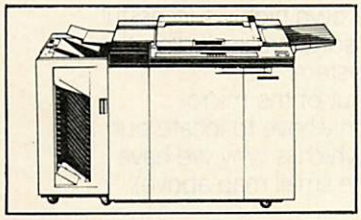
The simple desk top machine converts typed, printed and photocopied pages into prestige perfect-bound presentations in seconds. The Bind-o-Matic 2000 presents information in its most compelling form to command immediate attention. So easy to operate, stand it beside the copier where anyone can use it. And it's fast — 25 booklets in 40 seconds. Single documents even quicker. Above all, such beautiful results! Price lists, quotations, reports, etc in superb quality. A4 covers which can be printed with your Company name and logo. I have all the details.

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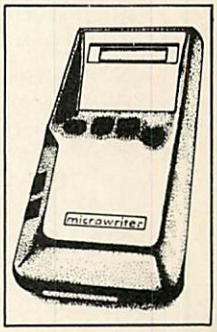
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Microwriter's free self teach course has been such a success with my readers that many have bought one right away. Others have said that they would like an opportunity to try one for a few days first. Microwriter have kindly agreed to give Page Plus readers an amazing money back guarantee. Here's a great chance for all you non typists who'd like to be word processing for yourselves. Seeing really is believing — it's so simple. It will only take a few hours to master, leaving you plenty of time to practice editing, formating, etc. Contact me for more details of this limited offer.

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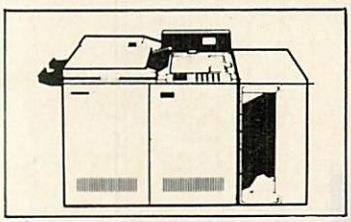




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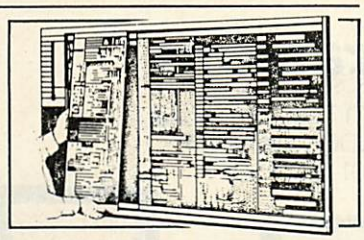
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The 1075 copier was designed by Rank Xerox to meet the most complex copying needs. It offers several flexible system configurations — each one capable of meeting specific requirements, eg the Computer Forms Feeder copies computer printout and reduces it to a standard A4 size automatically. All systems feature automatic double-sided copying, reduction facilities, automatic monitoring and a control to ensure good quality, even from hard-to-copy originals. No sophisticated copier has ever been so simple to operate. Get the facts from me.

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Key facts at a glance

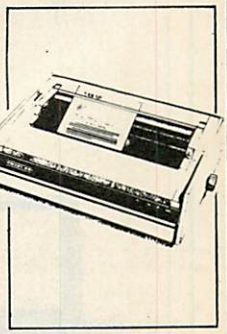
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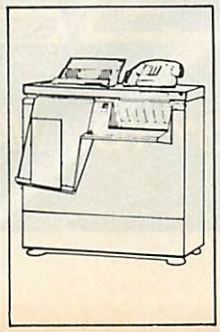
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The Trend 930 printer means business

The latest addition to Trend's successful 900 series of high speed printers is the 930 printer. This versatile machine gives dual mode printing. When your letters need to create the best impression select the Executive Quality 80 characters per second, with the daisywheel look-alike finish. For office memos, etc, choose the Draft Mode with its quick 200 cps speed. The 930 will handle cut sheets and multi-part fanfold forms. Optional sheet feeder available. Contact me now for more details of this superior WP printer.

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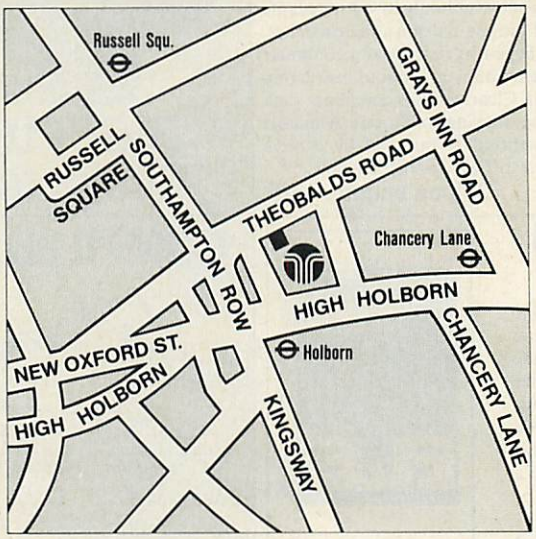


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● **Circle No. 132**

TANDY 2000

Glyn Moody tries out the newest addition to Tandy's flock and finds that despite its ugly duckling appearance the machine runs like a beauty.

TANDY is following Commodore in hedging all its bets in the micro game. Instead of opting for one processor or operating system, Tandy has launched systems based on 6809s, Z-80s, 8085s and 68000s, running variously under CP/M, TRS-DOS and Xenix. Latest addition to the stable is the Model 2000, an MS-DOS machine sporting the new and elusive 80186 Intel processor — see Chip-Chat page 37.

The rest of the specification is undramatic: 128K RAM expandable to 768K, two half-height 720K 5.25in. floppies, keyboard and screen, for a cost of about £2,000. A 10Mbyte hard disc version is available for £3,678.

No recesses

The review system had high-resolution colour graphics, for which an extra board is required. The 14in. colour screen is very large and bulky and lacks any helpful recesses to grapple with, which makes it even more unmanageable. The main processor unit is also surprisingly large, and its general appearance is not helped by Tandy's ugly duckling styling. Apart from the disc drives, the power and reset buttons are positioned sensibly at the front instead of being placed awkwardly at the rear. Unfortunately the design of the keyboard socket verges on the wilfully perverse: a DIN-type plug connects inside a deep recess that is inaccessible with the unit in normal use.

At the rear, from left to right, are sockets for a monochrome TV, parallel interface and RS-232 port. To the left of the cooling fan and kettle-plug power socket are four removable slots used for additional boards. Inside is the corresponding card cage and the discs and power supply take up most of the remaining space. The motherboard is slotted underneath, and is accessed by removing four screws, although Tandy discourages users from tampering directly with the innards. Similarly two screws release the main cover.

On the review machine evidence of last-minute patching was apparent since a couple of EPROMs and a few straggling wires were visible on the main circuit board. The overall design of the internal circuitry is robust and the review system worked first time when reassembled.

The keyboard shares the same unlovely rounded styling as the processor unit, and uses novel roll-up legs for tilting. Apart

(continued on next page)



The main processor unit and colour monitor are large and bulky, and awkward to handle.

Benchmarks

The table shows the time in seconds to run eight standard Microsoft Basic routines. As the table shows, the Model 2000 is one of the fastest machines we have reviewed.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Tandy Model 2000 — 80186	0.5	2.0	4.3	4.7	5.2	9.5	13.8	13.7	6.7
HP Model 16 — 68000	0.2	0.6	1.4	1.6	1.7	2.8	4.3	15.0	3.5
OEM Orion — 8086	0.6	2.1	4.8	4.9	5.8	10.5	16.7	13.0	7.3
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8

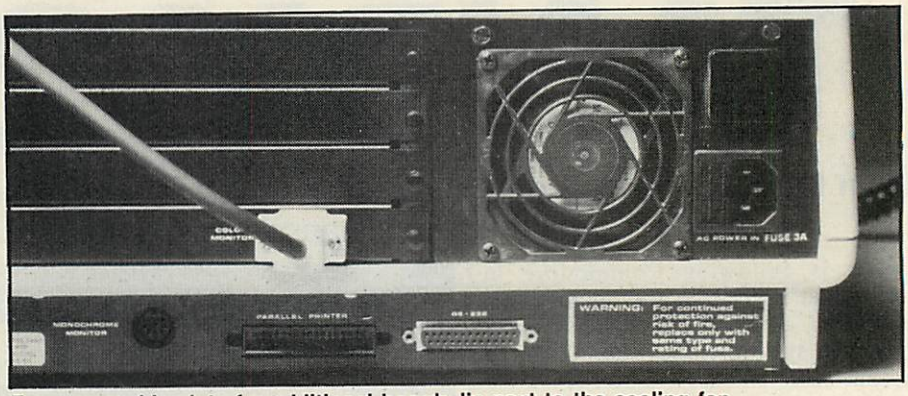
TANDY

(continued from previous page)

from standard Qwerty, there are 12 function keys, and a numeric pad which provides additional characters \ and ~ in default mode. With the number lock On, the numeric pad functions normally. The keys themselves are light and slightly shallow but should present no problems for word-processing applications.

The main point of interest with the Model 2000 is clearly its processor, which is one of the new generation of chips on the 8086 but with an extended instruction set and running at higher speeds — in this case 8MHz. The speed certainly shows up in performance: the Benchmarks are the second fastest of any machine we have tested, beaten only by those of the 68000-based HP 16. Unfortunately this power is rather marred in Basic by a curious hobbling vertical scroll which soon becomes tiring on the eyes. Microsoft Basic and MS-DOS come bundled as standard.

Additional cards slot in at the rear of the machine and mate internally via edge-connectors. Current options available are high-resolution monochrome or colour graphics; memory up to 786K, the first 128K of which is plugged directly on to the motherboard, and a mouse peripheral.



Four removable slots for additional boards lie next to the cooling fan.

Specification

CPU: Intel 80186, running at 8MHz
Memory: 128K RAM expandable to 768K; 128K, bootstrap only
Display: 12in. monochrome or 14in. colour; 25 lines by 80 characters; 640 by 400 pixels; eight colours from a palette of 16
Keyboard: 12 function keys; numeric keypad
Interfaces: RS-232, parallel port
Discs: one or two half-height 720K 5.25in. floppies
Software in price: MS-DOS and Basic
U.K. prices: twin floppy-disc £1,999 ex. VAT, hard disc £3,678 ex. VAT.
U.K. distribution: Tandy Corporation, Tameway Tower, Bridge Street, Walsall, West Midlands, WS1 1LA. Tel: (0922) 648181. Available now.

Conclusions

● The 80186 is a neat chip but it is also in very short supply and there is a backlog of orders for the Model 2000 in the U.S. So apart from the initial launch batch in the U.K., machines will be very hard to come by.

● The Tandy will never win any beauty contests, despite its new styling. But if it is speed rather than looks that you are after, the 2000 offers good value for money.

● The standard system specification provides a usable business machine, though the footprint verges on the excessive. In particular, the colour monitor is far too large so unless colour facilities are vital, the monochrome option is probably a better choice.

SWAP MICRO TO MICRO FILE TRANSFER SYSTEM

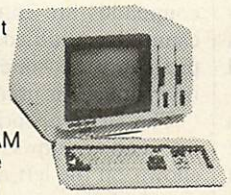
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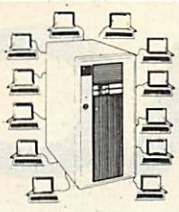
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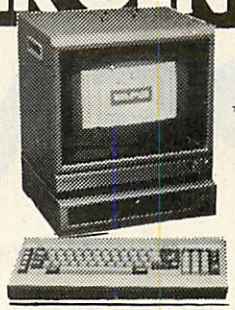
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OPEN ACCESS

The final part of Paul Myerscough's look at this integrated package for the PC.

WITH ITS windowed displays, well-considered general design, context-sensitive Help facility, and well-produced documentation, Open Access presents a very good image. However, the word processor and time-management software examined in *Practical Computing*, July, are not reason enough for buying the package. This month the remaining and more significant functions, namely information management, spreadsheet and graphics, and communications are examined.

Information management sets out to provide all that is needed to create a custom-built file-based system, including input and enquiry screens, selection and sort procedures, and reporting routines. Software Products International claims superiority over some of the competition by enabling files to be related by common data fields and by its structured query language — supposedly a derivation of that available to IBM mainframe users.

Although the main menu has 21 options, Open Access maintains its simple-to-operate image since they are implemented in a similar fashion. The easy-to-use feel is achieved by the use of windows and by the four commands which make up the query language. The user guide provides an adequate 18-chapter tutorial covering most features, but the reference manual is not well structured for obtaining functional or technical information.

A file may have up to 32,000 records each with 55 fields, of which 15 may be key fields, giving a maximum 1,024 bytes. The maximum undocumented field size seems to be 59 characters for text and up to 18 significant digits for decimal numbers.

A new file is created together with its screen mask. Heading text is typed free-format within the window, while a data field is indicated at the cursor position by hitting a function key. Another key opens a window showing default characteristics for the field, which may be designated text, number, decimal or date.

Among the 10 field attributes there are some concessions to the need for validated input. For example, Evaluated allows a single range check against input and Must Match requires the entry to match a key field in another file, while Must Fill makes an entry mandatory. The process is simple, but to spread a display over more than one screen seems impossible, despite the manual's assertion that up to eight screen pages are allowed.

Data is added to a file through the Entry option. If a non-existent mask name is given then the design process is invoked, thus enabling an alternative updating screen to be created. The chosen mask is displayed in its window, allowing full-screen data entry. For Must Match fields a window may be opened showing valid entries from the matching file.

An impressive range of viewing options is enhanced by the four query commands: From, Select, Where and Order. From indicates up to five files that are to be accessed simultaneously; Select gives the fields to be displayed; Where allows the entry of conditional information for relating files together and selecting records based on key fields; Order gives the required retrieval sequence. During entry of the commands Search will provide a list of files or fields which can be copied into the query command window by a single keystroke.

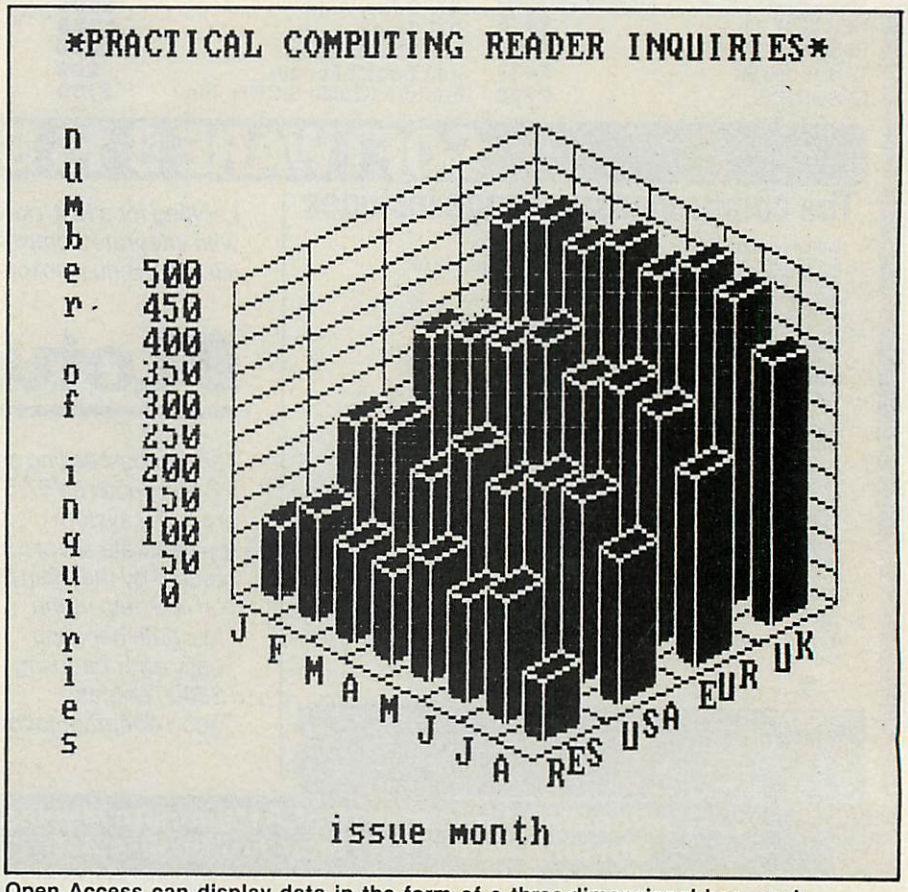
Query window

While other packages often present Selection and Sort as separate procedures to be saved to disc and executed when required, Open Access provides a query window after any file-access function is chosen. So to save a procedure you must use the Learn option. However, this is not satisfactory, since once the query commands are entered and invoked they cannot be modified. Neither can a Learned procedure be edited, although it can be interrupted for user input.

The Browse option divides the display into two windows. A list of key values is shown on the left and may be scrolled, or searched for a specific value or part value. The key with the cursor against it has its record's data field values displayed in the right-hand window. Alternative keys can be accessed by a keyboard entry, and the data record displayed may be changed, deleted or used as a template for adding a new record.

The Display option uses a screen mask to show one record at a time, page commnds being used to scroll through the file. List presents a set of records rather like a spreadsheet table with one record per line and horizontal scrolling where the record is longer than the screen width. Individual records may be changed or deleted from both functions. Using query commands, fields from more than one file can be joined and appear on the screen as one record.

The Update command provides a means to update records in batch mode without



Open Access can display data in the form of a three-dimensional bar graph.

screen intervention. This operates on just one field per invocation, but does allow the use of a simple conditional expression. As well as adjustments to numeric and text fields, such as replacement by a constant or calculated value, Open Access also allows date arithmetic.

Data may be printed as a screen-mask dump from the List, Browse and Display options, or as a formatted report, or using the Mailer option, which will merge file data into a word-processor generated document. The Format command provides an easy way to enter formatted report requirements. A selected output device provides page-size characteristics to which the user adds line and page-throw information.

A report is divided into a page header, a page footer, the main body — printed for each input record — and totals. Each of the sections is designed separately in full-screen mode. Thus on entering header definition, a display is created — with horizontal scrolling if the report pages are wider than the screen — showing default heading values which may include date, page number, file name and field names. The values may be moved through cursor control or removed with a single keystroke, or edited or replaced by opening a Make Entry window and changing the entry attributes.

While the process of defining a report seems particularly neat and easy, there are some distinct restrictions. The use of work fields for intermediate calculations is not particularly flexible, nor is the provision of two control breaks which must be whole key fields. Also it is possible to introduce errors in entry expressions which prevent successful printing.

Further utility functions are provided for sorting a file, again on key fields only, modifying a file or increasing its size by creating a new one, appending data from one file on to another, importing/exporting files created by or to be used in external programs, transferring data to other Open Access functions, and checking for damaged files and rebuilding indexes. Common in many other file-system packages but not available in Open Access is the ability to password protect data and to build custom menus.

Failure

From the manual the utilities for handling external files seem good, but attempts to use them ended in failure. Text produced using another word processor was impossible to import to Open Access, and a specific option for reformatting and importing dBase II records left only 14 records out of a file of 200 by the time the data reached information management. The manual suggests that problem files are edited using the word processor, but imported fields are truncated and only the first 77 characters of a record are accessible.

Open Access information management is easy to use. The facility to join up to five files is good and can be compared with other packages' use of master files and transactions. Learned procedures can be used for any repetitive tasks, including the use of the simple query language.

Despite bettering some stand-alone packages Open Access falls short as a heavyweight for system design. It lacks more than basic input validation, the use of multiple screens and extensive reporting facilities.

It is clear that SPI's prime target for Open Access is the Lotus 1-2-3 market. The spreadsheet is well developed as a piece of software and, given that most products have all the basic features required, comparison comes down to ease of use and potential restrictions.

The spreadsheet function is very simple to use. The basic size of the worksheet at 216 by 3,000 cells is beyond any normal requirement and, because data is spooled to and from disc, memory size is not a constraint.

A requirement high on the priority list for many users is a facility to import data to the spreadsheet from an outside source. Open Access uses its own interchange file format called SIF, and provides utilities to convert the more common DIF format as well as dBase II files and text files to this.

There are some problems with these utilities, which seemed to add spurious data and then report errors. They can be overcome by editing the resultant SIF file, though the Open Access word processor is next to useless for this task. However, passing data to and from other Open Access modules is easy and efficient using the Context option.

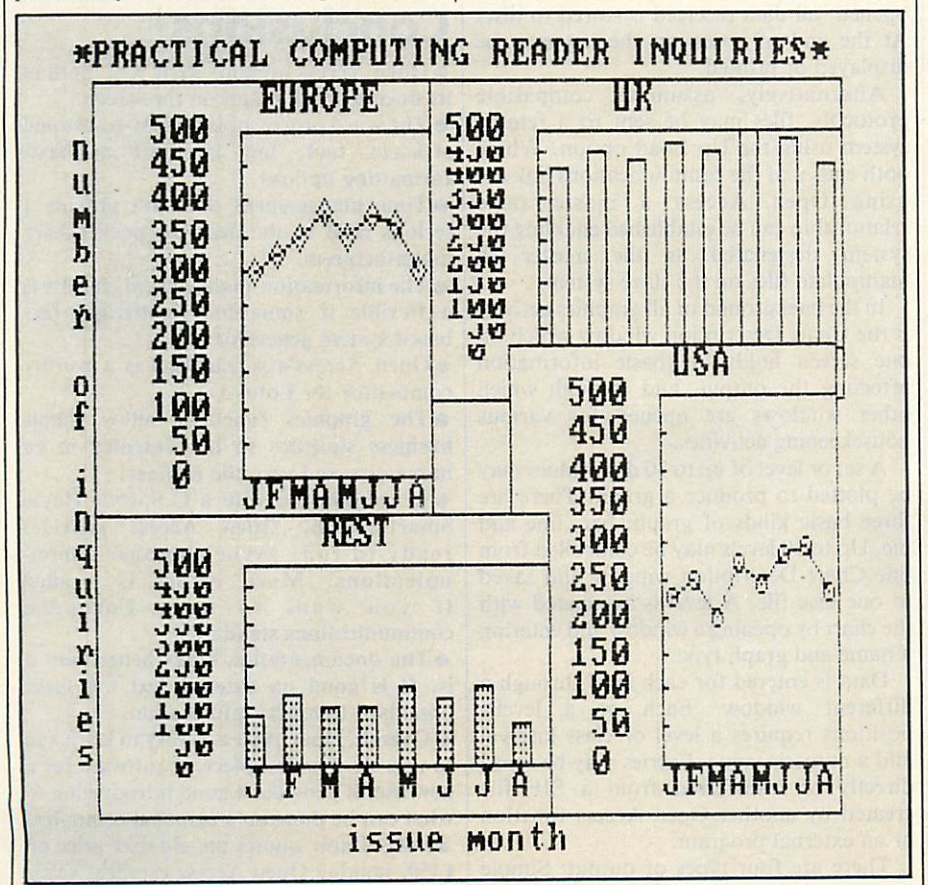
The worksheet display shows 18 rows, with system information and the data input line below. A menu can be called up in order to select from the 23 commands available or, for those familiar with the package, commands can be invoked directly. As throughout Open Access context-sensitive Help is available.

Cells in the worksheet have a whole range of attributes that may easily be set by a Format command. They cover width up to 72 characters, justification, protected or hidden values, flags requesting the cursor to jump to a cell or include it in consolidation, display/print attributes, decimal precision up to nine places or a bar-graph representation, and numeric editing characteristics. The ability to request a rounded or truncated result is the only missing option.

Getting around the worksheet is made easy by several features. The usual cursor-control keys move the pointer to an adjacent cell and the tab key allows the entry of a specific co-ordinate. The model may be set up so that after data entry the pointer stays where it is or moves to the next cell across or the next cell down. In Auto mode, through field attributes, the pointer can be made to jump from one specific cell to another.

The Locate command reaches a particular text value. By dividing a

(continued on next page)



Up to four different windows can be viewed at any one time.

(continued from previous page)
worksheet into more than one window several sections may be viewed at once and the pointer may be moved from one to another. A name assigned to an area of the worksheet may be used in place of co-ordinates for many of the commands, and the assignment of named data as indexes to other named areas enables references like

PROFIT[1984]

or

SALARY[SMITH]

Numeric entries may be any combination of constants, co-ordinates which may refer to external worksheets, mathematical operators, and built-in functions. There are 17 maths functions, nine business functions, and several others including two types of table look-up as well as If-Then-Else constructs.

A powerful copy feature enables values, formulae and attributes to be transferred from one part of the worksheet to another. When formulae are involved it may operate in relative or absolute mode and, most usefully, in prompted mode where each co-ordinate in a formula is prompted "relative or absolute?". External models may be linked, enabling copying from one model to another.

Up to six different windows can be created, of which four may be viewed at one time. They may show different parts of the same worksheet, or up to three external worksheets, and may be used for displaying either data or formulae. The first row and column of a sheet often contains heading information, and the columns can be locked so they always appear on the screen while the rest of a sheet scrolls underneath them. When two windows are connected, scrolling in one window causes automatic scrolling in the second.

What If?

After data entry, recalculation of the model may be requested and made specific to a certain area of the worksheet. The Update command will apply a user input formula to constant numeric entries across an area of the worksheet. By combining this feature with model reclaculation, What If? projections can be made. Reuse of the Update command with = instead of a formula restores the original values.

Different models, provided they have a common format, can be consolidated automatically into one. Open Access also provides for recursive consolidation where the sheets to be consolidated are consolidations themselves.

Printing worksheet areas is straightforward, most of the options being taken care of in the printer set-up process — see part 1 of this review. The printer window allows the selection of the output device, then heading text may be typed to appear at the top of the model. As much of the matrix as possible is fitted across the page; following columns appear on the next page. The formulae may also be printed with an optional cross-reference list.

The Goal-Seek function makes use of Newton's algorithm to test different values of an independent variable to give a stated target value for a related field. For example, if revenue is dependent on growth, and profit on revenue, when given a target value for profits the system can determine the required growth factor to meet this.

Speed of operation depends much on the size of model in use. Larger worksheets require constant disc access, and where there is not room on disc for a working copy any restructuring commands will take more than five minutes. However, simple recalculation is less alarming.

U.S. modem

The Open Access communications software provides management of direct connection and modem connection to other systems. As the U.S. modem protocol is not compatible with the rest of the world, there is some work involved using the configuration option for setting the system up for U.K. or European operation. The distributor, Softsel, says this works successfully. For those with a U.S.-style Hayes 1200 Smartmodem there is little to do — just set up your Phone file, select a number, and you are in business.

Once communication is established using a modem or a direct RS-232 connection, an option puts the system in dumb terminal mode and, provided a log file has been opened, all data received is stored to disc. At the end of a session the log may be displayed or printed.

Alternatively, assuming compatible protocols, files may be sent to a remote system using the Up Load option. Where both ends a of the communications link are using Open Access a master/slave relationship can be established enabling the system designated as the master to manipulate files on the slave system.

In the background of all graphics activity is the Chart Description window which on one screen holds the basic information affecting the output, and through which other windows are opened for various housekeeping activities.

A set or level of up to 30 data values may be plotted to produce a graph. There are three basic kinds of graph: bar, line and pie. Up to 30 levels may be controlled from one Chart Description window and saved to one disc file. A level is associated with the chart by opening a window and entering a name and graph type.

Data is entered for each level through a different window. Each of a level's positions requires a level or class interval and a numeric value. Entries may be typed directly or transferred from a SIF file created by another Open Access function or an external program.

There are four types of output: Simple shows a basic graph for one level of data; Overlay combines several graphs producing, for example, a line graph superimposed on a bar chart; Windowed shows up to 30, but more practically four or five graphs side by side on the screen; and 3D produces a three-dimensional bar graph.

Entries in the Chart Description window control headings, scale factors, the choice of one of three three-colour palettes for charts, and the screen background colour. By selecting the View command all aspects of each graph may be changed within the general chart setting. So the outline and fill colour of a bar may be separately assigned from the current palette and the texture may be changed from a block of colour to stripes or something less solid. The style of a line graph may be changed, the size and position of elements of a windowed display may be altered, and the orientation of a 3D bar chart may be changed. All such changes and more are made by moving a pointer to a part of the screen and selecting an option by hitting a function key.

The print/slide window controls output to the printer and will store individual screens to disc as a slide or in ASCII format. Slides can be linked together in a carousel and called up in sequence, much as a slide show. The printed output on an Epson printer looks good and comes in one of three sizes.

Given the constraints described, the graphics software is easy to operate and presents unsophisticated graphics in an impressive and versatile manner.

Conclusions

- **Open Access presents itself well, both in its documentation and on the screen.**
- **The word processor is an easy-to-use and efficient tool, but is short on text-formatting options.**
- **Time management does not provide a serious rival to the desk- or pocket-diary manufacturers.**
- **The information-management, facility is a flexible if somewhat lightweight file-based system generator.**
- **Open Access's spreadsheet is a worthy competitor for Lotus 1-2-3.**
- **The graphics functions allow simple business statistics to be presented in an impressive and versatile manner.**
- **In conjunction with a U.S.-style Hayes Smartmodem, Open Access provides ready-to-run asynchronous communications. More effort is needed if you want to meet European communications standards.**
- **The documentation looks better than it is. It is good on tutorial text but lacks organised technical information.**
- **Overall, Open Access is easy to learn and to use. As the first piece of software for a new user it provides a good introduction to what can be done on a personal computer.**
- **Softsel now quotes an end-user price of £450, making Open Access excellent value for money.**

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OS-9

(continued from previous page)
or selectively erase families of files, processes easily carried out under MS-DOS and CP/M using the AFN convention.

The OS-9 manual has more than its fair share of inconsistencies and gives the impression that nobody at Dragon has had the time to go through it thoroughly to reconcile it to the hardware. For example, when you try to change the speed of the serial port with the line

```
XMode /P1 BAUD = 2
```

as documented, the baud rate remains resolutely at 1,200. Altering the baud rate at Dragondos level with a primitive Poke instruction worked fine, so the OS-9 implementation must be at fault.

There are other places where the Dragon's behaviour departs as drastically from the lines laid down by the manual. None of them that I encountered seriously devalue the system, but all require the user to put in unpaid time to complete the manufacturer's research and development program.

The Dragon's normal display is fairly crude. All characters are in upper case, and the best it can do to represent capitals is to put them in inverse video. The OS-9 disc brings relief in the shape of a routine called GO51 that provides a graphics-drawn upper-and lower-case 51-column by 24-line device driver for the TV display. The definition is a compromise, and I found it very hard to work with for any length of time.

Advantage

One immediate advantage of PIC is that because the separate modules are known to each other by way of the memory manager in the kernel, they can call each other with no need for explicit linking. This technique forms an important part of Basic-09, Motorola's own highly structured Basic.

Basic-09's closest familiar equivalent is BBC Basic, but whereas the procedure mechanism is simply an added feature to that dialect, it is absolutely fundamental to Basic-09. Under Basic-09, procedures are developed and debugged as completely separate modules and are knitted together into one large program only as the final step.

In BBC Basic, all variables are global unless declared Local; in Basic-09 all variables are strictly local to the procedure they appear in, and there are no globals at all. When you want to pass values between modules you have to declare explicit Parameters to do so.

Basic-09 consists of three main modules: Basic itself, the Edit module and the Debug module. The Debug mode switches in automatically on meeting a Pause instruction in the program, and again if a run-time error is encountered. It is often useful to enter the debugger directly, and the manual suggests you do so by entering Control-C from the keyboard. It is then that you remember that ther is no Control key, and stab fruitlessly about trying to find some alternative key combination.

It turns out that the Clear key doubles as a Control key while Basic-09 is up, but for some reason the Clear-C combination still does nothing, and the only way of getting into the debugger seems to be to enter the editior and create a module called Debug that consists of a single Pause statement. Then Run Debug will do the trick.

Pseudo-compiler

Basic-09 is more like Pascal than Basic, but manages to offer the best of both worlds by being a pseudo-compiler. Programs can be constructed with the help of the built-in editor and then run immediately. As you exit from the editor the pseudo-compiler is automatically run, breaking down the textual source statements you have constructed into what is known as i-code — "i" for "intermediate".

The editor is very smart in some ways. If you enter all the lines in lower case it sifts through and turns Basic-09 keywords into upper case, at the same time indenting the line to show program structure. But as a text editor it has no facilities for block moves or reiterated searches, and so is not easy to use for large programs.

Other languages supplied with the Dragon were C and Pascal, which both appear to be full implementations. As with Unix, OS-9 C is offered as a sort of extension to the operating system, and comes with a library of operating-system calls. The Pascal can create p-code or native 6809 code, and has a number of esoteric extensions. A debugger is included, along with a profiler which spots the modules that get the most wear. Unfortunately the language lacks the UCSD string-handling refinements that have now been adopted as more or less standard extensions in most other Pascal implementations.

The 6809 is an exciting prospect for the assembler programmer. The programmer's manual, complete with full details of the system hooks, makes it easy for even the raw beginner to write useful short programs in assembly language.

Microware's OS-9 editor, assembler and debugger are provided together on a disc that is cheap enough at £50, but there are some disappointing shortcomings. The Edit works like a superset of the Edit built into Basic-09, but for all its extended features like macros and double buffer handling it is still an old-fashioned line editor which takes far too long to get to know.

The assembler is not very glamorous either. It cannot handle code macros and

Multi-user OS-9

Because of the way programs coexist in memory there is no theoretical restriction on the number of users acessing them. Microware provides a module, which can be Loaded like any other program, that allows the RS-232 port to serve as an additional terminal. We happily hooked a Cifer VDU to the Dragon this way, with intriguing results: true multi-user processing, with a colleague working at the Dragon keyboard and TV screen while I programmed on the Cifer.

The crunch comes when the Dragon has to access the disc drives on behalf of either user, at which point all the processing coagulates until the drives stop. In practice, then, this aspect of the Dragon will not be of much interest to business users, but with a little goodwill it is perfectly possible to use the Dragon as a shared resource between a pair of programmers developing small modules in, say, Basic-09.

A factor that helps here is that code in OS-9 is re-entrant as well as position-independent. If two users both need to use the same program, ordinarily they would each need a separate copy. But re-entrant design allows them to share the identical module in memory. When the time-slicing mechanism steps in to switch out the current user, the contents of the 6809 registers are saved on the stack. One of these, the direct page register, is an eight-bit register that contains the address of a 256-byte page of memory in which the data for that user is stored. When the second user is switched in and his or her register values are restored from the stack, the direct page register will now contain the pointer to a different page of memory where the second user's data is being stored.

Machine-code-minded readers will be worrying that this shared stack might be a source of conflict. In fact, the 6809 has two stack pointers, one designed to be reserved for the system and a second for the user. At every time-slice the user stack pointer is replaced by that user's last stack address, as restored from the system stack. So as well as having separate pages of memory to store data, each use also has a distinct stack. By using different data this way each time the code is called, users can happily share the same program module — Basic-09, for instance — without conflict.

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A requirement high on the priority list for many users is a facility to import data to the spreadsheet from an outside source. Open Access uses its own interchange file format called SIF, and provides utilities to convert the more common DIF format as well as dBase II files and text files to this.

There are some problems with these utilities, which seemed to add spurious data and then report errors. They can be overcome by editing the resultant SIF file, though the Open Access word processor is next to useless for this task. However, passing data to and from other Open Access modules is easy and efficient using the Context option.

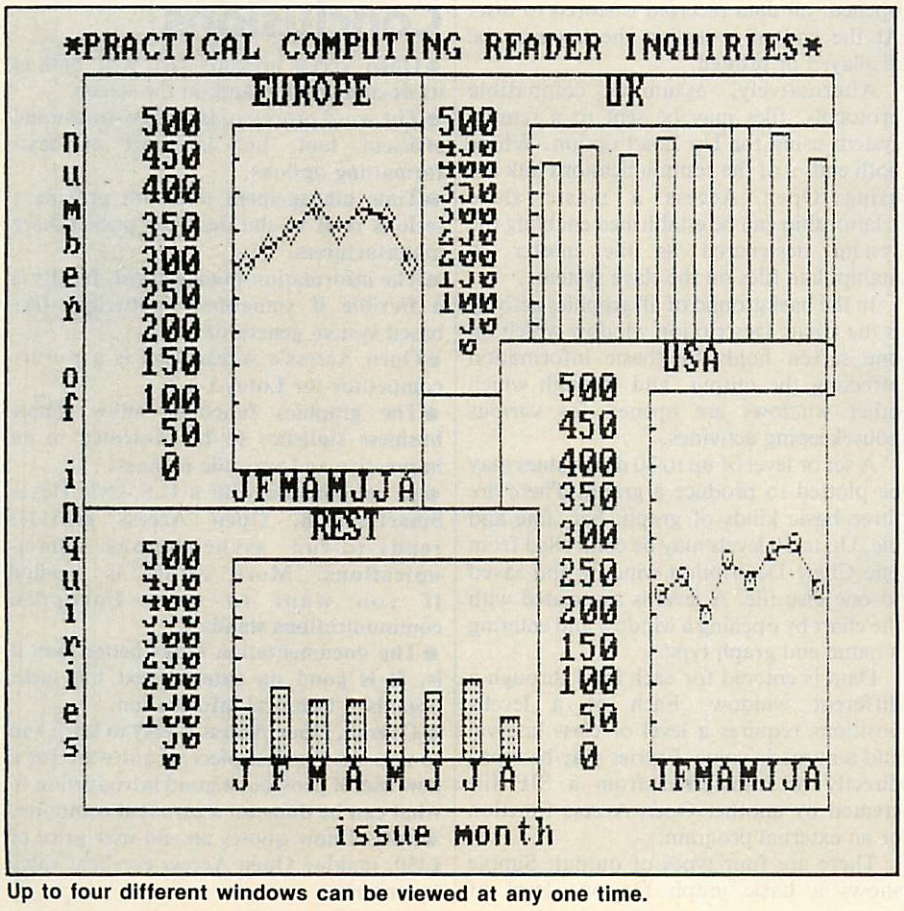
The worksheet display shows 18 rows, with system information and the data input line below. A menu can be called up in order to select from the 23 commands available or, for those familiar with the package, commands can be invoked directly. As throughout Open Access context-sensitive Help is available.

Cells in the worksheet have a whole range of attributes that may easily be set by a Format command. They cover width up to 72 characters, justification, protected or hidden values, flags requesting the cursor to jump to a cell or include it in consolidation, display/print attributes, decimal precision up to nine places or a bar-graph representation, and numeric editing characteristics. The ability to request a rounded or truncated result is the only missing option.

Getting around the worksheet is made easy by several features. The usual cursor-control keys move the pointer to an adjacent cell and the tab key allows the entry of a specific co-ordinate. The model may be set up so that after data entry the pointer stays where it is or moves to the next cell across or the next cell down. In Auto mode, through field attributes, the pointer can be made to jump from one specific cell to another.

The Locate command reaches a particular text value. By dividing a

(continued on next page)



Up to four different windows can be viewed at any one time.

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worksheet into more than one window several sections may be viewed at once and the pointer may be moved from one to another. A name assigned to an area of the worksheet may be used in place of co-ordinates for many of the commands, and the assignment of named data as indexes to other named areas enables references like

PROFIT[1984]

or

SALARY[SMITH]

Numeric entries may be any combination of constants, co-ordinates which may refer to external worksheets, mathematical operators, and built-in functions. There are 17 maths functions, nine business functions, and several others including two types of table look-up as well as If-Then-Else constructs.

A powerful copy feature enables values, formulae and attributes to be transferred from one part of the worksheet to another. When formulae are involved it may operate in relative or absolute mode and, most usefully, in prompted mode where each co-ordinate in a formula is prompted "relative or absolute?". External models may be linked, enabling copying from one model to another.

Up to six different windows can be created, of which four may be viewed at one time. They may show different parts of the same worksheet, or up to three external worksheets, and may be used for displaying either data or formulae. The first row and column of a sheet often contains heading information, and the columns can be locked so they always appear on the screen while the rest of a sheet scrolls underneath them. When two windows are connected, scrolling in one window causes automatic scrolling in the second.

What If?

After data entry, recalculation of the model may be requested and made specific to a certain area of the worksheet. The Update command will apply a user input formula to constant numeric entries across an area of the worksheet. By combining this feature with model reclaculation, What If? projections can be made. Reuse of the Update command with = instead of a formula restores the original values.

Different models, provided they have a common format, can be consolidated automatically into one. Open Access also provides for recursive consolidation where the sheets to be consolidated are consolidations themselves.

Printing worksheet areas is straightforward, most of the options being taken care of in the printer set-up process — see part 1 of this review. The printer window allows the selection of the output device, then heading text may be typed to appear at the top of the model. As much of the matrix as possible is fitted across the page; following columns appear on the next page. The formulae may also be printed with an optional cross-reference list.

The Goal-Seek function makes use of Newton's algorithm to test different values of an independent variable to give a stated target value for a related field. For example, if revenue is dependent on growth, and profit on revenue, when given a target value for profits the system can determine the required growth factor to meet this.

Speed of operation depends much on the size of model in use. Larger worksheets require constant disc access, and where there is not room on disc for a working copy any restructuring commands will take more than five minutes. However, simple recalculation is less alarming.

U.S. modem

The Open Access communications software provides management of direct connection and modem connection to other systems. As the U.S. modem protocol is not compatible with the rest of the world, there is some work involved using the configuration option for setting the system up for U.K. or European operation. The distributor, Softsel, says this works successfully. For those with a U.S.-style Hayes 1200 Smartmodem there is little to do — just set up your Phone file, select a number, and you are in business.

Once communication is established using a modem or a direct RS-232 connection, an option puts the system in dumb terminal mode and, provided a log file has been opened, all data received is stored to disc. At the end of a session the log may be displayed or printed.

Alternatively, assuming compatible protocols, files may be sent to a remote system using the Up Load option. Where both ends a of the communications link are using Open Access a master/slave relationship can be established enabling the system designated as the master to manipulate files on the slave system.

In the background of all graphics activity is the Chart Description window which on one screen holds the basic information affecting the output, and through which other windows are opened for various housekeeping activities.

A set or level of up to 30 data values may be plotted to produce a graph. There are three basic kinds of graph: bar, line and pie. Up to 30 levels may be controlled from one Chart Description window and saved to one disc file. A level is associated with the chart by opening a window and entering a name and graph type.

Data is entered for each level through a different window. Each of a level's positions requires a level or class interval and a numeric value. Entries may be typed directly or transferred from a SIF file created by another Open Access function or an external program.

There are four types of output: Simple shows a basic graph for one level of data; Overlay combines several graphs producing, for example, a line graph superimposed on a bar chart; Windowed shows up to 30, but more practically four or five graphs side by side on the screen; and 3D produces a three-dimensional bar graph.

Entries in the Chart Description window control headings, scale factors, the choice of one of three three-colour palettes for charts, and the screen background colour. By selecting the View command all aspects of each graph may be changed within the general chart setting. So the outline and fill colour of a bar may be separately assigned from the current palette and the texture may be changed from a block of colour to stripes or something less solid. The style of a line graph may be changed, the size and position of elements of a windowed display may be altered, and the orientation of a 3D bar chart may be changed. All such changes and more are made by moving a pointer to a part of the screen and selecting an option by hitting a function key.

The print/slide window controls output to the printer and will store individual screens to disc as a slide or in ASCII format. Slides can be linked together in a carousel and called up in sequence, much as a slide show. The printed output on an Epson printer looks good and comes in one of three sizes.

Given the constraints described, the graphics software is easy to operate and presents unsophisticated graphics in an impressive and versatile manner.

Conclusions

- **Open Access presents itself well, both in its documentation and on the screen.**
- **The word processor is an easy-to-use and efficient tool, but is short on text-formatting options.**
- **Time management does not provide a serious rival to the desk- or pocket-diary manufacturers.**
- **The information-management, facility is a flexible if somewhat lightweight file-based system generator.**
- **Open Access's spreadsheet is a worthy competitor for Lotus 1-2-3.**
- **The graphics functions allow simple business statistics to be presented in an impressive and versatile manner.**
- **In conjunction with a U.S.-style Hayes Smartmodem, Open Access provides ready-to-run asynchronous communications. More effort is needed if you want to meet European communications standards.**
- **The documentation looks better than it is. It is good on tutorial text but lacks organised technical information.**
- **Overall, Open Access is easy to learn and to use. As the first piece of software for a new user it provides a good introduction to what can be done on a personal computer.**
- **Softsel now quotes an end-user price of £450, making Open Access excellent value for money.**

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OS-9

Motorola's 6809 is the Cinderella among eight-bit CPUs; Chris Bidmead investigates a late candidate for the role of Prince Charming.

OS-9 DRAWS much of its inspiration from Unix, and if you know something about that operating system you should be able to pick up the rudiments of OS-9 fairly easily. MS-DOS users, too, will feel at home with many of the features.

Like MS-DOS and Unix, OS-9 maintains treed directories and treats its devices like files as far possible. OS-9 steers its way through the branches of the directory tree by keeping track of a pair of current directories: the Executable Directory, which holds a fistful of runnable files, and the Data Directory, which is searched by a currently executed program each time it tries to open an input file.

This is an improvement on MS-DOS, which only keeps track of a single, all-purpose current file using the Chdir command, although it does allow attachment of a second all-purpose file by means of the Path command. The more specialist commands used by OS-9 corresponding to Chdir and Path are Chx or Change Executable Directory, and Chd or Change Data Directory.

Unlike CP/M-80 or MS-DOS, OS-9 can hold more than a single program in memory at any one time: it is a multi-tasking operating system. The programs share the processor by a method known as timeslicing. The activities of the processor are interrupted 60 times a second, and each of these 1/60th of a second slices can be allocated independently among the processes. At each 60Hz tick of the clock the current process can be suspended and the attention of the CPU turned to the next process in the queue. It all happens so quickly that to the user the separate programs seem to be running simultaneously.

Something of this kind was attempted by Digital Research when it developed the MP/M operating system for the 8080 CPU. Although many MP/M systems are still in use today, the 8080 is not up to it. The software kludges which were required mean that the machine has to spend far too much of its processing time deciding whose turn it is next. The 6809, on the other hand, was born to the work, with a special instruction set that makes it simple to write everything in what is called position-independent code, PIC.

In a conventional single-tasking operating system, programs always have to start at the same fixed address: 100 hex for CP/M. If you want to run a second program you have to lay it down in memory over the locations occupied by the previous program, so unless you make special arrangements two separate programs cannot coexist. The PIC programs used in OS-9 can be installed in any available memory space. The operating system's memory manager keeps track on them in much the same way as a disc directory takes care of saved files.

The operating system keeps a bit map at addresses 100 to 11F. Instead of being considered as 32 separate bytes, this patch of RAM is treated as an array of single-bit flags, each marking the condition of a 256-byte page of memory, so 32 bits can

The 6809 CPU

The 6809 chip is described in Dragon's glossy brochures as "pseudo-16-bit". That's a double misnomer; it is not a 16-bit chip, and there is nothing pseudo about it.

The 6809 uses an external eight-bit data bus and more or less symmetrical 16-bit registers manipulated by a small but powerful instruction set. Its 59 machine-code instructions can go a very long way when complemented by 10 addressing modes and 24 sub-modes based on indexing.

Motorola has since carried the same philosophy of elegantly simple symmetry over to the 68000 family, but the earlier eight-bit chip has not enjoyed anything like the same success. This is not because of any technical shortcomings — many independent commentators regard the 6809 as the apotheosis of eight-bittery — but as a result of its unfortunately timed entry into a market where the 6502 and the Z-80 had already taken tenacious hold, and when "eight-bit" has become in the public mind — quite wrongly — a synonym for "Stone Age".

The Dragon 64 business system

OS-9 software can be run on a number of expensive micros and two very cheap ones — the Dragon and the Tandy Color Computer.

The resemblance between these two is not accidental. Motorola supplies two support chips with the 6809: the synchronous address multiplier to manage the memory, and the video display generator taking care of the screen. Between them these three chips virtually define the hardware, enabling Microsoft to supply the same version of Basic for both machines.

The Dragon 64 differs from the primarily games-playing Dragon 32 — reviewed in *PC* October 1982 — in having twice as much memory, as well as auto-repeat keys and an RS-232 serial interface mapped on to a seven-pin DIN socket. Both machines have a full-sized, professional-style keyboard that curiously lacks Control and Escape keys. Efforts are made to replicate these functions in software by combinations of the Clear and Break keys, but not always consistently.

As in the 32, the Dragon 64 gives up 16K of its memory space to the built-in Basic interpreter. But rather than using the ROM Basic directly, on powering-up the 64 copies it into the top 16K of RAM and then switches out the ROM. For most ordinary purposes the machine works exactly as though it were running the ROM Basic directly, but the Basic can be dismissed at any time to leave the full 64K available to the processor. The advantage of this very clean architecture is that the personality of the machine can be completely transformed by loading a different operating system, leaving the quirks of the old games machine behind.

The first stage of the 64's transformation into a business system comes when you plug the disc adaptor into the cartridge slot and hang a floppy-disc drive on the other end of it. When you power-up, the ROM detects the presence of the disc adaptor cartridge if the disc drive is already powered, and loads directly into Dragondos.

You are now talking to the hardware through an enhanced Basic interpreter that is a version of Microsoft GWBasic with Paint, Line, Color and so forth. It has most of the standard statements: Renum, for example, is present in the 64's ROM; and Auto, together with some other commands, is added when the disc cartridge is plugged in.

cover the whole 64K of addressable memory. If the flag is off, the page it represents is free for assignment; if it is on then that page has already been allocated, is a page of ROM or is unavailable for some other reason.

There are two ways of using programs under OS-9. If you invoke one from the command line simply by typing its name, the effect is transient and the memory manager throw its address away after it has been run. Programs called like this behave very like their equivalents on a single-tasking operating system.

Programs held

Programs can be retained in RAM for later use by calling them as a parameter of the Load command. The command

LOAD DIR

for example, pulls the Dir module into memory, leaves it there and passes its address to the memory manager. You may then continue with further Load commands to place other modules in memory up to the capacity of the RAM. All these commands are now active, and any of them can be run and rerun when their name is called, until they are deliberately disposed of by a process called "unlinking".

This is impressive on a small machine, but the Dragon implementation has its limits. A fully fledged multi-tasking system would manage disc and core memory, swapping files between the two as they are needed. A less comprehensive system would at least manage core memory dynamically and shift the resident modules to keep them together, leaving the maximum of contiguous free memory. OS-9 level 1 as supplied by Dragon does neither of these things, so free memory tends to fragment as modules are loaded and subsequently unlinked. Even though the total amount of memory available might be enough to load a requested program, the memory manager will refuse the request if it does not occupy a continuous address space. In this respect, OS-9 is not always able to make the best use of its limited 64K playground.

It is remarkable how little you appreciate simple facilities until you are deprived of them. Up to now I have taken the AFN, ambiguous file name, conventions of CP/M and MS-DOS for granted. The AFN principle enables you to write something like

COPY *.BAS

to copy all the Basic files such as Test.Bas, Demo.Bas and so forth. Similarly

DEMO?.BAS

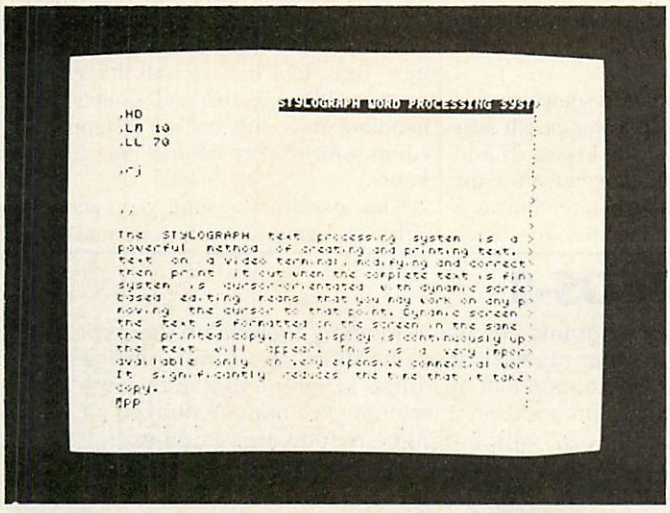
can be used to copy all the files with names like Demo1.Bas, and

COPY *.*

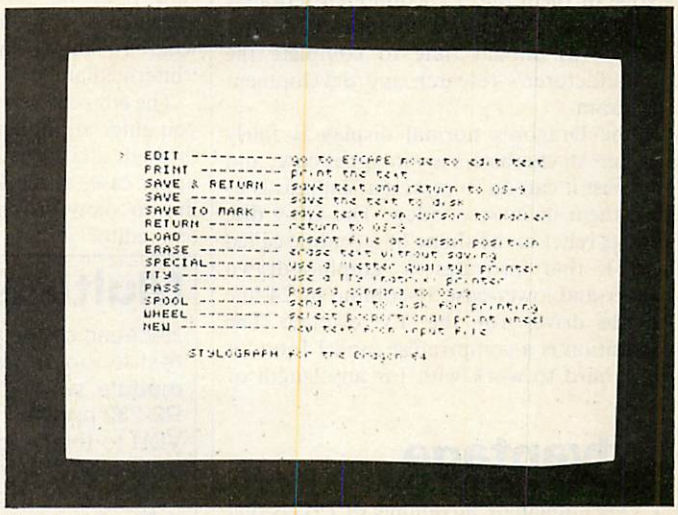
copies all files.

There is a utility called DCopy that creates a batch file by reading a directory and constructing Copy instructions for each of the files it finds there. Apart from this, the lack of an ambiguous-naming convention means that OS-9 insists on all file names being spelt out. It is also impossible to look at subsets of dictionaries

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The GO51 routine brings lower-case text to the Dragon.



The Stylograph word-processing menu.

Graphics is very fully catered for. Pictures are drawn on eight logical screens that are separate from each other and from the text screen. Multiple paging makes it very easy to experiment with animation by drawing slightly different pictures on each page and flipping from one to the other. Setting up programs like this is simplified by the command PCopy, which enables you to copy the contents of one page to another. Sprite-like animation is also possible using Put and Get, which save and restore graphics to and from an array.

Sound is relatively elementary. There is only a single sound generator, driven by the commands Sound and Play. It accepts a string that defines the melody according to a few simple rules. Like the Atari, the Dragon can also relay music direct from the cassette to the TV audio output, controlling the tape with the Motor On/Off command.

Dragondos runs on the 32 or 64 versions of the machine. It is a simple disc handler, and falls a long way short of being what CP/M or MS-DOS users would understand as an operating system as it remains firmly based in Basic. But at least it recognises that discs are fundamentally different from cassettes, and does not have to wind through the sectors sequentially searching for data.

The Basic commands FRead and FWrite appear when you plug the disc interface into the cartridge socket. They handle disc data in a way that is particularly easy to use. The cartridge also adds other commands to Basic like On Error Goto, Wait and Swap, bringing it up to the 5.2 standard familiar on business machines since the beginning of the decade. Variable names can be any length, but unfortunately only the first two characters are recognised.

Shortly after this review was written we heard that Dragon Data had called in the receiver, and Dragon machines will not have much of a future unless someone steps in swiftly to pick up the pieces. Though the initial success of the 32 was due to its lucky arrival at a time when other suppliers had underestimated the demand for home computers, the Dragon Small Business System reviewed here is in many respects the best eight-bit system ever to have passed through this office. If the Dragon 64 is going out, it is certainly going with a bang.

OS-9

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or selectively erase families of files, processes easily carried out under MS-DOS and CP/M using the AFN convention.

The OS-9 manual has more than its fair share of inconsistencies and gives the impression that nobody at Dragon has had the time to go through it thoroughly to reconcile it to the hardware. For example, when you try to change the speed of the serial port with the line

```
XMode /P1 BAUD = 2
```

as documented, the baud rate remains resolutely at 1,200. Altering the baud rate at Dragondos level with a primitive Poke instruction worked fine, so the OS-9 implementation must be at fault.

There are other places where the Dragon's behaviour departs as drastically from the lines laid down by the manual. None of them that I encountered seriously devalue the system, but all require the user to put in unpaid time to complete the manufacturer's research and development program.

The Dragon's normal display is fairly crude. All characters are in upper case, and the best it can do to represent capitals is to put them in inverse video. The OS-9 disc brings relief in the shape of a routine called GO51 that provides a graphics-drawn upper-and lower-case 51-column by 24-line device driver for the TV display. The definition is a compromise, and I found it very hard to work with for any length of time.

Advantage

One immediate advantage of PIC is that because the separate modules are known to each other by way of the memory manager in the kernel, they can call each other with no need for explicit linking. This technique forms an important part of Basic-09, Motorola's own highly structured Basic.

Basic-09's closest familiar equivalent is BBC Basic, but whereas the procedure mechanism is simply an added feature to that dialect, it is absolutely fundamental to Basic-09. Under Basic-09, procedures are developed and debugged as completely separate modules and are knitted together into one large program only as the final step.

In BBC Basic, all variables are global unless declared Local; in Basic-09 all variables are strictly local to the procedure they appear in, and there are no globals at all. When you want to pass values between modules you have to declare explicit Parameters to do so.

Basic-09 consists of three main modules: Basic itself, the Edit module and the Debug module. The Debug mode switches in automatically on meeting a Pause instruction in the program, and again if a run-time error is encountered. It is often useful to enter the debugger directly, and the manual suggests you do so by entering Control-C from the keyboard. It is then that you remember that ther is no Control key, and stab fruitlessly about trying to find some alternative key combination.

It turns out that the Clear key doubles as a Control key while Basic-09 is up, but for some reason the Clear-C combination still does nothing, and the only way of getting into the debugger seems to be to enter the editior and create a module called Debug that consists of a single Pause statement. Then Run Debug will do the trick.

Pseudo-compiler

Basic-09 is more like Pascal than Basic, but manages to offer the best of both worlds by being a pseudo-compiler. Programs can be constructed with the help of the built-in editor and then run immediately. As you exit from the editor the pseudo-compiler is automatically run, breaking down the textual source statements you have constructed into what is known as i-code — "i" for "intermediate".

The editor is very smart in some ways. If you enter all the lines in lower case it sifts through and turns Basic-09 keywords into upper case, at the same time indenting the line to show program structure. But as a text editor it has no facilities for block moves or reiterated searches, and so is not easy to use for large programs.

Other languages supplied with the Dragon were C and Pascal, which both appear to be full implementations. As with Unix, OS-9 C is offered as a sort of extension to the operating system, and comes with a library of operating-system calls. The Pascal can create p-code or native 6809 code, and has a number of esoteric extensions. A debugger is included, along with a profiler which spots the modules that get the most wear. Unfortunately the language lacks the UCSD string-handling refinements that have now been adopted as more or less standard extensions in most other Pascal implementations.

The 6809 is an exciting prospect for the assembler programmer. The programmer's manual, complete with full details of the system hooks, makes it easy for even the raw beginner to write useful short programs in assembly language.

Microware's OS-9 editor, assembler and debugger are provided together on a disc that is cheap enough at £50, but there are some disappointing shortcomings. The Edit works like a superset of the Edit built into Basic-09, but for all its extended features like macros and double buffer handling it is still an old-fashioned line editor which takes far too long to get to know.

The assembler is not very glamorous either. It cannot handle code macros and

Multi-user OS-9

Because of the way programs coexist in memory there is no theoretical restriction on the number of users acessing them. Microware provides a module, which can be Loaded like any other program, that allows the RS-232 port to serve as an additional terminal. We happily hooked a Cifer VDU to the Dragon this way, with intriguing results: true multi-user processing, with a colleague working at the Dragon keyboard and TV screen while I programmed on the Cifer.

The crunch comes when the Dragon has to access the disc drives on behalf of either user, at which point all the processing coagulates until the drives stop. In practice, then, this aspect of the Dragon will not be of much interest to business users, but with a little goodwill it is perfectly possible to use the Dragon as a shared resource between a pair of programmers developing small modules in, say, Basic-09.

A factor that helps here is that code in OS-9 is re-entrant as well as position-independent. If two users both need to use the same program, ordinarily they would each need a separate copy. But re-entrant design allows them to share the identical module in memory. When the time-slicing mechanism steps in to switch out the current user, the contents of the 6809 registers are saved on the stack. One of these, the direct page register, is an eight-bit register that contains the address of a 256-byte page of memory in which the data for that user is stored. When the second user is switched in and his or her register values are restored from the stack, the direct page register will now contain the pointer to a different page of memory where the second user's data is being stored.

Machine-code-minded readers will be worrying that this shared stack might be a source of conflict. In fact, the 6809 has two stack pointers, one designed to be reserved for the system and a second for the user. At every time-slice the user stack pointer is replaced by that user's last stack address, as restored from the system stack. So as well as having separate pages of memory to store data, each use also has a distinct stack. By using different data this way each time the code is called, users can happily share the same program module — Basic-09, for instance — without conflict.

does not create relocatable libary modules. The limitations of these two programs can be overcome by hard work, and for the price represent a bargain for the user with more time than money to spend.

The debugger holds an unpleasant surprise for anyone who has used a CP/M or MS-DOS system. CP/M's DDT is regarded as fairly rudimentary by modern standards, but it has two features that I would find it hard to live without when emabarking on the exploration of a new chip. It will dissassemble object code, turning it back into assembler mnemonics to help you analyse how your code is working, and it also has a simple assembler built into it. With DDT you can construct short stretches of code, have your assembler-writing checked for syntax as you enter it in much the same way as Basic does, and then run the code for testing.

Patience

Unfortunately OS-9's Debug models itself on Unix's ADB, a debugger that knows nothing about assembler mnemonics. It will tell you the values of the bytes making up a stretch of code, but if you want to understand them as instructions you will need a book of the 6809's instruction set and a good deal more patience than I can muster.

The application packages all have the snag that they oblige you to work with a television screen or monitor in conjuction with the existing keyboard. I would much prefer to do serious work on the machine by way of a proper 80-column by 24-line VDU, like the Cifer, but there is no provision for reconfiguring the screen controls.

As a WYSIWYG word processor Stylograph is more thorough than most. For example, if you set up a header instruction with the comma command

,he

that header will actually display on each page of the screen, as well as appear in print. Comma commands are roughly equivalent to WordStar's dot commands.

Stylograph combines the functions of a word processor with a spelling checker and a mail-merging package. All this makes it tremendously good value for money, although there are two snags. First, the technique used by the Dragon hardware to scan the keyboard is a compromise that does not always guarantee detection of every key in a series of keys pressed in quick succession. Regrettably, the Dragon is not the best choice of machine for word processing by a reasonably fast typist.

Secondly, Stylograph has a number of design features that may irritate you if you are used to WordStar. It is page-orientated, and the amount of text it will handle is restricted by the size of available RAM. It is also built around the idea of modes — there is a mode for inserting text, another mode for moving the cursor, and a third mode that removes the text from the screen and gives you a menu of options for actions like printing. Having to switch modes every time you want to slip back over the text to make changes isn't something that appeals to me. If it has any advantages for the user I can't think what they are.

There is not much to say about DynaCalc. If you know spreadsheets this one will give you pretty much everything you expect to find. The GO51 character set is particularly tough on the eyeballs when reading numbers, and this is where you really need a decent monitor.

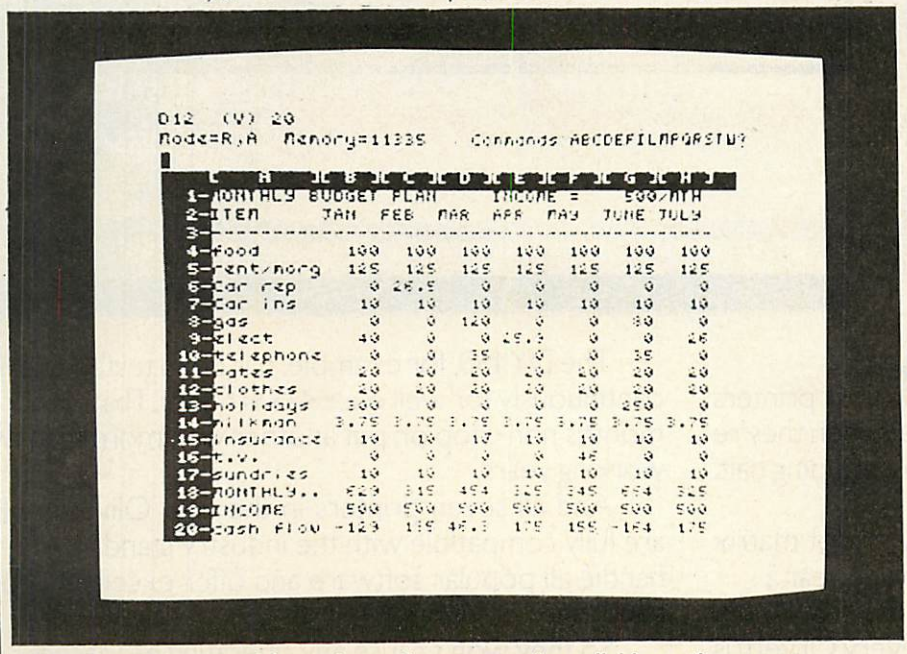
RMS is a transactional database-management system that seems to be very good value for money. A transactional database usefully extends the idea of a simple flat file by allowing each record in the file to attach an unlimited number of secondary records to itself. For example, you can create a file of customer names and have records of monthly accounts attached to each customer. It is considerably less flexible than a relational database system, but is simple to install and can cope with most business situations.

Screen layout

There is an editor for entering data into files, but setting up the screen layout has to be done outside RMS, using Stylograph. The system uses hashing, which requires you to guess at the maximum file size when you are setting it up; access is liable to be slow if your guess is wrong. You can search for records on an index field and obtain simple reports, including or excluding records on particular criteria.

RMS is not dBase II, but it may well take you as far as you need to go. If you are prepared to get involved in a little programming you can always extend its facilities by reverting to Basic-09. The Basic-09/RMS interface is greatly simplified by the fact that all the files it uses are straightforward text files.

Copy deadlines did not permit testing the Cash/VAT system, the Stock Recording system or the advance copies of the Sales Ledge and Purchase Ledger, all supplied by Computer Support Services. I hope to be able to report on them later if the news of Dragon Data's future turns out to be hopeful. From the very clear documentation they appear to comprise a formidable accounting package for the small to medium trader. Once the tricky question of future support for Dragon is settled, the bundle may be quite a bargain at around £50 per program.



OS-9's DynaCalc spreadsheet shows the commands available on the screen.

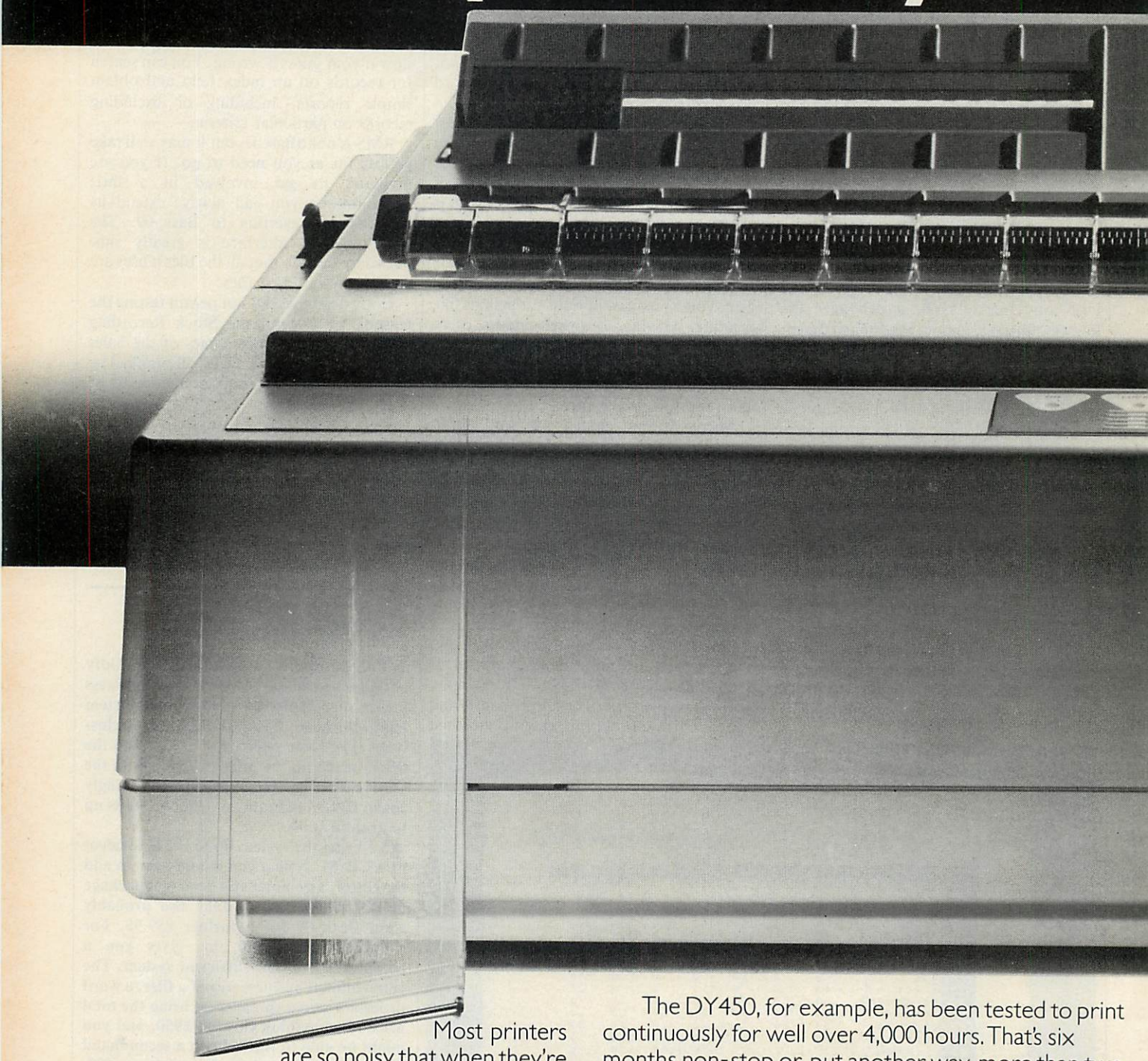
Conclusions

● To compete against the rapidly cheapening range of lower-end business micros the full disc-based Dragon 64 system has to be cheap. It is — though not conclusively. The basic micro costs £225, and the drives make up the price to £614. With the OS-9 operating system at an astonishingly cheap £39.95 the total system cost adds up to around £650.

● To bring the system up to the equivalent of a CP/M system you would have to add the editor, assembler and debugger package at £49.95, and you would also probably want Basic-09 for a further £59.95. For something like £750 this gives you a comprehensive, self-sufficient system. The conventional business trio of a filer, a word processor and a spreadsheet bring the total price to something close to £950, and you might be able to track down a secondhand monochrome monitor for another £50, making £1,000.

● Compared to CP/M and MS-DOS the amount of commercial software available to run on it is very limited, but what there is works well and is cheap — around £75 a package. Other languages to run under OS-9 at bargain prices are C and Pascal, costing around £80 each.

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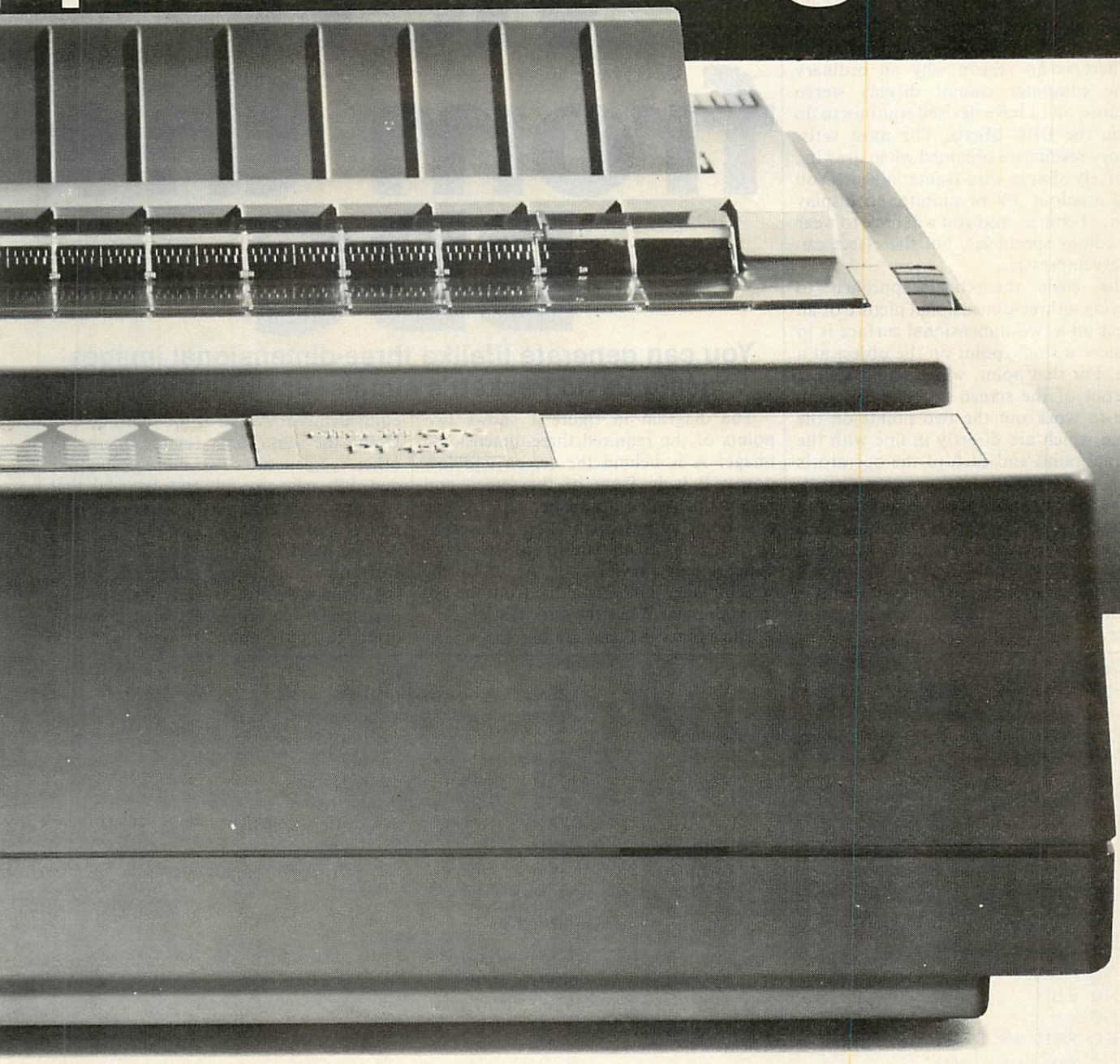
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In-depth view from the BBC

You can generate lifelike three-dimensional images using David Peckett's simple Basic routines.

THE HYPE for a number of recent computer games has made much of their use of graphics, and in particular of "three-dimensional" graphics. With few exceptions such programs use perspective for their effect: foreground objects appear larger than distant ones and partially obscure them.

Impressive as such pictures can be, they are not truly stereoscopic in the way that films like *Jaws 3* are, and the images do not leap out of the screen at you. In technical terms, they are not anaglyphs.

There is no reason why an ordinary home computer cannot display stereo pictures, and I have devised routines to do so on the BBC Micro. The most satisfactory results are obtained when drawing relatively simple wire-frame images. You need a colour TV or monitor to display them, of course, and you will have to wear two-colour spectacles, but the effect can be very impressive.

The basic theoretical approach to drawing a three-dimensional picture of an object on a two-dimensional surface is to consider a single point on the object at a time. For that point, which could appear in front of the screen or behind it, you have to work out the two points on the screen which are directly in line with the original point and each of the operator's eyes.

The right eye must then be persuaded to see only its associated point on the screen, and the left eye to see only its point. If this can be done successfully, the operator's brain will be fooled into thinking that it is looking at the original point hanging in space.

The diagram in figure 1 shows two points of the required three-dimensional image: A is behind the screen and low down; B is in front of the screen and higher up. A line drawn between the eye and point A passes through the screen at A1, the point known as the two-dimensional transform of A on to the screen plane. Similarly a line from the eye through point B hits the screen at B1.

The points A1 and B1 are the screen equivalents of A and B for that one eye. Doing the same thing for the operator's other eye generates two more points, A2 and B2, near to A1 and B1. All that remains is to persuade the first eye only to see A1 and B1, and the second eye to see A2 and B2. The brain will do all the clever stuff of welding the two images together.

Graphics on the BBC Micro are usually described by co-ordinates which have their origin in the bottom left-hand corner of

Listing1.

```
 10 REM ** Demonstrate effects of
    colour mixing
 20 REM ** by D S Peckett
 30 REM ** 11 May 1984
 40
 50 MODE2
 60 VDU23,1,0;0;0;0;
 70 PROCdisc(470,650,1):REM ** Red
 80 PROCdisc(810,650,2):REM ** Green
 90 PROCdisc(640,360,4):REM ** Blue
100 REM ** Wait
110 A=GET
120 VDU23,1,1;0;0;0;
130 MODE7
140 END
150
160 REM ** Draw a disc, centre (x,y),
    colour "col"
170 DEF PROCdisc(x,y,col)
180 radius=350
190 GCOL 1,col:REM ** Mix colours
200 steps=30
210 REM ** Set up for fast circle
    drawing
220 sin1=SIN(2*PI/steps)
230 cos1=COS(2*PI/steps)
240 sin=0:cos=1
250 MOVE x,y+radius
260 FOR I%=1 TO steps
270   REM ** Compute next angle
280   temp=sin
290   sin=sin*cos1+cos*sin1
300   cos=cos*cos1-temp*sin1
310   x1=x+radius*sin
320   y1=y+radius*cos
330   REM ** Draw next segment
340   MOVE x,y
350   PLOT 85,x1,y1
360   NEXT
370 ENDPROC
```

Listing 2.

```
19960 REM ** Code to control 3D
19970 REM ** by D S Peckett
19980
19990 REM ** Set up 3-D routines
20000 DEF PROCInit3D
20010 DIM CursX(2),CursY(2),ex(2)
20020 VDU 29,640;512;:REM ** Centre
      origin
20030 VDU 19,1,1;0;:REM ** Left eye
      (red)
20040 VDU 19,2,2;0;:REM ** Right eye
      (green)
20050 VDU 19,3,3;0;:REM ** Both eyes
      (yellow)
20060 ScreenWidth=12:REM ** Screen width
      in inches
20070 EyeZ1=30:REM ** Viewing distance
      (inches)
```

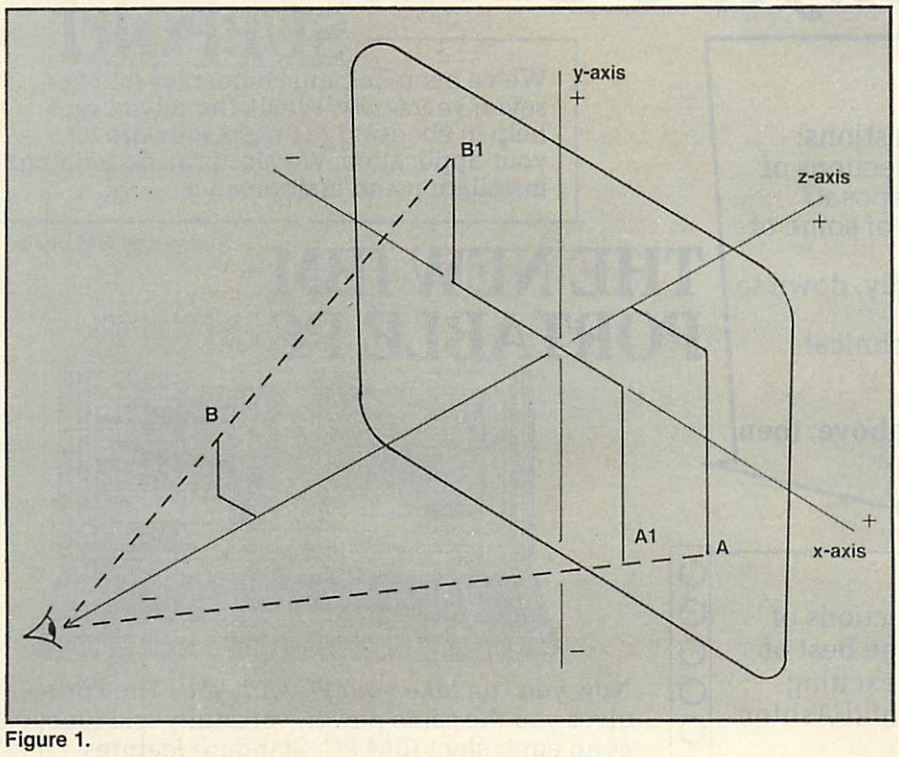


Figure 1.

the screen. This is the system which BBC Basic's graphics commands use. For three-dimensional graphics, however, it is more convenient to have the origin at the centre of the screen, especially as a Z-axis is required — in addition to the usual X- and Y-axes — to define distances behind and in front of the screen.

Positive X co-ordinates are defined as being to the right of the screen centre line, positive Y co-ordinates above the centre line, and positive Z behind the screen. It is convenient to work in BBC graphics units, GUs, which means that the screen is 1,280 GUs wide and 1,024 GUs high. From now on, it will also be assumed that the picture is being viewed from a point in front of the middle of the screen, with the operator's eyes level — that is, along the X-axis.

Now you have to calculate where on the screen to put the two images representing the point x,y,z on the three-dimensional image. The positions can be called x_{sr},y_s for the right eye and x_{sl}, y_s for the left eye. Because the eyes are level, the two Y co-ordinates are identical.

Figure 2 shows the basic layout for calculating y_s, as seen from the right and with the viewing eyes e_z GUs from the screen. From the geometry of the similar triangles ISO and IAB

$$y_s/e_z = y/(e_z + z)$$

and

$$y_s = y * e_z/(e_y + z)$$

Figure 3 shows the view from above, with the eyes set $2e_x$ apart. For the right eye, the triangles RSQ and RAB are similar, so

$$(x_{sr} - e_x)/e_z = (x - e_x)/(e_z + z)$$

and

$$x_{sr} = e_x + (x - e_x) * e_z/(e_z + z)$$

For the left eye, the important triangles are LTP and LAC, so

$$(x_{sl} + e_x)/e_z = (x + e_x)/(e_z + z)$$

and

$$x_{sl} = -e_x + (x + e_x) * e_z/(e_z + z)$$

The equations for x_{sr} and x_{sl} are very similar — the difference is only in the sign of e_x — which simplifies matters when it comes to working out x_{sl} and x_{sr}.

These formulae specify where to plot points for each eye, but the problem remains of separating the image intended for the left eye from that intended for the right eye. The answer is to plot each image in a different primary colour.

Try displaying three patterns on the screen, one in each of the additive primary colours red, green and blue. If you view them through a filter which is in one of the

(continued on page 89)

```
20080 EyeZ=EyeZ1*1280/ScreenWidth:REM **
      Convert to GU
20090 EyeX1=3:REM ** Distance between
      eyes - inches
20100 EyeX=EyeX1*1280/ScreenWidth:REM **
      Convert to GU
20110 ex(1)=-EyeX DIV 2:ex(2)=EyeX DIV 2
20120 REM ** Initialize starting values
20130 OffsetX=0:OffsetY=0:OffsetZ=0
20140 LastX=0:LastY=0:LastZ=0
20150 ENDPROC
20160
20170 REM ** 3-D "MOVE" command
20180 DEF PROCMove3D(x,y,z)
20190 PROCPlot3D(4,x,y,z)
20200 ENDPROC
20210
20220 REM ** 3D "DRAW" command
20230 DEF PROCDraw3D(x,y,z)
20240 PROCPlot3D(5,x,y,z)
20250 ENDPROC
20260
20270 REM ** Core 3D "PLOT" command
20280 REM ** Equivalent to PLOT n,x,y
20290 DEF PROCPlot3D(n,x,y,z)
20300 IF (n AND 2) THEN n=(n AND &FD)
EOR 1:REM ** Cancel inverse/background
      colour requests
20310 IF (n AND &50)=&50 THEN n=(n AND
&AF):REM ** Cancel triangle fills
20320 REM ** Handle relative movements -
      convert to absolute
20330 IF (n AND 4)=0
x=x+LastX,y=y+LastY:z=z+LastZ:n=n OR 4
20340 REM ** Save new position in screen
      co-ords
20350 LastX=x:LastY=y:LastZ=z
20360 REM ** Allow for offset drawing
      point
20370 x=x+OffsetX:y=y+OffsetY:z=z+Offset
Z
20380 FOR Colour=1 TO 2
20390   GCOL 1,Colour:REM ** Use "OR"
      function to mix correctly
20400   MOVE CursX(Colour),CursY(Colour)
      :REM ** Position where left off
20410   CursX(Colour)=FNPosX(x,z,Colour)
      :REM ** Calc. new...
20420   CursY(Colour)=FNPosY(y,z)
      :REM **...position
20430   PLOT n,CursX(Colour),CursY(Colou
r):REM ** Plot to new position
20440   NEXT Colour
20450 ENDPROC
20460
20470 REM ** Position 3D cursor in
      X-axis
20480 DEF FNPosX(x,z,sign)
20490 =ex(sign)+EyeZ*(x-ex(sign))/(EyeZ+
z)
```

(listing continued on page 89)

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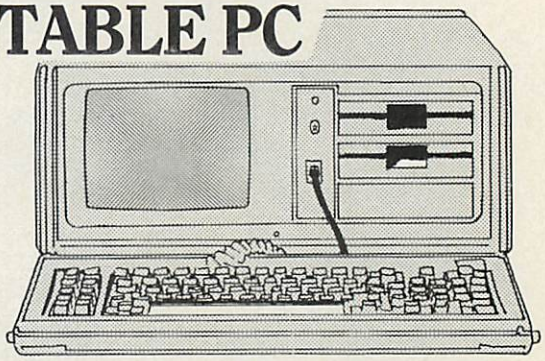
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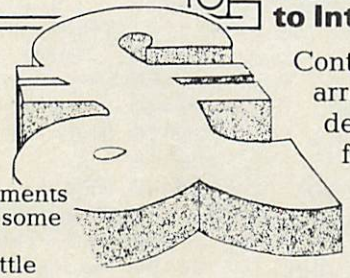
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(continued from page 87)

three colours you will only see the pattern displayed in the corresponding colour; the other two will disappear. Two-colour spectacles will therefore separate the images for the left and right eyes. The mixed colours yellow, magenta and cyan each correspond to a pair of primaries, as shown in table 1. Where the two eyes' patterns meet, the intersections can be made visible to both eyes by displaying the appropriate mixed colours.

You can use any pair of primaries for the right and left displays, as long as the crossing points are always coloured appropriately. The traditional red and green are largely arbitrary. The display you set from listing 1 will show you all the possible combinations and how the colours mix together.

Listing 2 gives the code to display three-dimensional pictures. The first part, ProcInit3D, sets up the system and must be executed before anything is drawn. It defines the small arrays which are used and sets up the system constants.

The three-dimensional graphics system must be used in at least a four-colour display mode, such as Mode 1 or Mode 5. Lines 20030 to 20050 set up the colours to be used. I selected red for the left eye and green for the right eye simply because they happened to be the colours of my viewing glasses. Use the physical colour numbers which apply to your system — see page 224 of the BBC *User Guide*.

The various system constants are then set up and converted into graphics units. You must enter values for Screenwidth, EyeZ1 and EyeX1 to suit your own display and eyes. The other system constants are zeroed, including OffsetX, OffsetY and OffsetZ.

The Offset commands allows you to offset the origin of your drawing away from the system origin at the screen centre. Set up the values of Offset to the zero point you wish to draw from, and the procedures will automatically shift the three-dimensional image to where you want it.

Once the system has been set up with the left and right cursors at the screen centre, ProcPlot3D(n,x,y,z) acts as a direct counterpart of the Basic command Plot n,x,y. The variable n can take on exactly the same values, with similar meanings, except that the space- and triangle-filling routines are not provided.

Primary 1	Primary 2	Mixture
red	green	yellow
red	blue	magenta
green	blue	cyan

Table 1. Mixing additive primaries.

ProcPlot3D first sets up its basic parameters and checks n for validity. For each eye colour if then does a GCol 1, colour to give the correct, Ored mixing for line overlaps, moves to the last cursor position, calculates the new cursor position, and draws a line to it. It uses FNPosX and FNPosY to calculate the correct screen positions. The commands ProcMove3D and ProcDraw3D act just like Move and Draw in Basic, except that you must provide the Z co-ordinate as well as the X and Y.

To see what three-dimensional images the routines are capable of producing, enter the procedure definitions and FNdefinitions from listing 2, followed by listing 3. When run, the program selects Mode 1 and uses ProcInit to set up the system. It then waits for your commands. ProcInit creates separate text and graphics windows for the display, allowing you to

(continued on next page)

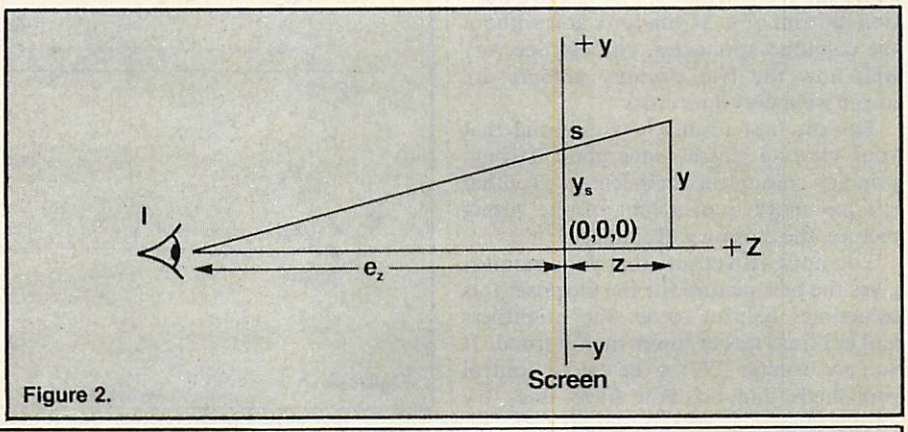


Figure 2.

(continued from page 87)

```
20500
20510 REM ** Position 3D cursor in
      Y-axis
20520 DEF FNPosY(y,z)
20530 =(EyeZ*y)/(EyeZ+z)
```

Listing 3.

```
  10 REM ** Code to draw 3D "anaglyphs"
     on BBC microcomputer
  20 REM ** by D S Peckett
  30 REM ** 11 May 1984
  40
  50 MODE1
  60 PROCInit:REM ** Initialize demo
  70 END
 990
1000 DEF PROCInit
1010 DIM PX(5),PY(5),PZ(5):REM ** For
     pyramid
1020 REM ** Set screen windows
1030 VDU 24,0;260;1279;1023;
1040 VDU 28,0,31,39,24
1050 REM ** Initialize 3D system
1060 PROCInit3D
1070 REM ** Set function keys
1080 *KEY0PROCMove3D(
1090 *KEY1PROCDraw3D(
1100 *KEY2PROCPlot3D(
1110 *KEY6PROCLINES|M
1120 *KEY7PROCCUBE|M
1130 *KEY8PROCPYRAM|M
1140 *KEY9PROCSPIRAL|M
1150 ENDPROC
1990
2000 DEF PROCLINES
2010 OffsetX=0:OffsetY=0:OffsetZ=0
2020 CLG
2030 PROCL(-300,0)
2040 PROCL(-150,-200)
2050 PROCL(0,-500)
2060 PROCL(200,-700)
2070 PROCL(400,-900)
2080 ENDPROC
2090
2100 REM ** Draw a 300 GU vertical
     line
2110 DEF PROCL(X,Z)
2120 PROCMove3D(X,0,Z)
2130 PROCDraw3D(X,300,Z)
2140 ENDPROC
2990
3000 DEF PROCCUBE
3010 OffsetX=0:OffsetY=100:OffsetZ=0
3020 CLG
3030 PROCMove3D(-300,-300,0)
3040 PROCDraw3D(300,-300,0)
3050 PROCDraw3D(300,300,0)
3060 PROCDraw3D(-300,300,0)
3070 PROCDraw3D(-300,-300,0)
3080 PROCDraw3D(-300,-300,600)
```

(listing continued on next page)

(continued from previous page)
type in commands at the bottom of the screen while looking at the top. It then sets up the red function keys f0 to f2 to make it a little easier for you to enter three-dimensional commands directly. Keys f6 to f9 are programmed to call up the four demonstration routines.

ProcLines draws a line 300 GUs, high in several positions on the screen. It appears to come towards you as it moves from left to right. ProcCube draws a wire-frame cube, initially at the centre of the screen. Try changing the OffsetX/Y/Z values at line 3010 to see how putting the cube in different positions affects the display.

ProcPyram draws a kind of pyramid looming out of the screen at you. The effect of a shape hanging in mid-air can be quite uncanny. Again, alter the Offsets to see the effect of changes. You can also change the Data at lines 4180 to 4220 to affect the pyramid's shape. Finally, ProcSpiral attempts to show a line spiralling from behind the screen to a position in front of it. If you look at it without the coloured spectacles, you can see very well how the two primary colours are mixed whenever lines cross.

For the best results it is essential that your viewing glasses have good, strong, primary colours in their lenses. If either eye has more than a hint of the wrong picture, the illusion will collapse.

You must also ensure that your monitor gives the best picture for the purpose. It is sometimes helpful to set the brightness and contrast rather lower than normal. If you are using a TV, set the colour control very high and, if you have one, try adjusting the tint control. It may also help to view the picture in a dim light. You may find that Mode 5 works better than Mode 1: the broader lines help.

Do not try to display very complicated pictures. If there are too many lines on the screen, the whole thing breaks down into a confusing jumble. To display text, use Colour 3 so that the characters appear in the plane of the screen.

Not everyone can accommodate their eyes to the three-dimensional picture, but if you can, its possibilities are almost endless. Why not try to write games, even simple bat-and-ball ones, which move in and out of the screen? PC

CursX(2), CursY(2) — present position of left and right cursors
ex(2) — distances, measured in GUs, of left and right eyes from axis
EyeX — distance between eyes, in GUs
EyeX1 — distance between eyes, in inches
EyeZ — distance of eyes from screen, in GUs
EyeZ1 — distance of eyes from screen, in inches
LastX/Y/Z — last 3D point drawn
OffsetX/Y/Z — dummy origin of drawing
Screenwidth — width of monitor screen, in inches

Table 2. Major system variables.

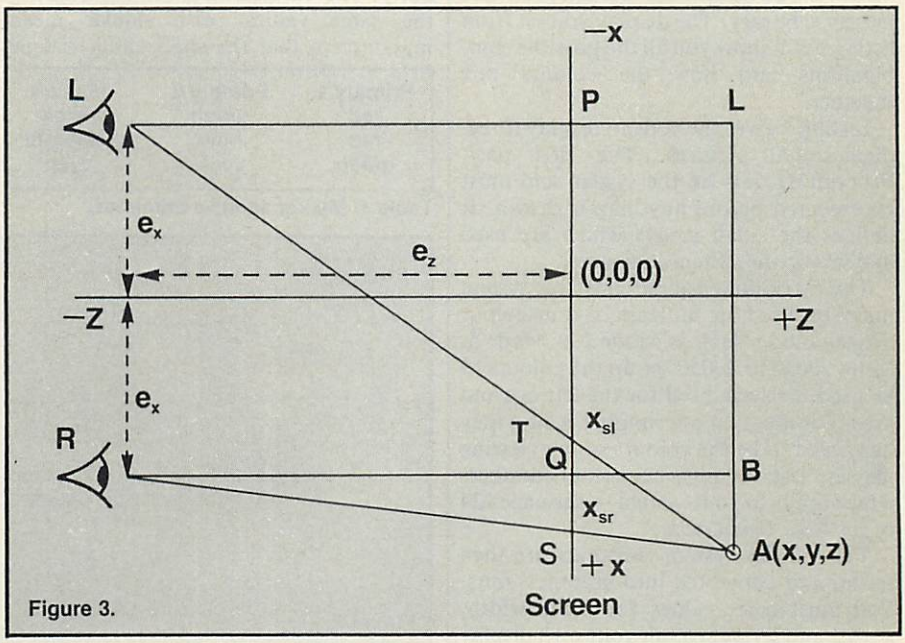


Figure 3.

(continued from previous page)

```
3090 PROCDraw3D(-300,300,600)
3100 PROCDraw3D(300,300,600)
3110 PROCDraw3D(300,-300,600)
3120 PROCDraw3D(-300,-300,600)
3130 PROCMove3D(300,-300,0)
3140 PROCDraw3D(300,-300,600)
3150 PROCMove3D(300,300,0)
3160 PROCDraw3D(300,300,600)
3170 PROCMove3D(-300,300,0)
3180 PROCDraw3D(-300,300,600)
3190 ENDPROC
3990
4000 DEF PROCPYRAM
4010 CLG
4020 OffsetX=0:OffsetY=0:OffsetZ=-200
4030 RESTORE 4180:REM ** Read vertices
4040 FOR I%=1 TO
5:READ PX(I%),PY(I%),PZ(I%):NEXT
4050 PROCMove3D(PX(1),PY(1),PZ(1))
4060 FOR I%=2 TO 4
4070   PROCDraw3D(PX(I%),PY(I%),PZ(I%)
4080   NEXT
4090 PROCDraw3D(PX(1),PY(1),PZ(1))
4100 FOR I%=1 TO 4
4110   PROCMove3D(PX(5),PY(5),PZ(5))
4120   PROCDraw3D(PX(I%),PY(I%),PZ(I%))
4130   NEXT
4140 ENDPROC
4150
4160 REM ** Data for pyramid vertices
4170 REM ** Each point in X-Y-Z order
4180 DATA 0,0,-500
4190 DATA 400,150,100
4200 DATA -200,350,500
4210 DATA -500,150,200
4220 DATA 126,350,-400
4990
5000 DEF PROCSPIRAL
5010 OffsetX=0:OffsetY=100:OffsetZ=0
5020 CLG
5030 increment=30:REM ** Steps per
     circle
5040 sininc=SIN(2*PI/increment):cosinc=
COS(2*PI/increment)
5050 sin=0:cos=1:REM ** Starting value
5060 radius=200:REM ** Radius of
     spiral curve
5070 PROCMove3D(0,radius,2000)
5080 iterations=5*increment:REM **
     5 complete circles
5090 FOR I%=1 TO iterations
5100   sindummy=sin
5110   sin=sin*cosinc+cos*sininc
5120   cos=cos*cosinc-sindummy*sininc
5130   x=radius*sin
5140   y=radius*cos
5150   z=1500-3000*I%/iterations
5160   PROCDraw3D(x,y,z)
5170   NEXT
5180 ENDPROC
```

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● Circle No. 141

The clean machine

Dust and dirt can cause your computer to malfunction. Chris Naylor dons his overalls as he tells you how to keep your micro in peak condition.

YOU MAY WELL have a dirty machine without even knowing it; you might simply think that your computer has gone wrong. For example, I use an Apple II which has been working tirelessly, unlike its owner, since 1979. And it was still working tirelessly when I decided to shove in a few extra boards and run CP/M on it. However, upon plugging in the Z-80 card, 80-column card and 16 RAM card it ceased to work properly.

Everything would be going fine until, say, a BDos Err on P occurred and, even if CP/M purists insist that, with only two drives connected, I had not got a P to have a BDos Err on, it was still the sort of error that occurred. And it occurred with sufficient frequency to wreck all chances of carrying out useful work.

Fix it!

Clearly, since it was once working and then was not, the new boards were at fault. Then followed a sequence of events well known to computer users. It involves packing the machine up into the box it came in and wandering the length and breadth of the land with computer in hand in order to dump the offending goodies on the counters of certain retailers with the request that they fix it or replace it at once.

Said retailers were, by and large, helpful and sympathetic. Cards were replaced as requested. But, at the end of each day, the errors still kept on coming, as they did after three more expeditions of the same kind.

However, on the fourth expedition, when I visited a firm with a service department and an engineer, someone commented that the machine itself was not altogether clean. An observation probably inspired because it was necessary to scrape away the dust in order to read the legends on the chips.

Could it not be, it was suggested, that a little dirt might be causing a build-up of stray inductive capacitance on the board which, when appropriately loaded, might lead to timing errors thereby causing the machine to conk out? Nonsense, I retorted. Try checking the power supply or something sensible instead.

Dirt is the cause

But, as the checking proceeded and more and more components were found to be intrinsically without fault, the rumour of dirt as the main cause began to gain ground in my mind. However, like most people with computers, I do not like parting with mine. So the obvious thing to do was to go home and clean it myself.

The process of cleaning began gingerly. A Kleenex soaked in isopropyl alcohol removed much of the dust from the motherboard. But still no improvement showed. And, with failure, came an increasing boldness. After ripping out the motherboard and purchasing a litre of

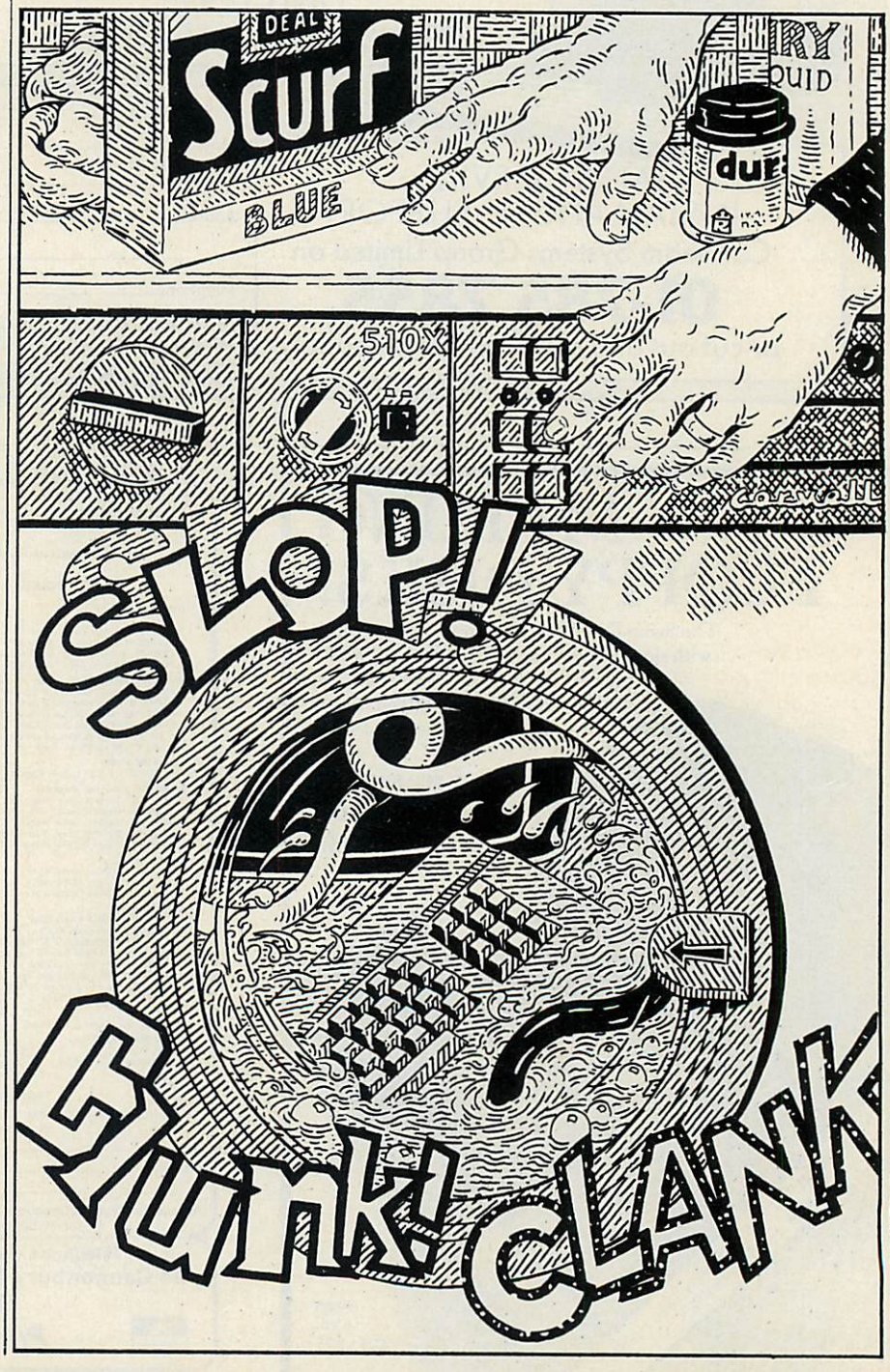


ILLUSTRATION: STEPHEN WRIGHT

Beware!

Do not dismantle your machine unless you are absolutely sure that you know how to put it back together again.

Never get any solvents near the keyboard switches — once in they rarely come out again, leaving you with a defunct key switch. Replacing key switches requires expertise with a soldering iron.

Do not try to clean the power-supply unit. It is unlikely to be too much troubled by dirt and often contains strange, non-digital components.

The commonest cause of disc trouble is cigarette ash so you could try giving up smoking — some hope, with problems such as these on your mind! However, you should at least give up smoking when using isopropyl alcohol, unless you want to take up flying as well.

A useful purchase would be a dust cover for the machine to help keep it dust-free in the first place.

Never add or remove any components while the power is switched on to the machine. Switch off the power; touch earth to dispel static; then, and only then, can you touch the machine's components.

isopropyl alcohol, the entire motherboard got a good soaking. Fitting it back into the machine gave some improvement, but not enough and failures still occurred.

Ripping the board out again it got a better soaking — only this time I pulled out every chip in sight so that the goodness of isopropyl alcohol could penetrate everywhere. On pulling the chips, I noted that the pins of many were not dirty, but black. Scrubbing them with isopropyl alcohol did not seem to help but throwing them away and buying new chips did.

Replacing the board again showed a distinct improvement in behaviour. But not an entire improvement. Things still went wrong, though less frequently than before. So the motherboard was ripped from the machine once more, the kitchen sink filled with warm water and Fairy Liquid, every chip was pulled from the board, and the whole lot was immersed and gone over with a soft scrubbing brush.

The chips were dropped into a jug of Goddards Silver Dip, their pins pristine. Come the end of the day, everything was reassembled and dried with a hairdryer. Switching on, it worked and hasn't gone wrong since and, if it had gone wrong again, the next step would have been to sling it in the washing machine selecting super wash for fast coloureds to see what that did to it.

The moral of the story is that if your machine is not working it may be because it's dirty, even if the failures look somehow regular enough to suggest another cause. The reason why my machine failed on inserting three new cards was probably not because the cards were faulty but because they changed the loading on the motherboard in such a way as to make previously unnoticeable dirt appear to have electrical significance.

Cleaning your micro

- Remove the motherboard and take out all the chips. Make a note of the positions of all cable connectors and the positions and orientations of all chips so that, having dismantled it, you are sure you can reassemble it. It is not sufficient to know what sockets take which chips; make sure you know which way the dots on the chips face.
- Clean the motherboard using isopropyl alcohol and a soft brush. Do not soak any boards for any length of time in anything in case the tracks start to lift. Do not clean the board with a toothbrush or anything made of nylon as isopropyl alcohol can react with some nylons. I used the Hi Fi Parastat from Cecil Watts as a brush. A camel-hair brush is also suitable. When brushing the board down make sure that you do not bash any components, such as the capacitors, too hard.

Many people speak out against using water in any form for cleaning electrical components, pointing to the fact that it is rather dirty — containing things like calcium and flouride, which might at some stage react with the board.

Carbon tetrachloride seems a suitable alternative to isopropyl alcohol, but all cellulose- or acrylic-based cleaners should be avoided like the plague because they will dissolve the board, the IC sockets and just about everything else in sight, leaving you with something that looks a little bit like warm toffee. Methylated spirits has the disadvantage of leaving a slight residue.

The big advantage of isopropyl alcohol is that it leaves no residue which can react with anything. So if you do clean any part using something else, always try to finish the job off with isopropyl alcohol to get rid of whatever the previous cleaner has left. Isopropyl alcohol can be bought over the counter at a chemists and costs £2 to £3 for 500c.c.

- Clean the chips using isopropyl alcohol. If that does not work, fine emery paper will get the pins clean. Also Goddards Silver Dip works well because many chips have silver-plated legs. But, again, clean with isopropyl alcohol afterwards to get rid of anything which might be left over.

Take care in handling chips. Some are prone to static charges such as you may have about your person. Try to avoid touching the pins at all and try earthing yourself by touching a water pipe or the case of your power supply, if it is earthed, before touching the chips. If you want you can earth yourself by winding a piece of wire around your wrist and taking that to earth as a precaution. But, if you do this, take every precaution to see that you do not come into contact with any live wiring while you are so earthed.

Be careful on removing and replacing chips not to bend or break any of the pins. So, if you are using a screwdriver to lever them out work at one end then the other and so on until it comes out gently. Straighten any bent pins before replacing the chips.

- Dry everything. A hair dryer can be useful but some people advise against warm air which might cause the board to shrink and expand, so cracking the tracks. Cold air is safest.
- Clean the peripheral slots and connectors. Apart from using isopropyl alcohol and a brush, the best technique involves going over all connectors with a rubber. Shaping the rubber into a point can help get it into the slots themselves. A rubber can remove fingermarks which isopropyl alcohol will not shift.
- Clean the rest of the machine. That way it looks nicer and there is less dust and dirt around to be absorbed. You could use warm water and Fairy Liquid, or Duraglit and Brasso for cleaning shiny plastics.
- If you have a disc drive or tape recorder, isopropyl alcohol can be used for cleaning heads, tapes and discs. But always use a lint-free cloth to avoid scratching the surfaces. Commercial disc cleaners consist of isopropyl alcohol plus a high price tag. Cotton buds can be useful for getting at tape leads. Ingredients sold commercially for cleaning hi-fi tape equipment will generally be fine for cleaning disc equipment.

STY-X SOFTWARE

by Jean Miles

Listen, you've got to believe me . . . Oh, I know, you think I'm crazy. I can see already you want to get away from me. Look, I'm not begging for money. This suit I'm wearing, it came from Saville Row. You can tell, can't you? That's my Aston Martin out there in front of the pub. I've got all the money in the world. I'll buy you a drink, any drink you want, I'll give you money, just say what you want, but you've got to listen to me, you've got to believe me . . .

Two years ago, I was a teacher. Nottingham. No Saville Row suits and no Aston Martins up there, I can tell you. I used to teach Latin, that wasn't so bad. Then the school went comprehensive, they made me teach classical studies, history, all sorts of stuff. I couldn't keep order any more. The kids were bored, they gave me hell, it was hell.

One consolation, though. We had a good computer department, and I got interested early on. I used to stay after school a lot, working on programs. The caretaker let me stay late whenever I wanted.

That's how it started. I was working late one evening. It was getting dark but I was too busy to get up and switch on the light. I just went on by the light from the screen. You know how it is? And suddenly, there was this guy. I hadn't heard him come in, but there he was.

> ***"We'll give you £10,000 a year and I think we can arrange that the tax man won't hear about it. You'll want some computing equipment at home. An IBM PC perhaps? You name it."***

"Foster?" he said.

"That's me. What can I do for you? I'm afraid the office will be closed by now."

"Quite all right, Mr Foster. It's you I've come to see. Your work here has come to our attention." And he handed me his business card.

"Luke Ferry. STY-X SOFTWARE" it read. Good quality card. I was surprised. I'd done a few little things, programs to teach the principal parts of Latin verbs. I'd tried them on children. Little wretches were too stupid to understand anything but Space Invaders, but maybe one of them had been talking about my programs at home. Perhaps that's how Mr Ferry had heard of me. I felt pretty chuffed. I got up and switched on the light.

"How can I help you? I'm afraid it isn't very comfortable here. Perhaps we . . ."

"This is fine," Mr Ferry said. "I like being around computers. Yes, we admire your work. I hope I can persuade you to sign a contract with us."

"A contract? Well . . ."

"It needn't interfere with your work here," he said. "If you want to go on teaching, that's alright with us. We'll give you £10,000 a year and I think we can arrange that the tax man won't hear about it. You'll want some computing equipment at home. An IBM PC perhaps? You name it. All we require is your signature here. Exclusive rights to your . . ."

I took that paper out of his hand so fast he didn't get a chance to finish talking. I took a look at the top page and there it all was, just as he said: £10,000 a year, computing equipment, exclusive rights to any software I wrote, royalties for me of 85 per cent on the purchase price of all sales. There were a couple of lines of small print but I didn't bother. For terms like that, I'd sign anything. I'd probably sign my soul away.

So I signed, and he folded up the paper and slipped it into his pocket.

"Have you ever thought of trying to do a program that would work out the school timetable?" he asked. "It's an idea I've been amusing myself with."

"It's not possible," I said. "No one's been able to come up with a timetable program that will fit in a micro."

He took up my pencil and sketched a flow chart. "The user has to type in all the school requirements. We'd use prompts, like this . . . It would take an hour or so the first time. Much quicker after that. Then the computer would work out the whole timetable. I've done some of the code."

Well, I don't need to go on telling you about that conversation. If you're not in education yourself maybe you've never head of Timetable. It was a great success. Every school in the country must have bought one. And Mr Ferry said that I deserved all the credit, so I got the royalties.

I gave up my job at that school PDQ. Left them in the middle of term, in fact. Damned if I was going to spend another minute in a classroom with those kids if I didn't have to. The school wasn't very nice about it. Was I glad to get out of that place!

So I worked from home after that. I never seemed to get any ideas, though. My wife was always wanting me to do this and do that, and the childen would have been underfoot all the time if I hadn't clouted them pretty solidly. One afternoon Mr Ferry turned up again.

"I'm sorry I haven't sent you anything lately, sir," I said. "I've been working on something, but . . ."

"Don't you worry," he said. "We're very pleased with you, very pleased indeed. I've just dropped round for a chat. I always like to talk computers with a real expert."

I felt really nervous. All that money and I hadn't really done anything yet: was this leading up to some bad news?

He started poking at the computer keyboard. "Here's an idea I've been pushing around a bit," he said. "For a game. Look — you set up some little red things like this, and then you . . ."

> ***"I knew the form by then, I knew I didn't have anything to worry about. But I wasn't too glad to see him, all the same. Something about him made me feel uncomfortable."***

It didn't take much looking to see it was a really good idea, something absolutely new. I mean, you may not have heard of Timetable, but you must have heard of Dante. Everybody in the whole world has been playing it for the last year. They did a

version for the big arcade machines, but it really runs better on a home micro. It was Luke Ferry's idea, as I just told you, but he said I'd done all the work and that I had to have all the royalties and that meant I was really rich.

So I left Nottingham and came down here to London. The wife wasn't pleased. Kept whining about taking the kids away from a school they liked, and she didn't want to leave her garden, one thing after another. We bought a nice flat not far from here, no bloody garden, best part of Kensington. If she wants flowers she can walk in the lousy park. Sent the children to the best boarding schools in the book to get some peace and quiet for my work.

I was at the computer all day, not feeling too well, put on a bit of weight, still couldn't come up with anything. A few months ago Ferry turned up again. Well, I knew the form by then. I knew I didn't have anything to worry about. But I wasn't too glad to see him, all the same. Something about him made me uncomfortable. He was pleased with himself that day.

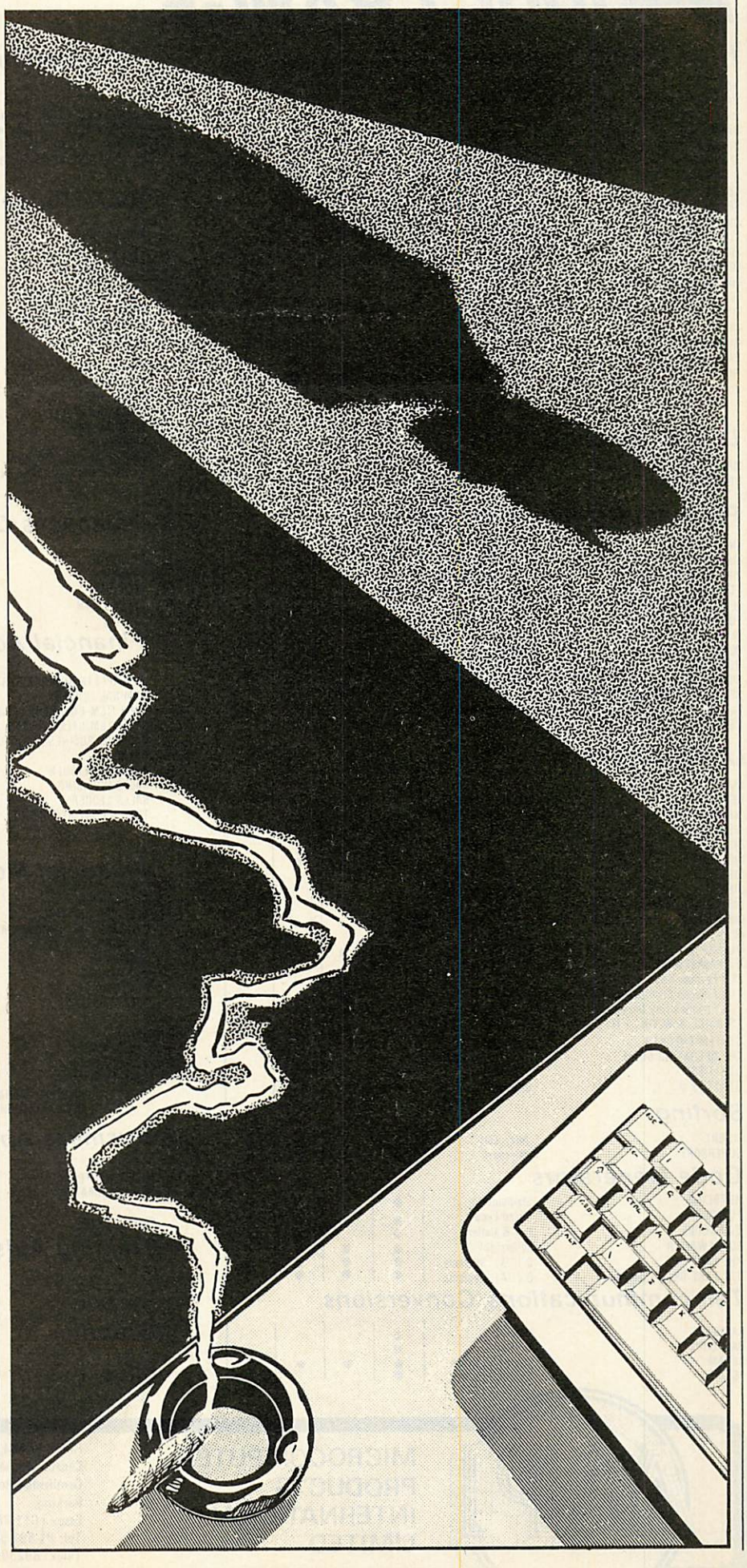
And well he might be. That time, the little trick he had up his sleeve was a real world-beater. Literally. A voice-recognition and translation program. The very thing all those artificial intelligence boffins had been working on for years. They didn't get there — Luke Ferry did. Gave me the the credit again, but I didn't deserve it. It was all him. Wonderfully simple idea once you saw it. Interpreter, we call the program.

I know you've heard of it. Everybody has. And I know what you're thinking: if I wrote Interpreter, I must be George Foster. Sir George Foster to you, since the last Honours List. That's right. That's who I am. I live alone now, just around the corner from here. Left the wife a couple of weeks ago, couldn't take the whining any more. Lady Foster, for Christ's sake.

So that's my story, up until yesterday. Not quite what you were expecting, is it? Not exactly a hard luck story. I haven't asked you for anything, have I? Want another drink, before I tell you the end? Anything you say. Have another of these cigars.

It's hard to say it. I'm a rational man. I'm sure you are too. I mean, people used to believe these things, but it's all rubbish, isn't it? I've been working too hard. I just imagined it all. I just imagined that Luke Ferry came back last night and it wasn't pleasant at all. I kept smelling fire and his teeth were pointed like something out of a goddamned horror movie and he said I had sold him my soul and he was here to collect. I could have 24 hours, he said. Find someone. Tell them my story. If I can find someone to believe me, he'd let me off.

Don't go away. I know what you're thinking, but it's true, every word I said is true. Don't go away. It's getting dark, Don't go away . . .



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Graphics

dGRAPH	Fox & Geller	●			●
STATSGRAPH	Supersoft	●			

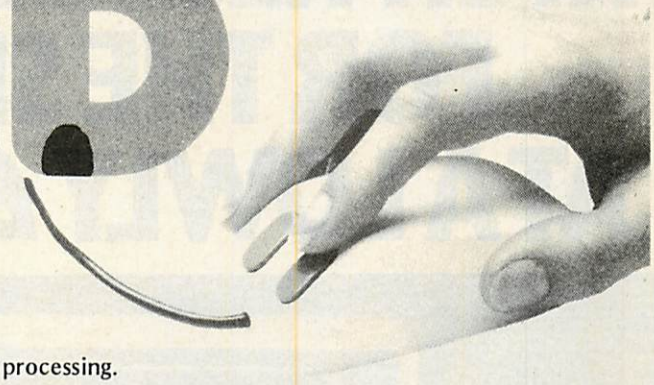
MPI

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FEATURES

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The Mouse makes text editing and command selection simpler and faster.

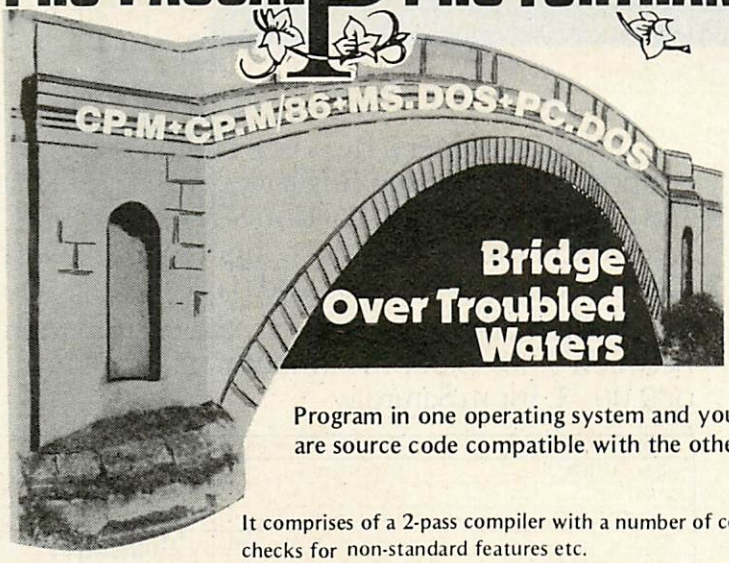
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Style sheets let you set up repeatedly used documents instantly.
You can store line spacing, typestyle positioning and page format, ready to be recalled by two key strokes.

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Pages can be formatted on-screen to new column widths and page lengths.
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PRO PASCAL:

In addition to the features of Standard Pascal, the Pro Pascal, language has a number of extensions which are important for "real world" programming: dynamic strings for character and text manipulation, long integers and random-access file handling for data processing applications, single and double precision floating-point arithmetic for scientific work, an assembler-level interface for system programmers, a separate compilation of program segments for building libraries of commonly-used procedures allowing large object programs to be constructed.
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Pro Fortran is a complete implementation of Fortran 66, with a number of the features from the later Fortran 77. It allows the programmer to use very fast REAL, DOUBLE PRECISION and COMPLEX arithmetic and functions.
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Both Pro Pascal and Pro Fortran have been developed in the UK. The packages include a compiler, linker, librarian, run-time library, a source cross-referencer, and a utility to configure the software to suit variations, such as differing disc capacities.

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What comes naturally

Ian Stobie introduces our feature on alternatives to the keyboard and mouse.



ALL THE FUSS about mice over the last year has focused attention on the task of making computers easier to use. At the moment the standard QWERTY keyboard, developed over 100 years ago for the early typewriter, is still the main way computers are controlled and most data is entered. In this special section we look at the most promising alternatives, concentrating particularly on voice, handwriting and picture input.

The present conventional system of computer use, even with a mouse supplementing the keyboard, still sticks to the basic arrangement of using the hands to input to the machine and the eyes to read output off a screen or off paper. This may not be the most natural way of doing things. We interact with other people largely by speaking to them and watching and listening for their response; we also write them notes, often in a barely legible scrawl, and show them things.

An obvious approach to making computers more usable is to make interacting with them more like interacting with people. There are probably limits to how far this can go, and here it is useful to make a distinction between inputting commands to control the system and inputting the masses of data.

Innovation is likely to take place most rapidly in the way systems are controlled. A mouse is good for controlling systems by letting you point to pictures and data on the screen. It is also good for entering data which already takes a graphic form, but it is not much good for entering numbers and text.

The handwriting input tablet has some potential as an alternative to the keyboard in inputting numbers and text, and may be more natural to many people. Although handwriting does not seem ideal for controlling systems, handwriting tablets set up with tick boxes work well in some applications. Voice does well in both areas; it is a natural medium for giving commands, and is also potentially suited to inputting masses of data.

Of these alternatives, voice input seems to have the greatest potential. The voice-based telephone system already exists, and once computer systems can accept voice it provides an instant worldwide network of input terminals. But the full development of the potential of voice input requires the solution of difficult artificial intelligence problems.

Existing voice-input systems generally require you to train your system to recognise a restricted set of words or phrases. You can then trigger your machine into some pre-designated response by saying the appropriate word or phrase. This sort of voice system is useful, though only at a very similar level to the mouse; it is fine for control but not much use for entering data.

Also already available are simple dictation systems which store speech by representing the sound. Such systems do not have the ability to transcribe spoken words into ASCII text, and this is an important limitation. To be more than an expensive alternative to the tape recorder a voice-input system must be able to convert voice into a form usable by ordinary application software.

Most present-day picture-input systems work at a similar level and have similar limitations. Images of things placed in front of a camera are stored merely as bit patterns. They can be reproduced and manipulated to a degree, but hold much of the information locked into a purely graphic image which is not usable by other application programs.

To extract full benefit from both picture- and voice-input systems requires a large additional step. A full dictation system needs to recognise a much larger number of words than the mouse-level voice-control system. Obviously the user will expect to find this vocabulary in the system when it is purchased, so it must not be upset by differences in individual pronuciation. To transcribe into a text data format such as ASCII, the system must also know how to spell, and how to distinguish between like-sounding words. Humans make such decisions by analysing context, so oven the apparently simple task of transcribing dictation requires intelligence.

The computers of science fiction, such as *Blake Seven's* Orac and K-9 from *Dr Who,* go further and actually extract meaning from the words spoken to them. Since individual human beings take several years learning to do this, and since the processes involved are a long way from being understood, natural-seeming voice interactions with computers must still be a long way off in practice.

What is more, natural communication between people involves several senses at the same time, and it is always to some extent two-way. As a person speaks they monitor the effect they are having in several ways, visually as well as aurally. The truly user-friendly computer of the future will be multi-channel and will answer back.

Open sesame

Much to the consternation of his colleagues, Ian Stobie has taken to shouting at his micro as he tries out Texas Instruments' Speech Command System.

UNTIL RECENTLY voice-input systems have been little more than toys. Although speech is probably the main way humans communicate with each other, getting a computer to recognise what a person is saying has turned out to be very difficult.

Now, really for the first time, genuinely useful speech-input products are coming on to the market. Speech add-on systems aimed at the general office user have recently appeared for the IBM PC, Texas Professional and other machines. Now ACT has launched the first personal computer with speech input as a standard feature, the new Apricot portable.

All systems currently on the market work with a limited vocabularly, typically between 50 and 500 words, which they need to know in advance. Furthermore, they can not cope reliably with unknown speakers: each new user has to train the system to understand their own specific pronounciation.

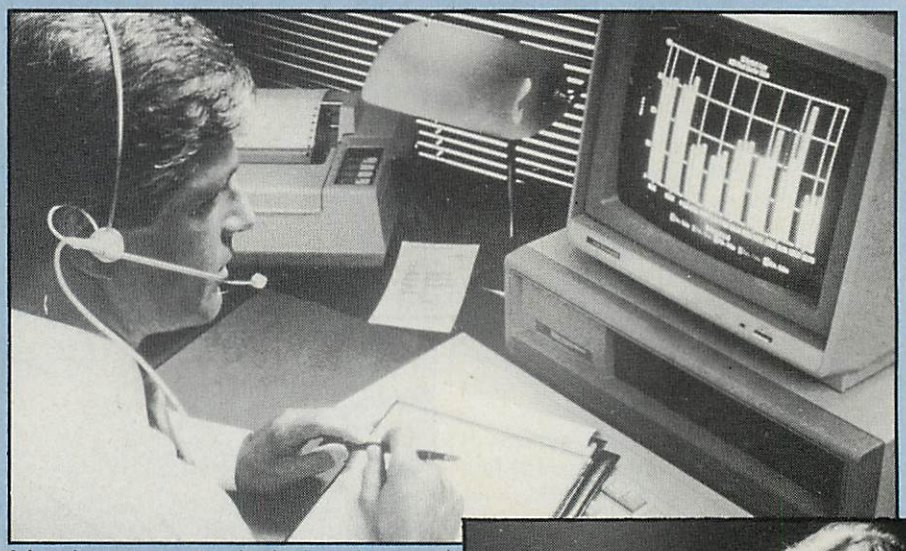
Systems which can understand normal human conversation are still a long way off, but the current technology does allow speech recognition. The system waits until you say something you have trained it to expect, and then carries out a predetermined action.

We have had a Texas Instruments Professional Computer in the office to review, equipped with the TI Speech Command System, SCS. The SCS option is on sale in the U.K. and costs £1,250. For this you get a card containing the speech-recognition hardware, which plugs into one of the Professional's expansion slots, software on disc and a headset.

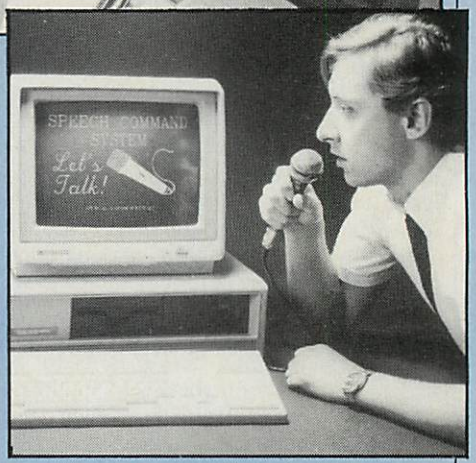
TI hardware

We were using the SCS with a TI Professional with 10Mbyte hard disc and colour graphics, costing £4,495. At least two floppy drives and 256K of RAM are required to support SCS; a minimum configuration with monochrome monitor cost £2,295. At present TI has no plans to offer the speech command system for use with any other manufacturer's hardware.

A microphone, will plug into a socket on the SCS card. Any standard microphone will do; we tried out one from a Tandy store, as well as the lightweight headset supplied by TI. TI says that SCS will work with a cordless radio-linked microphone, and will be able to accept input from the phone. We found that the headset proved the most practical; it is less susceptible to external noise and was not as disturbing to passers-by.



A headset or any standard microphone can be used as the input device.



There are in fact several things you can do with the Speech Command System, including speech output, but the most useful is what Texas terms the transparent keyboard. It works by equating a spoken word or short phrase with a string of up to 40 ASCII characters. When you speak into the microphone the word will then act like a function key, sending the string of characters to the computer exactly as if you had typed them in at the keyboard.

Where the characters are actually coming from has no effect on the application program you are running, and you can still use the keyboard. With any particular package you will typically use vocabularies of up to 50 words and phrases, associating them with particularly common command sequences for indeed anything you habitually type.

The software supplied with SCS on disc includes pre-defined vocabularies for Basic, MS-DOS, Multiplan, Easywriter, Lotus 1-2-3 and several other packages, and utilities to create your own new vocabularies. In this lies the major advantage of good speech-recognition systems over the mouse — it will work with any existing package that uses the keyboard BIOS in a normal way. To work with a mouse, most packages have to be substantially rewritten. Being able to choose at any time between using a voice command and using keystrokes is also an advantage.

Using the system in practice splits into the occasional task of setting it up for a new user or a new application, and the routine process of using packages enhanced with voice. SCS comes with a set of utilities for setting things up. After turning on the Professional and booting MS-DOS, you type SCS and the utilities menu comes up. Having selected the transparent keyboard option, if a vocabulary already exists for the package you are interested in you can just type its name.

We have reproduced a screen dump showing part of a Lotus 1-2-3 vocabularly as displayed by the SCS utility. On the left-hand side are the phrases, on the right the Lotus command sequences. You can type in alterations or delete any vocabulary entry or all of them. Creating a new vocabulary uses this same on-screen editor.

To train the system to recognise a new user you hit the Enrol All function key. The system highlights each phrase in turn, and you say it into the microphone. It can take several passes to get a good match on all the phrases. It is up to you how reliable

Other speech-input products

To be truly useful in a general office environment a speech-input system must be able to work with ordinary, unaltered, commercial software packages. At present, this ability is confined mostly to the more expensive systems. The products discussed here all claim to be able to do this, and mostly come with vocabularies already set up for common business packages like Lotus 1-2-3 or WordStar.

The **Votan Voice Card** for the IBM PC functions in a similar way to the TI system. Your utterances generate appropriate ASCII strings as if from the keyboard. What you get for your £1,950 plus VAT is the plug-in card itself, a microphone, a speaker and utility software on disc. A telephone modem is also included, though Votan's U.K. distributer Voice Input Ltd, says it has not yet received BT approval.

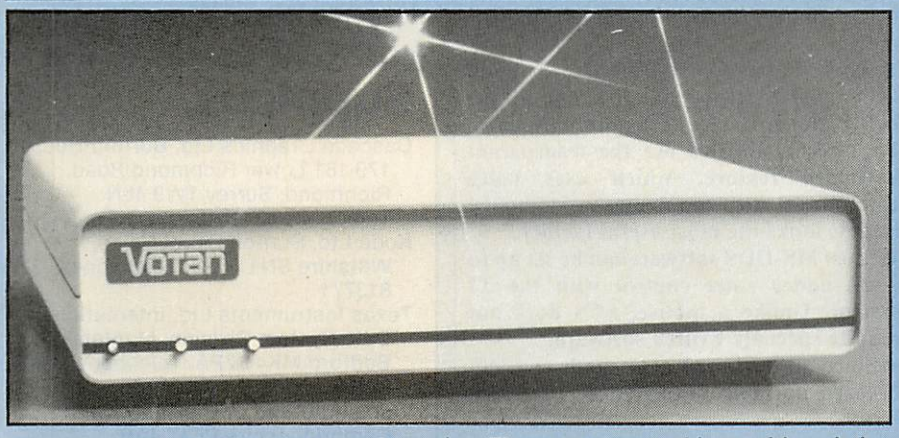
Another product for the IBM PC is **Vocalink,** available from Kode in the U.K. It costs slightly less at £1,570 plus VAT, but this price does not include microphone, speaker or modem, Vocalink again offers a transparent keyboard facility, and comes with vocabularies and utilities on disc.

Both products aim to use as few system resources as possible on the IBM PC so your other software will run normally. They are virtually separate computers in their own right. Vocalink, for instance, comes with 128K of RAM, 32K of software in ROM and has its own on-board 16-bit Intel 80186 chip.

Add-on boards for eight-bit micros are generally less powerful in raw hardware terms, but can still offer a useful transparent keyboard capability. VMC's **Voice Input Module** for the Apple II, for instance, has an eight-bit Motorola 6803 processor on board, 4K of software in ROM, and 8K of RAM to hold the user's utterances and their associated ASCII character strings.

The VIM accommodates vocabularies of up to 160 words or phrases, according to the manufacturer, Voice Machine Communications Inc. The price of £885 plus VAT includes headset and a disc with VisiCalc and other vacabularies already set up. In the U.K. the VMC VIM is available from Cascade Graphics. Voice Input Ltd offers a competing Apple II board from Scott Instruments, priced at around £825 plus VAT.

Some speech-input systems take the form of separate extension boxes rather than add-on cards, plugging into an RS-232 port. This approach gives compatibility across a wide range of eight- and 16-bit personal computers, and will also work with larger systems using separate display terminals. Examples are the **Interstate Electronics SYS-300,** available in the U.K. from Kode, which costs £1,900, and the **Votan Terminal,** obtainable from Voice Input Ltd, which costs £3,250 plus VAT. Both units have their own 16-bit processors and substantial amounts of memory, and offer sophisticated features including transparent keyboard emulation.



Left: The Votan VTR 6000 Terminal can be plugged into an RS-232 port

you want any particular phrase to be — the more samples the SCS has to work with the better. The Test option lets you check how good the current fit is; it highlights each phrase in colour as you say it, the particular colour indicating how unambiguous the match is.

In practice, enrolment of a typical package vocabulary of 40 or 50 words takes about 10 minutes. Each user has to go through this enrolling process before they can use a vocabulary, with a different name, for each user. Vocabularies can be printed out to remind you which commands are in the vocabulary.

For routine use of voice-enhanced packages it is probably best to set up an ordinary MS-DOS batch file to pull in the appropriate vocabulary and invoke the speech command system. The package comes up in the same way as normal, and can be used in the normal way. If, however, you say "Format" your fingers will not have to type your normal formatting command sequence.

There are some problems, although they can be overcome with a little thought. One of the virtues of SCS is that it can detect command words even if they are embedded in other speech. "Well I suppose it's about time to Reformat, oh trusty computer" works just as well as "Reformat". However, "Don't Reformat — Aaagh!" also reformats.

Apart from watching what you say or leaving particularly lethal commands to your fingers, you can get round this problem to some extent by creating lower-level vocabularies. The system allows you to have among your 50 words or phrases the name of other vocabularies. When you say one of these, here is a half-second delay after which another 50 words replace those you were working with.

For instance, you could put all your most destructive commands in a sub-vocabulary called Restricted. To delete a file you might than say something like: "Restricted (pause) Kill File (pause) Unrestricted". The last word here gets you back into your normal vocabularly.

Chain vocabularies like this is also the way to increase the number of words available to you. Up to nine vocabularies can be used in any one application, which gives you 450 words or phrases if you are prepared to accept a half-second delay whenever you switch vocabularies. In practice there is not much point exceeding 50 words for most applications, because you have to remember them. A small vocabulary with a well-chosen set is usually better than an over-elaborate one.

The reason there is any limitation on vocabulary size is that the voice template created by the SCS to correspond with each phrase takes up an appreciable amount of memory. Heavy memory use is a general characteristic to all present-day speech-recognition systems and is one of the fundamental problems to be overcome. Before anything like a completely speech-driven word processor, for example, can become a reality either memory prices will have to fall dramatically or a conceptual breakthrough will have to occur.

Toys experience

TI has, in fact, developed an exceptionally compact method of representing speech, drawing on its experience with the Speak n'Spell learning toys. One second of speech typically takes 1,200 bits using the TI method, as against probably 20,000 bits per second for a

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straightforward sampling method of digital encoding capable of the same discrimination. This not only saves space, but it makes possible the accurate real-time matching of the 50 phrases in the vocabulary against what is being said.

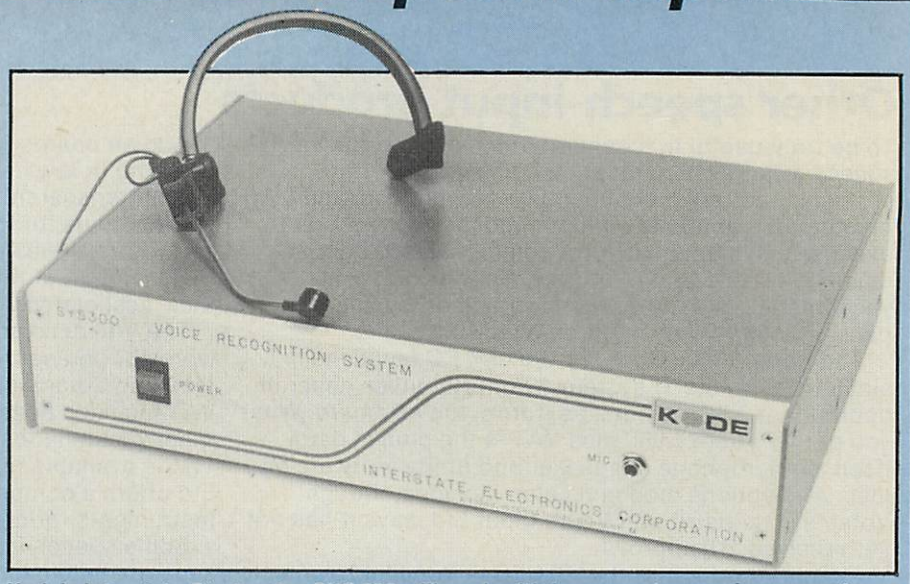
Chip developed

The SCS card contains a processor chip specially developed by TI for speech applications, the TI 320 DSP. It is a 16-bit processor optimised for fast 32-bit wide artithmetic. The microphone signal is first processed by filters which isolate the most significant part of the spoken sound spectrum. This is then analysed against a 12-parameter model of how the vocal tract produces sound. A heavily computation-intensive analysis technique called linear predictive coding is used to derive the parameter values from the signal. In the space of each second 50 sets of parameters are collected and stored.

The same hardware is obviously suitable for voice output, since what is stored are the values necessary to resynthesise your voice. The TI system is equipped with a loud-speaker, and SCS comes with dictation utilities which let you store and play back your own spoken messages on disc or, more usefully, incorporate them in your own Basic programs.

Telephone system

TI has a Telephone Management System awaiting BT approval. Used in conjunction with SCS it will let you enter data or control your system down the phone. With this system, computer-generated spoken messages will come into their own. The TI system looks like being capable of ringing up 150 people from a phone list and telling them things in a robotic voice. The age of mechanised telephone junk mail is about to dawn.



Kode's Interstate Electronics SYS-300 will work with larger systems using separate display terminals, as well as with personal computers.

Conclusions

● Despite the limitations, voice input has reached the stage where it has to be taken seriously. In fact, speech input is in many ways better than the much-vaunted mouse.

● The Texas Instruments Speech Command System looks like one of the better modern voice-recognition systems. For ordinary office use the transparent keyboard feature, which uses voice commands to supplement keyboard intput, looks the most useful facility.

● Most MS-DOS software can be set up to work under voice control with the TI system. Unlike a mouse, SCS does not require specially written software.

● Since all keyboard commands can still be used normally, experienced users are not frustrated by software designed to be user-friendly to beginners.

● The TI SCS utilities are fairly easy to use, and features like the TI Professional's colour capabilities are used well.

● Speech output is well used in the SCS demo program, but this facility seems likely to be of little practical interest until further products emerge to link the system into the phone network. ■

Suppliers

Cascade Graphics Ltd, Burford House, 179-181 Lower Richmond Road, Richmond, Surrey TW9 4LN. Telephone: 01-878 4072

Kode Ltd, Station Road, Calne, Wiltshire SN11 0JR. Telephone: (0249) 813771

Texas Instruments Ltd, International Data System Division, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466 ex. 3722

Voice Input Ltd, 7 The Quay, St. Ives, Cambridgeshire PE17 4AR. Telephone: (0480) 301852

```
Vocabulary Name: E:LOTUS002   Description: LOTUS DEMO

     Phrase                        Equivalent Keystrokes

  1 _ LET'S GET STARTED            123^0D
  2 _ CONTINUE                     /^1B^1B^1B
  3 _ MONTHLY FORECAST             /FRFORECAST^0D
  4 _ ANNUALIZED SALES             /GNUMONTHLY^0D
  5 _ QUARTERLY FIGURES            /GNU1QPROD^0D
  6 _ STATUS REPORT                /FRINVENTOR^0D
  7 _ SORT BY                      /DS
  8 _ ON HAND                      DA10.Z17^0DPF10^0DD^0DG
  9 _ INVENTORY ANALYSIS           /GNUOHANAL^0D
 10 _ PROBLEM ACCOUNTS             /FRACCOUNTS^0D

Options: F1 - Next Screen   F4 - Enroll All   E - Enroll   A - Add Entry
         F2 - Prev Screen   F5 - Update All   U - Update   D - Delete Entry
         F12 - Line Select  F6 - Test                      M - Modify Entry
Active Line: Mic/Speaker  Headset  Phone      ESC/BRK - Main SCS Menu
```

Screendump of transparent keyboard vocabulary utility.

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C Compiler		£399	PERSONAL BASIC Int		£107	
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Write on

Glyn Moody discovers the difficulties current technology has in coping with an age-old method of communication.

CHOOSING an input mode is largely a matter of horses for courses. However appropriate voice input may be for command sequences and even eventually for continuous text, as a means of inputting streams of numbers it is probably slower than direct keyboard entry. Similarly, visual input systems score when complex non-alphabetic or non-numeric information is being handled, though they lose out in accuracy and density of storage.

Using handwritten input might seem an ideal way for interfacing with a micro. After all, no special skills are required, and unlike voice input, for example, where surounding noise can cause problems, there are no problems of background environment. In fact, current technology imposes severe constraints on the use of such input. Although drawing pads have been available for some time which allow line drawing, space infilling and basic geometrical figures to be combined with text entry, adding the necessary degree of intelligence needed to recognise and distinguish alphanumeric characters represents a considerable leap.

Grid entry

So handwritten character-recognition systems limit severely the range of acceptable input. Apart from defining basic letter and number shapes, even the order in which pen strokes are entered and their direction — up or down — may be prescribed. A common technique is to use a grid entry system that allows for greater control over variations in input.

Quest's Micropad terminal adopts such an approach. A grid of 16 by 32 squares lies on a touch-sensitive pad. Text is entered using, say, pen or pencil, and a hand rest is provided to insulate the pad from direct hand pressure.

Various templates can be called from memory and overlaid on the A5-sized grid. Typically they consist of accounts information slips, registration forms and the like. Fields are set up as with database applications. Information can be entered anywhere on a form, in any order. The field selected is displayed on a 32-character single-line LCD, where it is also named. Malformed characters are signalled here by ? signs, and you can correct simply by overwriting.

Fields can be defined as alphabetical only, mixed, numeric, right justified and centred. The terminal's 16-bit TI 9900 chip checks that the input matches the pre-selected option. More impressively, the various figures entered throughout the form can be totalled automatically to another field, rather like defining relations between cells on a spreadsheet. In this way you can set up a sales invoice, say, where the total and VAT are calculated automatically and entered in the appropriate spaces.

On the character-recognition side, additional features include a lower-case facility. You enter text as normal, and select lower case by touching a command area with a pen. Also you can draw characters larger than the grid box size; the terminal simply establishes the centre of gravity of the input and places a normal-sized character at that point.

Forms can be set up by marking off squares on the grid. You can then link some of them together using the calculation facility. The process is relatively straightforward and the user is prompted throughout. The final forms can be saved to disc and coded under a two-character name. Forms are pulled into the terminal's one-page memory by writing the code on the pad. Once entry is complete, the data is stored to disc in the same way.

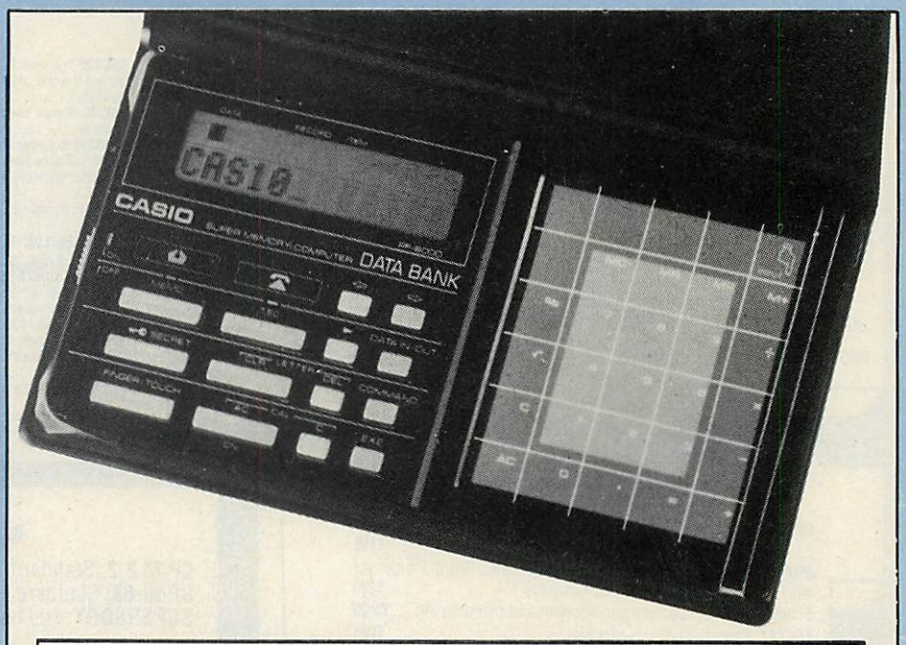
The host computer, which was an IBM PC in the review, is used only initially to download the software held on disc, and to store formats and completed data. The various fields' data can be accessed by other programs just like a standard database application. The Micropad uses an RS-232 port, and can act as an intelligent terminal to micros or minis.

Current users include government departments, the police and insurance companies, all of which have a high throughput of standard forms. Businesses using such fixed inputs may find that the Micropad's A5 size can handle their needs.

Slow and precise

However, whether they really need this kind of direct handling of information is debatable. On the plus side, it does allow users without specific computer training to input data into databases; the prompts are reasonably self-explanatory, and there is little that can go wrong either mechanically or in terms of system crashes. But the pad entry technique is rather slow: letters must be formed carefully and precisely, and errors corrected.

Similar constraints and considerations apply to Pencept's Penpad, distributed in the U.K. by Kode. A micro such as the IBM PC is used as a host computer, and a card is



FINGER INPUT (48 CHARACTERS)

A	A	F	F	K	K	P	P	U	U	Z	Z	4	4	9	9	÷	÷	)	»
B	B	G	G	L	L	Q	Q	V	V	Ø	0	5	5	•	•	=	=	:	:
C	C	H	H	M	M	R	R	W	W	1	1	6	6	+	+	%	%	SPC	_
D	D	I	I	N	N	S	S	X	X	2	2	7	7	−	−	√	√		
E	E	J	J	O	O	T	T	Y	Y	3	3	8	8	*	*	(	«		

Casio's pocket-sized PF-8000 accepts finger-written input of text and data, operating either as a calculator or a memo pad. The table shows the range of drawing styles recognised by the machine.

available that occupies one of the expansion slots. Unlike the Micropad, the Penpad uses a magnetic pen. A pulsed magnetic field generated in the head of the pen, which connects to the pad by a thin flexible wire, allows the position of the pen above the pad to be detected. A microswitch detects when the pen is actually in contact with the writing surface, and when input is to be accepted.

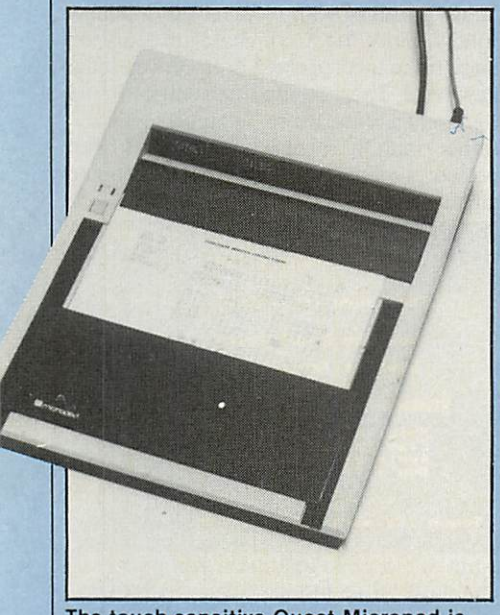
The capacity to hover over the pad, as distinct from moving over its surface, is utilised in a full-colour graphics capability. Such freehand drawing options have been available for some time on many home micros, and offer the possibility of rough freehand sketching. The Penpad scores in allowing the normal facilities of line, circle, rectangle drawing and colour infills to be used alongside a character-recognition system.

As the illustration shows, Penpad can mix pictorial input with alphanumeric characters in a wide range of sizes. The letter or number is input on the pad at the appropriate position, and drawn to scale. The computer attempts to recognise the character and redraws it to the nearest standard size. For larger characters this is rather crude but with practice words can be built up. However, it is not possible to input whole words at a time because the program attempts to analyse the entire input as a single letter.

Various options such as freehand, circles and colour changes are selected from a command area on the pad, which may be either a horizontal or vertical band. A command template is laid over the band and is calibrated before use by marking three of its corners with the magnetic pen. Touching the appropriate area on the template then activates various command options.

As with Micropad, the templates can be set up from a utilites program which is used to define specific functions for a particular area. Also like Micropad, you can set up the whole active area of the pad with a grid structure in which characters can be placed for standard forms. The actual grid size is software programmable. A lower-case capability is available through the use of half-height characters: they appear in the entry box in normal lower-case characters.

Templates have been produced for standard applications like Lotus 1-2-3 to allow comands and data to be input directly. The commands are called up either by writing the first letter of a command, or by using the magnetic pen as a mouse. The mouse function is produced by holding down a small switch on the pen; in other functions this can also act as a Carriage Return or Enter key.



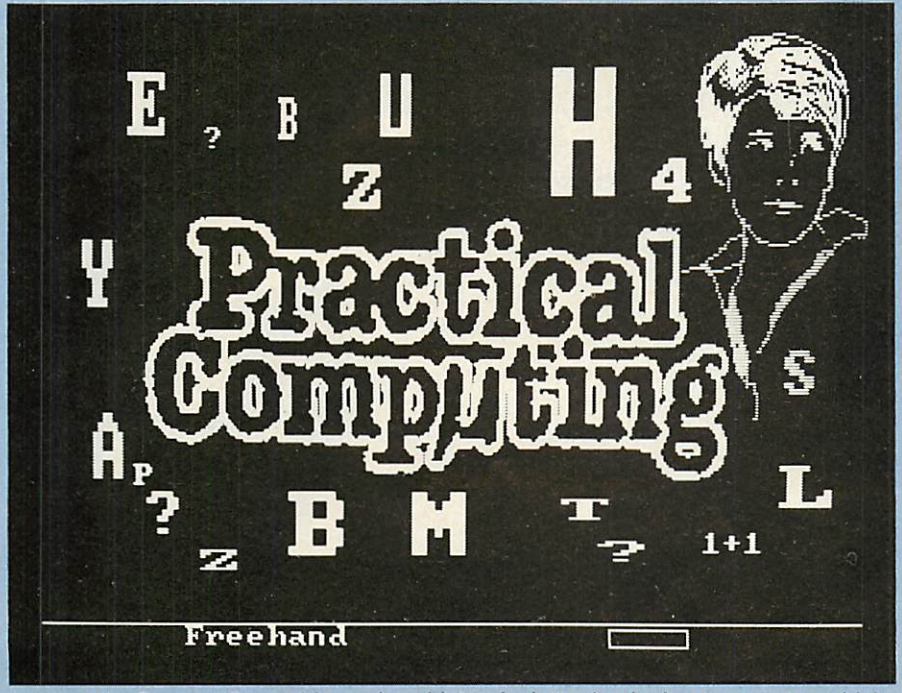
The touch-sensitive Quest Micropad is divided into a 16 by 32 grid, and text is written in pen or pencil on an A5 overlay. Unrecognisable characters can be corrected simply by overwriting.

Suppliers and prices

MICROPAD
Supplier: Quest Micropad, School Lane, Ford Industrial Estate, Eastleigh, Hampshire SO5 3YY. Telephone: (04215) 66321
Price: standard system £995, intelligent system £1,295; prices exclude VAT, and both systems require host computer. Software for IBM PC, Sirius, etc. supplied free.

PENPAD
Supplier: Kode Ltd, Station Road, Calne, Wiltshire, SN11 0JR. Telephone: (0249) 813771
Price: Penpad 200, terminal with screen, £1,985; Penpad 320, for IBM PC, £750; all prices excluding VAT.

CASIO PF-8000
Supplier: Casio Electronics Ltd, Unit 6, 1,000 North Circular Road, London NW2 7JD Telephone 01-450 9131
Price: £59.95 including VAT



Input to the Pencept Penpad is analysed letter-by-letter by the host computer, which reproduces it in one of several standard sizes. It also accepts freehand input and provides graphics facilities such as circle drawing and colour infill.

A4 work area

The 11in. by 11in. workpad can take A4 sheets either vertically or horizontally, allowing more flexibility than with Micropad and over twice the usable area. The magnetic pen will function through about 30 sheets of ordinary paper — that is up to 0.25in. A standard RS-232 interface is used to link up with the host machine. The control card contains a 10MHz 68000 chip with 128K ROM for dynamic character recognition in real time, as well as 128K RAM. In addition to the Penpad designed as a plug-in card for the IBM PC, there are also versions with and without screens that are designed to function as terminals to other micros, via the RS-232, and to minis and mainframes.

At the other end of the spectrum is Casio's PF-8000, which could well prove to be this year's executive toy. A pocket calculator-cum-computer, it offers all the standard arithmetical functions together with a small alphanumeric memory. The input mode is precisely the same as for the Micropad and Penpad.

As with the two micro-based systems, upper-case letters can be recognised within certain prescribed variations. The order the letter strokes are entered is crucial. You enter them by moving your index finger over a special touch-sensitive pad, which replaces the conventional keyboard. Characters appear on a 12-digit LCD the contrast of which can be adjusted by a knob at the side.

(continued on next page)

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There are two main modes of operation. As a straightforward calculator, figures can be entered by touching sections on the touch pad which correspond to particular numbers, or the finger stroke mode can be invoked and numbers drawn on the whole touch region. One advanced feature is the ability to calculate directly in this mode. Figures and arithmetical operations are entered in sequence; entering the sign then implements the calculation.

The non-calculator mode, which always utilises full alphanumeric touch pad, has two main facilities. One is a straighforward memo that allows up to 929 characters to be stored. The other is a telephone directory holding up to 253 entries of names and numbers, which are automatically sorted into alphabetical order. Output can be either sequential, or by direct search, or by initial letter. Information can also be entered in the Secret mode, whereby information is coded with a password which must be keyed in to access that data.

The Command key allows various system parameters to be displayed and altered. For instance, the finger input speed can be adjusted on a scale from 1 to 9, a buzzer can be switched on and off, and the amount of memory capacity used and the amount remaining shown.

Hit and miss

The PF-8000 uses CMOS technology and is powered by two removable lithium batteries as well as one memory backup battery. The whole unit weighs only 106g. and measures 5in. by 3in. Like the more sophisticated devices discussed, letter input is rather slow and can be hit and miss at times. Here at least the finger-pad entry serves a purpose: for limited entry of memos and telephone details it probably scores over the impractical keyboards normally offered on the credit-card sized calculator/computers.

However, the question remains to what extent this form of input is and will become viable. Straight text entry is far too slow and laborious with the present technology. The system comes into its own when standard forms with similarly structured information are being handled. The details can be fed in by relatively untrained operators, and the data saved to a central database. Even common transactions like sales lend themselves to this kind of application. For example, some retail stores are experimenting with pen tablets as a means of direct stock control at point of sale. Details are entered by the sales assistant, and the data is processed centrally where accounts and stocks are adjusted accordingly.

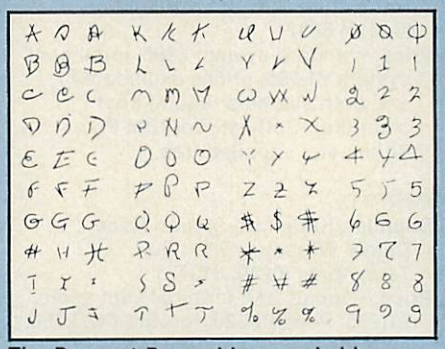
The real breakthrough will come when the basic mechanical technology of data capture using pen pads is married to some kind of artificial intelligence. Deciphering a written word can often depend on its context, where the baroque scribbles by themselves are ambiguous. For a full handwriting input system, a program that takes account of what is being written as well as how it is being written is necessary. As yet, the problem of natural-language recognition by computers remains unsolved. Computers still have difficulty coping with ambiguities like "Time flies like an arrow; fruit flies like a banana."

It is unlikely, too, that handwritten input will be appropriate by the time this occurs anyway. Voice recognition draws on similar techniques of pattern recognition, and taken with the same type of intelligent appreciation of context could provide the natural interface for most uses. Visual inputs will obviously remain appropriate for complex graphical details, and even form-filling applications are likely to be superseded by direct verbal input.

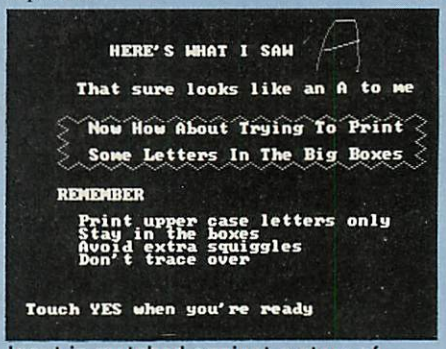
Until such time, pen pads and the associated letter-recognition techniques are likely to develop more into signature-verification methods, where it is not the content but the precise details of the input that are crucial. For example, it is not only the final form of the signature but the individual pen strokes, their speed and even their pressure that go to define its unique characteristics. A pen pad unit is ideal for examining them, and it seems likely that its use in this area will increase.

Extended range

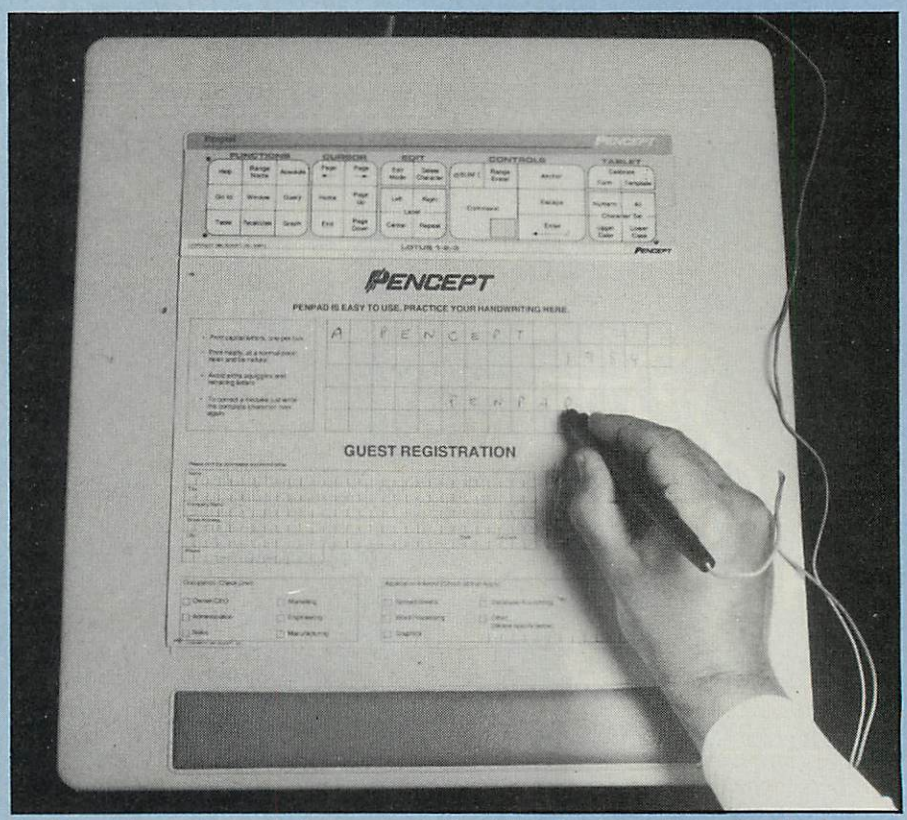
Other developments include foreign character sets. Obvious choices are the Russian, Cyrillic and Japanese alphabets. At the moment only the smaller set of Katakan characters is contemplated; the far larger group of Kanji letters will doubtless follow. Since the Kanji character set is too large to be incorporated on a conventional keyboard, direct handwritten entries would represent a real advance in input capability, rather than a mere alternative, as with present systems working with the Roman alphabet.



The Pencept Penpad is remarkably tolerant of the vagaries of handwriting.



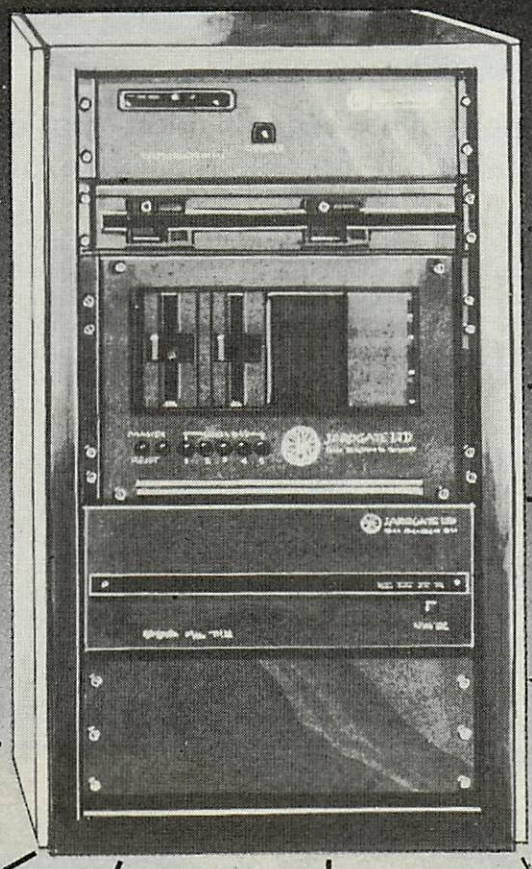
Input is matched against a store of standard letter forms.



The Penpad accepts inputs from a magnetic stylus. A microswitch in the head detects when it is in contact with the pad's surface, and a small button on the side allows it to be used in a mouse-like way.

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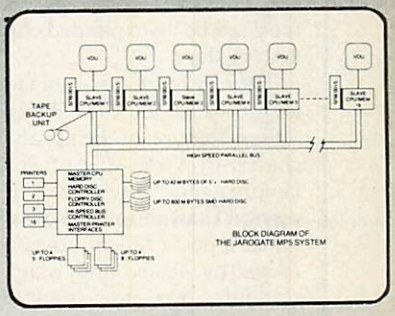
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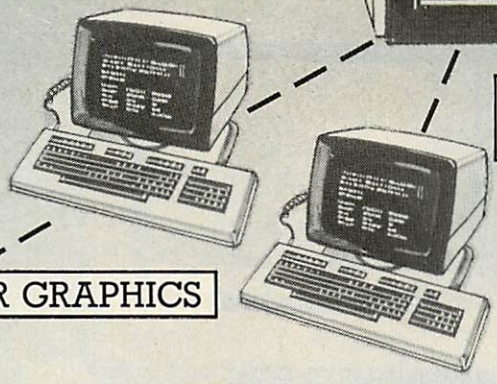
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Getting the image across

Chris Bidmead experiments with Wang's micro that can can digitise an image and print it out again. Is it more than a very expensive photocopier?

UNLIKE OLIVETTI with its M-24, Wang is not countering the huge threat of IBM in the PC market with an "if you can't beat 'em, join 'em" philosophy. The Wang Professional computer is not IBM PC compatible, and Wang's strategy is to sell that difference. The Pic, or Professional Image Computer, is an extension of the WPC that represents a large investment on Wang's part in software and hardware development to play that difference to the hilt.

Expanded chassis

The basic WPC was reviewed by *Practical Computing* in the July 1983 issue. A Pic system can be built up from it, but on the equipment demonstrated to us the standard five-slot chassis had been replaced by an expanded chassis with eight system slots.

The eight-slot box is bigger and heavier, and because of this Wang's ergonomic selling feature of being able to hang the chassis over the side of your desk is not encouraged. On the demonstration version I saw the chassis was firmly parked under a desk. Since it measured 59cm. by 25cm. by 38cm. and weighed 14kg., it certainly was not something to move around the office very often.

On the expanded chassis the on/off switch has moved from the back of the machine to share the front panel with the 5.25in. disc-drive slot and the 10Mbyte hard disc. Inside, the 128K of RAM on the motherboard has been expanded by a further 512K to accommodate the considerable demands made on memory by interfaces to a monitor and to a scanner.

The scanner height is adjustable to anything between 37cm. and 58cm. above the desk top, and photographs vertically downwards. Its power supply is American, and at present there are no plans to change it, so a transformer has to be added to make the adaptation to British power supplies.

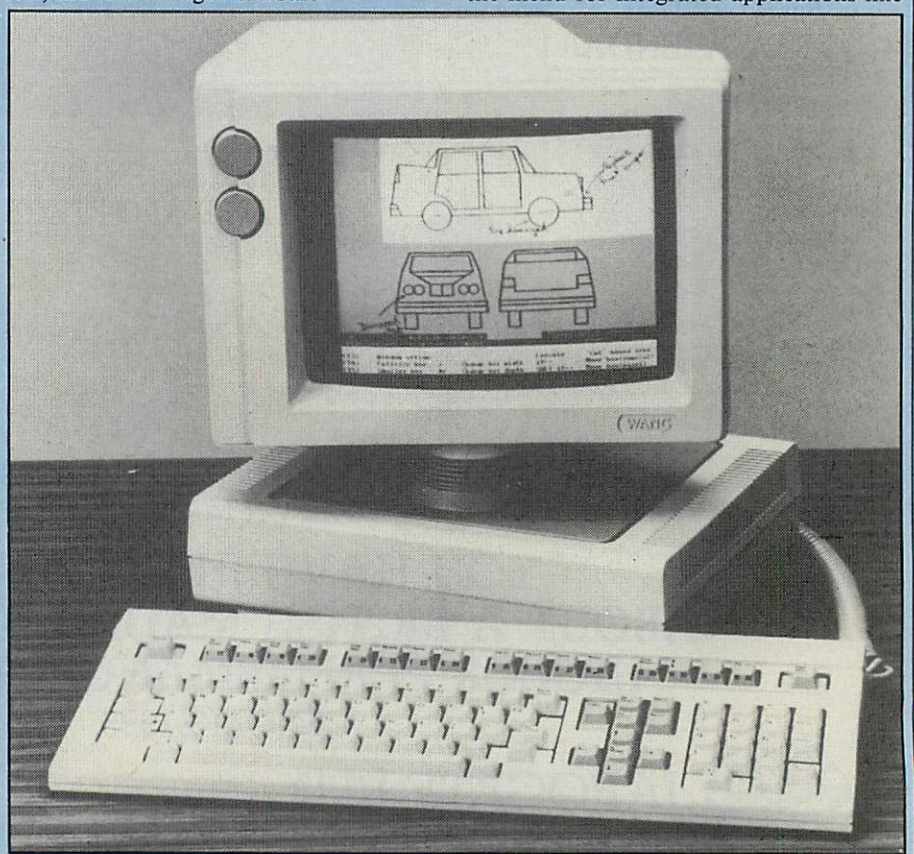
The system is available with a laser printer, the Lis-12, to give a printed image resolution of 300 dots per inch, printed out at up to 12 pages a minute. The Lis-12 is smart and at around £22,000 it should be. It includes software that can enhance the 200 dots per inch resolution to which images are internally stored in the Pic by deducing intermediate pixel densities and producing a final print resolution of 300 dots per inch. It also has its own built-in gallery of character sets, including the familiar Courier, Gothic, Prestige Elite and others, with results that are superior to an IBM golf-ball typewriter.

The simpler system we saw demonstrated uses a modest thermal printer costing a mere £1,500. Its 200 dots per inch pictures can be run off at around five pages a minute, depending on the density of the image. Specially treated thermal paper is fed through the machine from a roll, and torn off against a bar.

Despite data-compression techniques that Wang prefers to keep secret, image storage still demands a great deal of memory. Each one takes between 40K and 100K of RAM or disc space. So you will be lucky to store seven images per floppy, and cannot expect to get more than 100 images on the Winchester.

Everyday use

The Pic is designed for everyday use by office staff with no special computer knowledge. The whole system runs under MS-DOS, but it is possible to ignore this fact since all the functions can be accessed through a hierarchy of menus. The main Pic menu gives an option of image processing, image composition, entry to the menu for integrated applications like



Based on the Wang Professional computer, the Pic includes a high-resolution monitor.

word processing, making local communications, or accessing the remaining PC software, either through a menu or directly by way of the DOS command processor.

Wang micros sell to customers who have been brought up on Wang word processors, and the WPC's keyboard is therefore very word-processor orientated. It has not been specially adapted for the Pic functions, and in consequence a number of the single-keystroke commands are hardly intuitive. Hitting the Goto key from the main menu fetches an extended directory of the disc contents, showing the file name, which can be up to 35 characters long; the document type, for example, Formfill, Image, Notebook, Database, WP Document and so forth; plus there is a separate field for the author's name and for comments. Notable by their absence from a system of this price and quality are fields to record the dates when documents were created and last updated.

Reminders

We picked the image-creation option and gave the image the name Demo, at which point the screen cleared, displaying the title at the top and reserving four lines at the bottom for a menu of further options, namely Half Page, Portrait, Positive and Help. The Help key can be used to fill the screen with reminders of what the menu options do.

In default of anything better to offer the scanner we slipped a copy of the *Sun* on to the baseboard. Focusing and selecting the image size is achieved by means of an ingenious system often used in professional rostrum cameras. When you press a button marked Target on the head of the scanner a light is projected down through the lens, producing an illuminated grid on the material to be copied. A knurled knob on the stem raises or lowers the head until the grid is taking in the required amount of the image, and the final focus adjustment is made by rotating the lens until the image of the grid is crisp.

When the lens is in focus with the light travelling down on to the target, it will also be in focus when it travels in the reverse direction from the target on to the camera. A small lever on the head with positions marked from 0 to 10 can be used to limit the scan to select only portions of the whole image, its numbers corresponding to numbers that appear on the projected grid.

Anything up to a size of 11in. by 14in. can be copied, as long as it is reasonably contrasty and two dimensional. The system can pick out and store, for instance, a bar graph printed in a trade paper, signatures on a contract, a newspaper article or a handwritten entry in a card index.

By flicking a small toggle switch on the scanner head from Text to Photo it can also cope with photographs. Instead of storing them in a way that maps a single bit to each pixel of the camera, by setting aside three bits for each pixel it can save pictures in eight levels of grey.

One more step is necessary before the image can be photographed. Foldaway arms lever out on either side of the lens to position a pair of quartz-iodine lamps about 2ft. apart above the image for balanced lighting. The scan can be started either by pressing a button on the scanner head or from the keyboard by pressing the Insert key. The quartz-iodine copying lights come on and the image is visibly built up line by line on the screen, scrolling when the bottom line of the screen is reached. The process of image capture takes between four and 10 seconds.

When the lights go out the image remains on the screen and you can scroll back over it in much the same way as reading backwards over a body of text in a word processor. Our newly captured copy of the *Sun* was perfectly legible in this form, although because we had selected Text mode rather than Photo mode the photographs were of the stark high-contrast quality associated with photocopying. If photographs had been our prime interest we could have used the Photo mode, but Wang was not able to demonstrate this at the time of writing.

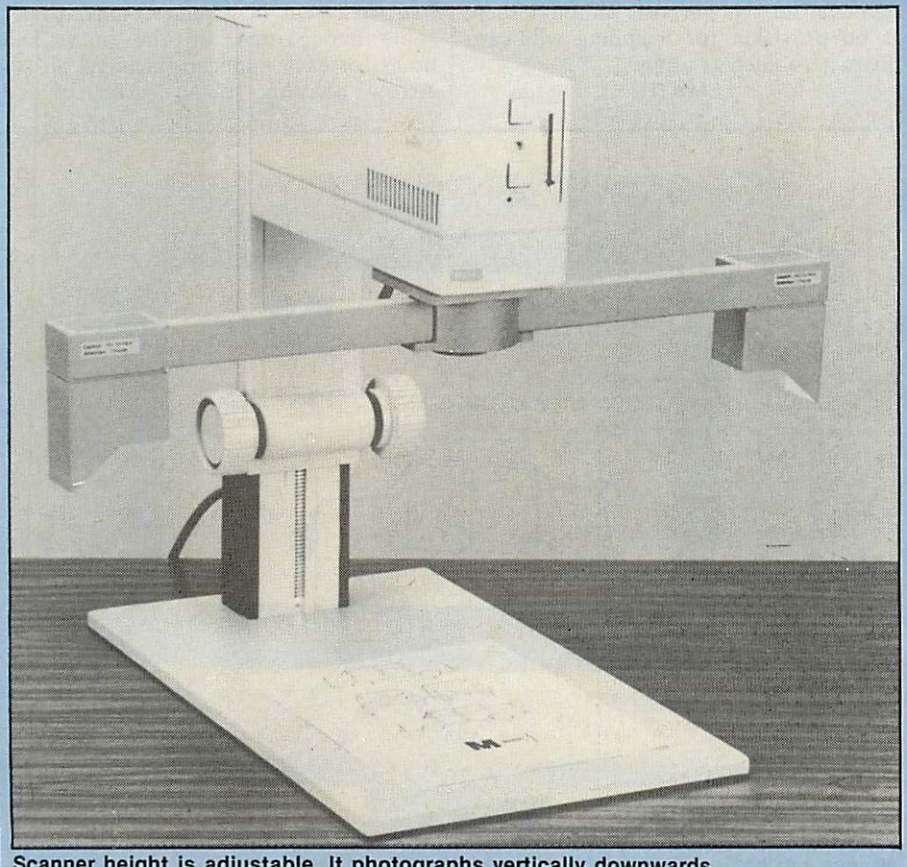
Limited

One limitation was the inability of the system to show the image on the screen prior to capture as a straightforward monochrome television picture, which would have been useful to adjust the setup to eliminate slight highlighting problems due to ambient lighting. Specular reflection from the surface of the copy can occasionally white out areas of the image, or where the highlight intensity is great, create dark areas due to signal inversion in the television camera. Wang says that this would not be a problem in practice because the imager setup would be in a permanent position in the office, where ambient lighting would be predictable and controlled.

While the image is still on the screen, a menu on the bottom four lines gives you the option of switching into full-page display, which squeezes the image down so that the whole page fits into the dimensions of the screen. Legibility is greatly reduced but this mode is very useful for studying the overall layout. A quarter-page option allows you to blow up a portion of the captured image to four times the size in order to study detail. You can also flip the image sideways, or convert the image to negative, for looking at, say, engineering drawings. In any of such modes it is possible to scroll up, down and sideways in either direction to the limits of the image.

At this stage the image is still only held in RAM and has yet to be sent to the disc. By hitting the Cancel key and then the Execute key, which must be a little confusing to the non-computer user, a thin horizontal line can be sent scanning down the screen, writing the image to the

(continued on next page)



Scanner height is adjustable. It photographs vertically downwards.

(continued from previous page)

Winchester drive. Like the original image capture, the whole process takes between four and 10 seconds. The screen then goes blank and presents a screen that offers you a return to the image you were last working on, or by hitting the Previous key, an exit into the main index.

By returning to the same Pic menu from which you select Image Creation, you can get into Word Processing mode to begin writing a text document by moving the cursor down over a list of options as follows: Image, Notebook, Voice, WP Document, Glossary, Text, Composite Formsfill, Database, Dictionary. The Voice option relates to a modem attachment still awaiting British Telecom approval and yet to be announced by Wang.

The WP Document options loads a special version of the standard Wang word processor with additional code to take care of image manipulation. Text is created in the usual way, but at any point an image can be selected from the disc and a part of it, or all of it, inserted into the text. Unlike image/text manipulation on a system like the Macintosh, the image and the text remain in completely separate parts of the memory, although they appear to be combined on the screen. This has the advantage that the image can be easily moved relative to the text, or even overlayed on it. Subsequently deleting or moving the image does not affect the text, and vice versa. Such independence remains even after the combined text and image has been saved to disc; the two are only indissolubly united when they are printed out.

The menu at the bottom of the page is used to pull in the image by way of an intermediate stage, Composite, which is called from the main menu. The required image is retrieved line by line from the Winchester into the composite buffer, and reappears on the screen.

Choosing the Cut option from the menu at the bottom of the screen, where options are denoted by two-figure numbers, produces a highlighted rectangle the dimensions of which can be altered by using the arithmetic keys on the keyboard. The Plus key widens the rectangle, the Minus key shortens it and the Multiply and Divide keys respectively increase and decrease its height.

The ordinary cursor keys are used to position the rectangle over the image. The Execute key then returns you to the text, with the square inserted at the point where you left the text cursor. Its position can be adjusted relative to the text until it is where you want it and hitting Cancel returns you to full word processing with the image in place. Additional text can then be written around the image, or ever superimposed on it, providing a useful way of captioning.

Although the Pic has provisions for selecting portions of the image, and gives a limited opportunity to alter the sizing according to the position of the imager head at the time of data capture, there is no way of rescaling the picture once it is inside the system. The ability of the Macintosh to pull and push images as if they were printed on the surface of a balloon is beyond the present capabilities of the Pic.

However, the image can be resited once it has been placed in the text, by again summoning up the high-intensity rectangle to box the image and shifting it across the page. Image and text are linked only by an address pointer, which appears to the user as a small Up Arrow text character. To remove the image from the text you position the cursor over the Up Arrow and delete it as though it were an ordinary character. In other setions of the software the Up Arrow is used with the same meaning and can appear as a reminder that a picture is associated with the text.

Image handling has also been added in to the WPC Notebook and Database software. As its name implies, Notebook serves as a free-form database system, allowing the user to enter text from the keyboard without any constraint of field names or field length. The individual records, all of varying sizes, are separated from each other by a border of dashes and asterisks but otherwise the Notebook screen resembles a screenful of word-processing text.

The Notebook records can be searched for particular string patterns, upper- and lower-case letters being regarded as identical for this purpose, although there is no provision for including wild-card characters, such as using

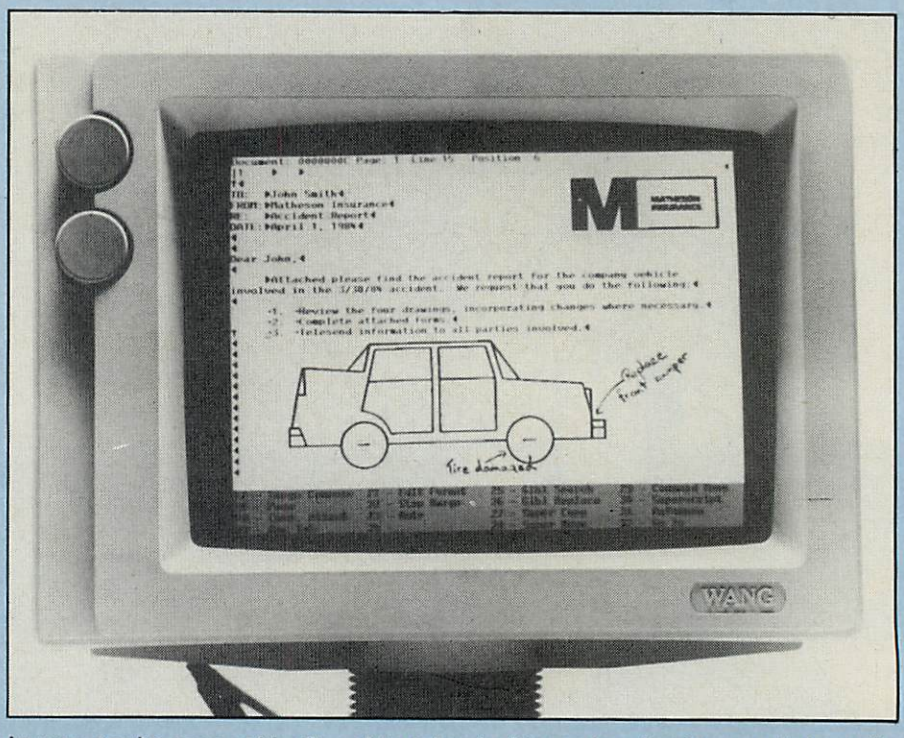
SM*TH

to search for somebody called Smith or Smythe. Neither is there any provision for searching for specific words found in combination, or within a particular number of characters from each other: for example if you wanted to find every record where Wang appears within 100 words of the word Image. Some of the new free-form database systems available under MS-DOS and CP/M, like Zyindex from Zylab, and Program-Makarna's Search and Find, allow searches on far more sophisticated criteria, and Wang's Notebook is a disappointment in comparison.

Prompts

If more than one record matching the search criterion exists a prompt appears to tell you. The only point of departure from standard WPC Notebook software is in the provision made for associating images with the text. Here the arrangement differs from the word processor: the images are not interleaved with the text, which has the advantage of helping to speed up the business of flicking through a series of entries in search of a particular set of data. Instead the presence of an Up Arrow advises the user that an image is attached and it can be brought to the screen by positioning the cursor over the Up Arrow and hitting a single key.

The demonstration Notebook contained a series of notes taken about job applicants as they might have been transcribed into the computer from a dictating machine. But the job applicants had each sent in résumés, some typed, some handwritten, so the transcribed notes for each applicant included an Up Arrow pointing to an image of the



Images can be any combination of text, handwritten notes, drawings or photographs.

résumés. Further pencilled notes scribbled on the résumés by the interviewer were also perfectly legible on the stored image.

Formsfill is a program that allows data to be entered at the computer keyboard and typed directly into an image of a printed form that has been previously photographed and stored. The demonstration data had been collected by capturing the image of a standard office form and using it to supply the layout and field structure for screen entry from the keyboard.

Indulgence?

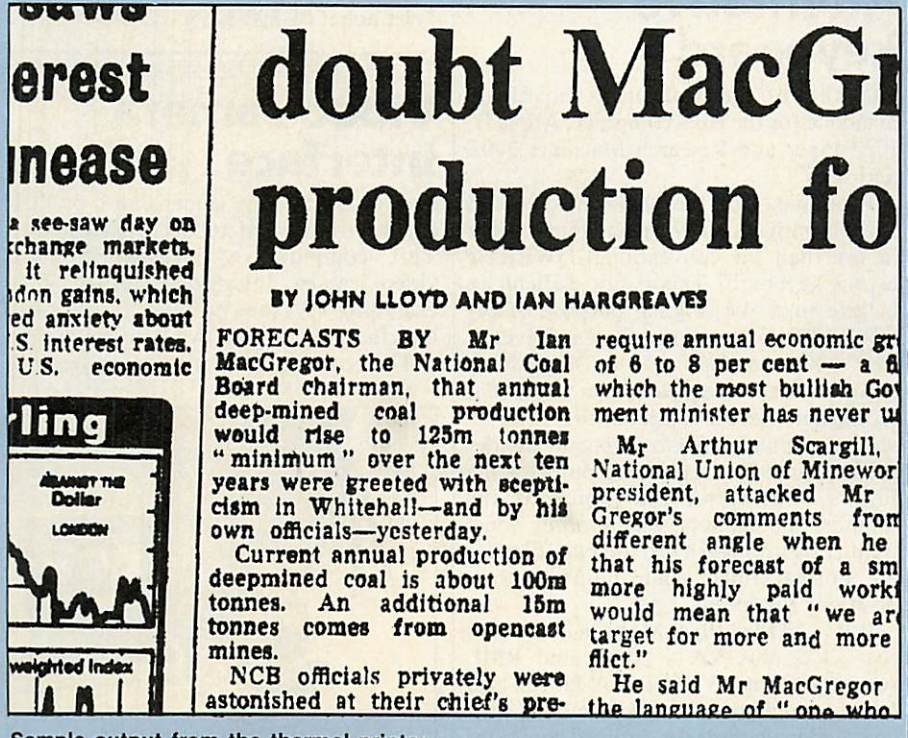
The advantages of this rather expensive way of setting up a form on the computer are not immediately obvious, but there is a case to be made for the technique. In a company where some departments are not computerised, computer-filled forms can easily be mixed with handwritten forms. If forms have to go out to the general public in the shape of invoices or insurance dockets, company logos and fine print can be included as necessary without additional programming. Setting-up time can be saved where complicated forms that are already being used around the office are converted to computer inputting, with the assurance that staff will not be disconcerted by any rearrangement of the traditional field layout. However, customers should have more than just this one use for the Pic if it is to be more than a very expensive indulgence.

Formsfill can also be used to set up a transactional database. By establishing one of the fields as an image field it is possible to link it to a second form, and via that one into a third and so on.

The Wang Pic thus represents an almost complete merging of text and image. It is not quite complete because one of the first questions the lay user is bound to ask is "Why can't the machine translate written document images into text I can manipulate with the word processor?" Unfortunately the kind of character-recognition computation this requires is still in its infancy. Although Wang is putting in a lot of development time into the subject, it seems likely that something more beefy than the existing Pic hardware will be needed.

However, image to ASCII translation is not as necessary as it first seems, and the Formsfill option demonstrates how far you can go without it. You do not have to translate a field called Employee Name into ASCII for the database system to recognise it as a tag. It is enough for the software to supply an internal field name, which the user need never know, and determine when data is to be connected to the tag from the position it is typed in on the screen.

A similar philosophy applies to the structured database which, unfortunately, is still a separate module of Wang's integrated suite. In a large conventional database system it may not be required or be practical to be able to search on every single field. So the fields you will not be searching on might as well be images as text. In effect what the Pic structured database system does is to tie textual captions to the stored images, and allow searching on the captions. Such an approach makes it possible to create a large indexed database system very quickly from existing typewritten, printed or even handwritten material.


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BY JOHN LLOYD AND IAN HARGREAVES
FORECASTS BY Mr Ian MacGregor, the National Coal Board chairman, that annual deep-mined coal production would rise to 125m tonnes "minimum" over the next ten years were greeted with scepticism in Whitehall—and by his own officials—yesterday.
Current annual production of deepmined coal is about 100m tonnes. An additional 15m tonnes comes from opencast mines.
NCB officials privately were astonished at their chief's pre-
require annual economic gr of 6 to 8 per cent — a fi which the most bullish Go ment minister has never u
Mr Arthur Scargill, National Union of Minewor president, attacked Mr Gregor's comments from different angle when he that his forecast of a sm more highly paid worki would mean that "we ar target for more and more flict."
He said Mr MacGregor the language of "one who

Sample output from the thermal printer.

The Integrated Database menu offers the following options: Access Data, Edit Definition, Select Definition, Create Record Definition, Create New Definition, Change Database (Replc), Select Option (Execute) and Exit (Cancel).

As with Formsfill, databases can be arranged hierarchically and the tree structure is made clear by the way their names appear in indented form in the directory of databases, which is confusingly called the Index. The database does not use highlighting or inverted video to distinguish between field names and data, which makes data entry and retrieval more confusing than it need be.

Advantages

The advantage of the Database over the Notebook is that Boolean manipulations can be applied to search criteria, and wild cards can be used. Field values, whether ambiguous or explicit, can be Anded or Ored with each other, using a space and the vertical-bar character respectively as operators. Numeric values can be compared against supplied limits, the colon being used to denote a range of two values. For example you could look for people with salaries lying between £12,000 and £15,000 by specifying 12000:15000 in the salary field. Alternatively a range of dates can be used, bearing in mind that the date type is in U.S. format.

The structured database file I saw was built up from what might have been part of an estate agent's records. Vendor's name, address and a brief description of the property were held in conventional ASCII record. But an additional field called Image offered a gateway into a pair of images attached to each records: one showing the property in plan, the other depicting a front view derived from a photograph or architect's drawing. Again, you can blow up a quarter of the image to fill the whole screen and you can intensify or lighten the dark pixels for maximum legibility.

Conclusions

● The Pic is scheduled to be available in the U.K. in November, but at £13,000 for the demonstration system, it is not for the casual home user. But with video camera technology rapidly simplifying around the concept of photo RAM chips, it certainly points the way that affordable hardware might be going in the near future.

● The system has potential but most of the activities I saw demonstrated could have been carried out with an ordinary hard disc PC and a photocopier. The Wang PC left me with the powerful sense that perhaps we can find surprising new ways of using our existing equipment. If this thought saves you £13,000, donations can always reach me via this magazine.

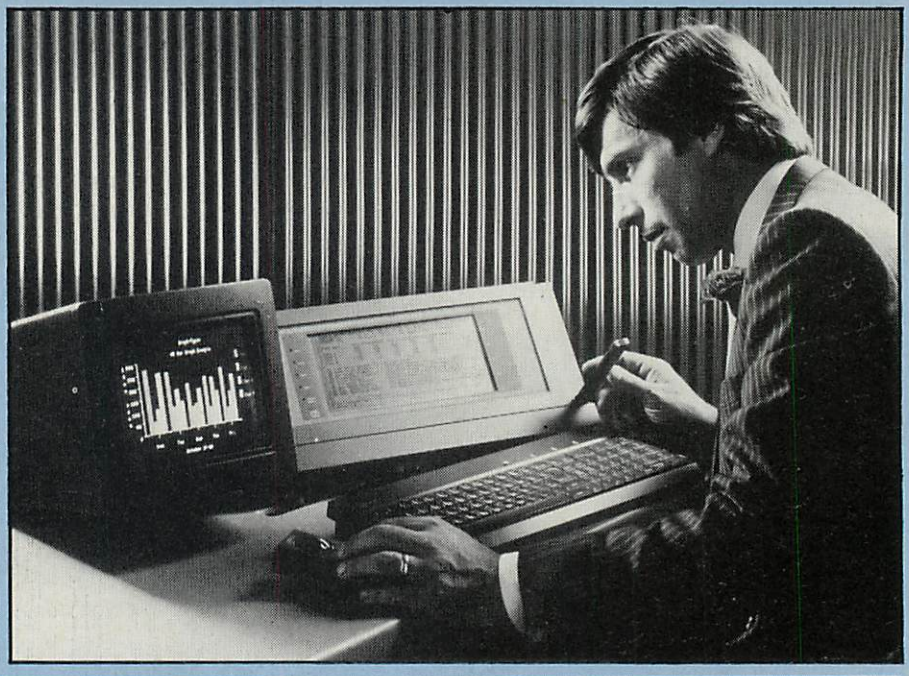
ACT backs voice

ACT's new apricot Portable is the first personal computer on the market which comes with speech recognition as a standard feature. Costing £1,695 for an 8086-based system with flat LCD screen, 256K of RAM and single 720K disc drive, the portable comes complete with a microphone and bundled software which includes two voice-driven packages.

ACT says the voice-input system can also be set up to work with most commercial MS-DOS packages, with spoken words producing character strings as if they were being typed in at the keyboard. A vocabulary of 64 words can be active at any one time, and according to ACT up to 64 vocabularies can be swapped in with minimal delay from disc.

The ACT portable also features an unusual double-sided mouse which can be used as a trackball if you turn it over. Both the mouse, which is available as an option, and the system's keyboard use a cordless infrared link to connect to the main unit.

Details from ACT (U.K.) Ltd, Shenstone House, Dudley Road, Halesowen, West Midlands B63 3NT. Telephone: 021-501 2284.

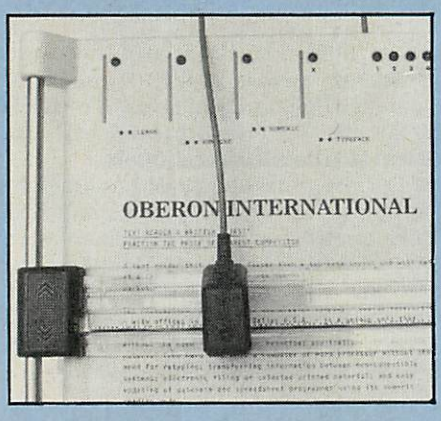


Omni-Reader

OMNI-READER lets you input ordinary typewritten or printed text into any computer equipped with an RS-232 interface. Scheduled for availability in the U.K. before the autumn, the price of £400, excluding VAT, places Omni-Reader well within the range of many personal computer users.

Omni-Reader consists of a flat board on to which you clip the document you want read, and a stylus containing a reading head. You enter text by moving the stylus line by line through the text. After each line the Omni-Reader beeps to confirm that the line has successfully been converted to ASCII.

Omni-Reader is capable of reading most typed or printed founts as long as it is first given a sample of text written in the appropriate order with which to calibrate itself. Omni-Reader's manufacturer, Oberon, says it will be supplying predefined founts in popular disc formats which will allow faster data entry speeds up to about 20 cps. Four standard founts come built-in with the system.



Interface software to allow Omni-Reader to be used to input text directly to packages using non-ASCII formats like Lotus 1-2-3 and WordStar will also be available for the IBM PC, Apricot, Macintosh, Apple II and BBC computer. Contact Oberon International, Unit A2, 2 Hall Road, Maylands Wood Estate, Hemel Hempstead, Hertfordshire. Telephone: (0442) 3803.

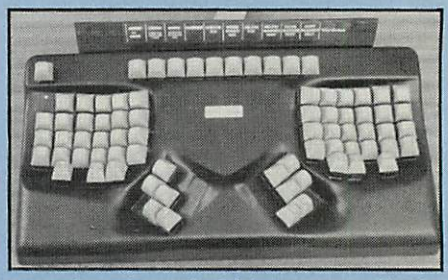
Alternative keyboard

VERSIONS of the Maltron keyboard are available for the BBC computer, Apple II, Pied Piper and Research Machines 380Z and 480Z.

Proponents of the Maltron keyboard say it is both easy to learn and much faster in use than the conventional QWERTY layout keyboard. This is not difficult to believe since the original purpose of the QWERTY layout when it was devised, over 100 years ago was to slow down typists because early mechanical typewriters were easily jammed.

The alternative Maltron layout divides the keys into two sculpted groups for the fingers, and two separate groups for the thumbs. The letters which occur most frequently in English text are placed under the normal finger and thumb resting-positions for speed.

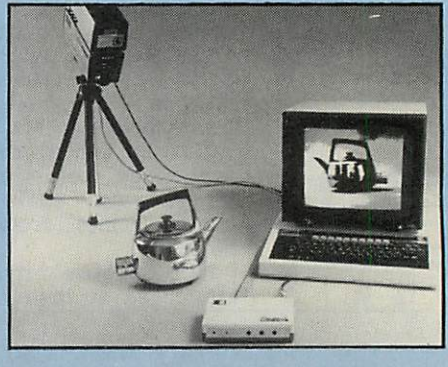
BBC and Pied Piper Maltron keyboards cost £175 plus VAT, Apple and RML version £295 plus VAT. PCD Maltron also makes single-handed and mouth-stick operated keyboards for disabled computer users the prices of which are generally the same as for Maltron keyboards. Details from PCD Maltron Ltd, 15 Orchard Lane, East Molesey, Surrey KT8 0BN. Telephone: 01-398 3265.



Video camera interface

IMAGES from video camera, disc or VCR can be transferred to the BBC or RML 380Z computers with Data Harvests's video camea interface. Costing £174 excluding VAT, the product consists of an interface box and software on disc.

The box converts signals from the video



source into a 220- by 312-pixel computer image, taking four seconds to process one image. Colour information in the original is ignored but the system creates a false colour image based on discriminating 64 levels of light intensity. The disc contains utilities to change the colour palette, manipulate the image in various ways and output it to printer or disc.

Details from Data Harvest Ltd, 28 Lake Street, Leighton Buzzard, Bedfordshire LU7 8RX. Telephone: (0525) 373666.

Spectrum speech recognition

MICRO COMMAND lets you control the Sinclair Spectrum with spoken commands. Priced at £50 including VAT, it consists of a box which plugs into the back



of the computer, a microphone, and a cassette containing utilities and a voice-controlled game. Micro Command cannot be used with unmodified existing software, but you can write your own Basic programs to work with it.

Contact: Orion Data Ltd, 3 Cavendish Street, Brighton, East Sussex BN2 1RN. Telephone:(0273) 672994.

Commodore 64 video imaging

A COMMODORE 64 version of Digithurst's popular Microsight digital imaging system has joined BBC, Sirius, IBM, Apple II, Research Machines and HP Model 16 versions already on the market. Costing £495 excluding VAT, the Commodore 64 version consists of a video camera, interface box and software.

The software lets you perform measurements and manipulations on the image, and will work on a cassette as well as disc-based Commodore 64 system. Details from Digithurst Ltd, Leaden Hill, Orwell, Royston, Hertfordshire SG8 5QH. Telephone: (0223) 208926.



Input lab weights

MICROSCALE is an electronic balance which connects directly to the BBC computer. Weights up to 1,000g. can be measured with a resolution of 1g. while smaller weights can be measured with a resolution of 0.1g.

Microscale costs £149 excluding VAT. Contact: Cherlyn Electronics Ltd, 22 High Street, Histon, Cambridge CB4 4DJ. Telephone: (022023) 4062.

Spectrum tracer

EDUCATIONAL SUPPLIER Griffin and George offers digital tracers for both the Spectrum and BBC micros. They let you copy original artwork and illustrations into your computer, and can be used for freehand drawing.

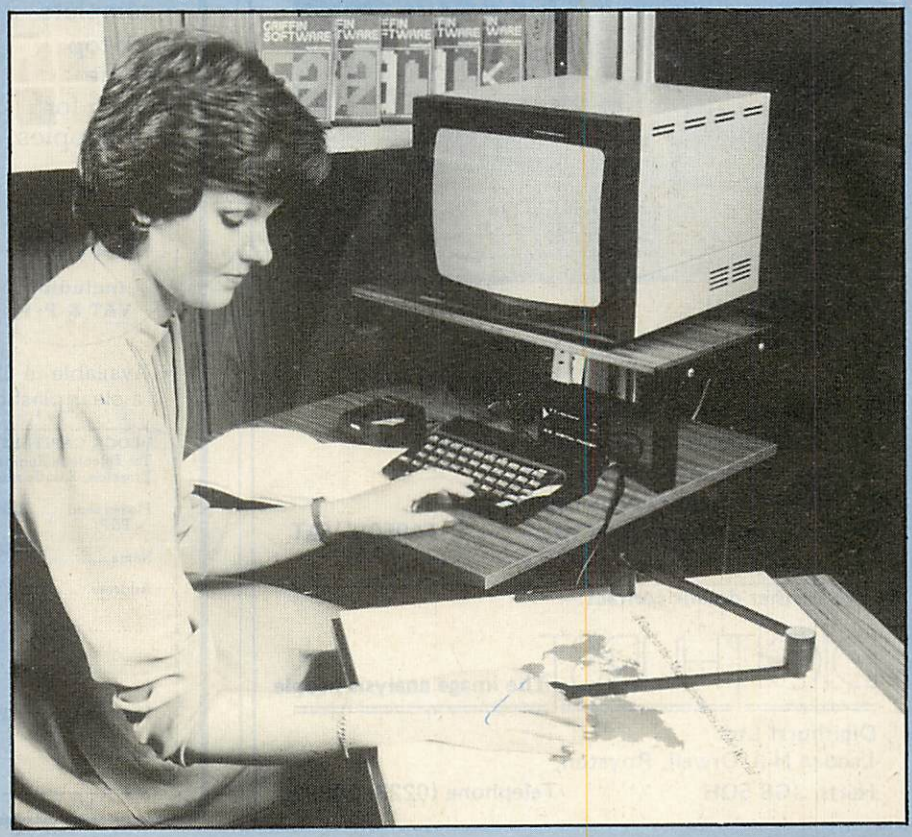
The Griffin and George tracers cost £61 for the BBC version, £48 for the Spectrum — prices exclude VAT — and come with cassette-based software to shade and scale plus other image manipulations.

Details from: Griffin and George, 285 Ealing Road, Alperton, Wembley, Middlesex HA0 1HJ. Telephone: 01-997 3344.

Trackball

THE Wico trackball for the Atari and Commodore computers will mainly be used for games, but for many serious applications it provides superior control to the joystick. It costs £45.

Details of Wico products from CGL Ltd, CGL House, Goldings Hill, Loughton, Essex IG10 2RR. Telephone: 01-508 5600.



MicroSight



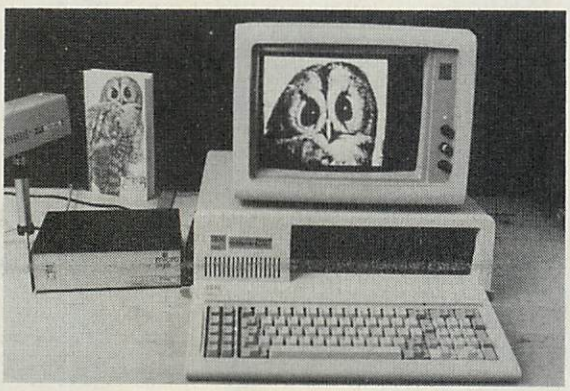
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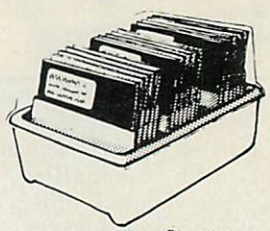
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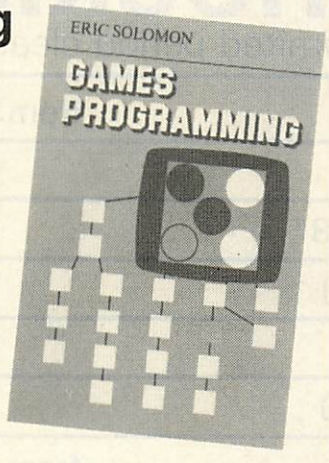
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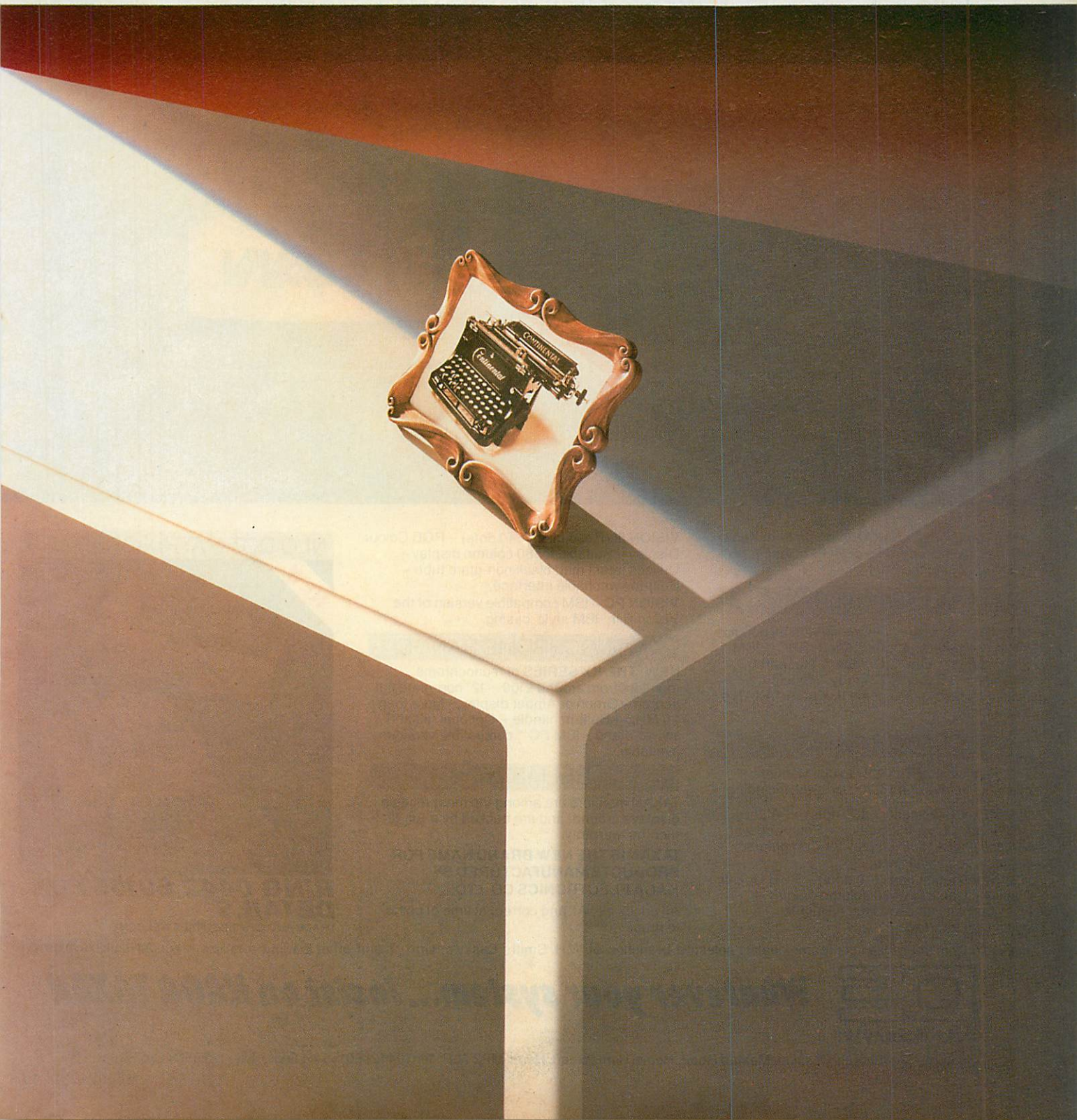
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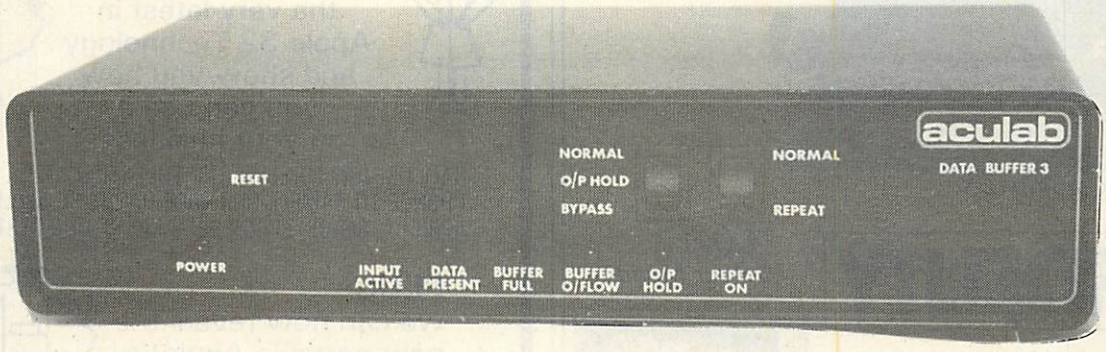
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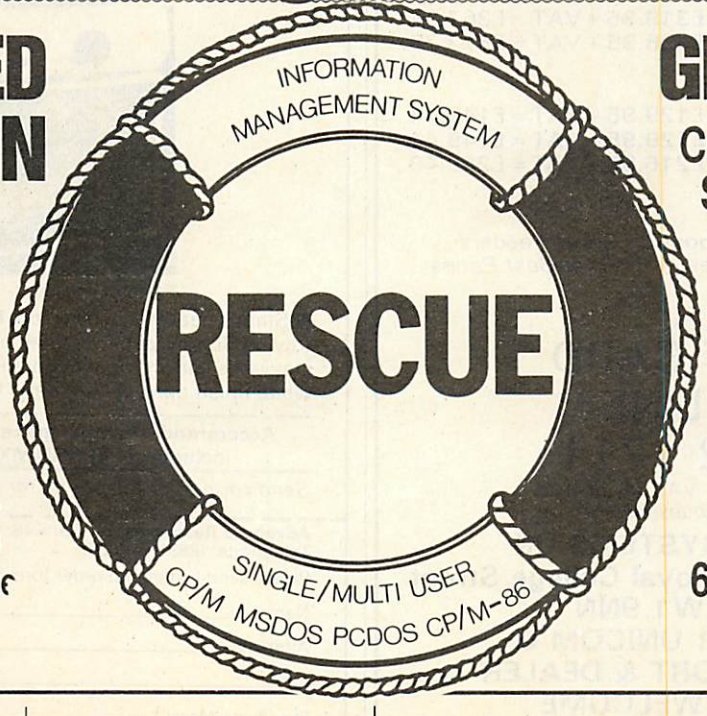
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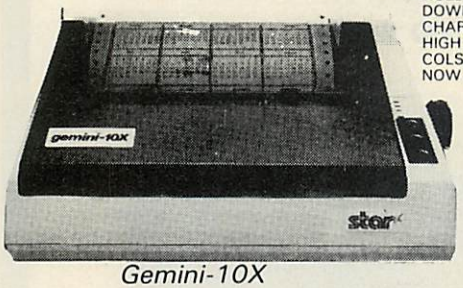
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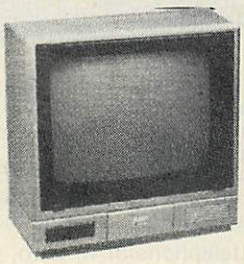
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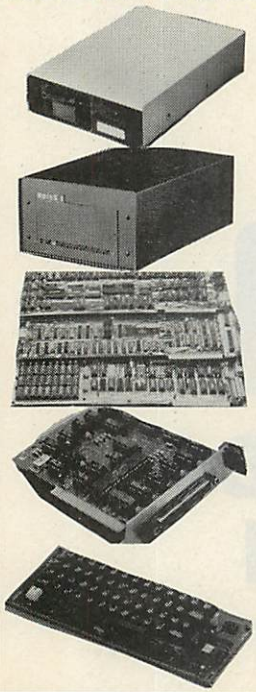
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Open File is the part of the magazine written by the readers of *Practical Computing*. All aspects of microcomputing are covered, from games to serious business software and utilities. Fully-debugged programs can be submitted for any micro, and for standard CP/M machines such as the Osborne and Superbrain. Programs can be in machine code or any language.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program listing. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics or inverse-video characters are either listed correctly or else include Rem statements to explain them fully.

Each program listing, tape or disc must have your name and address on it, or we cannot promise its safe return.

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>BBC

130 CIRCLE PLOTTER
P Cowley gets you going round in circles with his nifty circle utility program.

131 DE-REM
A short routine to save space in memory by removing Rem statements from listings and replacing them with backspace characters.

131 VULTURES
J R Gallimore supplies a bloodthirsty game in which you take pot shots at grisly birds of prey.

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A pair of programs to help you improve your knowledge of and try out your expertise in a foreign language.

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140 FRUIT MACHINE
Paul McPherson has devised this very fast game so that you can gamble without losing money.

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Mark Sanderson's program for any Spectrum allows you to print any ASCII or user-defined character on the screen as pixel co-ordinates.

>COMMODORE

147 PET POKES PROBLEM
Save tiresome fiddling around when loading programs written on the 64 into the Pet with this machine-code program.

147 KEYBOARD BLEEP FOR THE 64
A short program to reassure when keying in.

147 FORMATTED LISTINGS
A chance to tidy up your listings with Rune Nordberg's helpful program.

Circle plotter

A FAST machine-code circle utility has been submitted by P Cowley of Bath. The program will allow user designation of circles or arcs of circles of around 1/20th of a second per call on average.

The program is set in a test bed which resides at the bottom of the listing. The first part of the program assembles the machine code above Himem and sets up a table of values for sin x. Setting up the trig tables takes a few seconds, then the program is ready to be called by a user program.

The test bed section illustrates the use of the machine-code routine by calling it from Basic with a parameter block. The parameters must be integers or the program emits a bleep. It plots 100 circles of varying arcs and colours then prints the average time taken to plot each one.

The parameter block of the Call Circle statement needs five integers:

s% — the start angle of the arc, measured anti-clockwise from three o'clock in units of 10 degrees

a% — the angle of arc to be plotted, heading anti-clockwise in units of 10 degrees

r% — the circle radius in graphics units

x% — the x co-ordinate of the centre in graphics units

y% — the y co-ordinate of the centre in graphics units

The machine code is assembled above Himem, which is moved down to make room for it. It is simple to amend the first few lines of the program to put the machine code in Basic variable space using Dim circle 512. Zero-page memory locations &70 to &7E are used by the program.

In addition to providing a circle-drawing utility, the program also provides a useful fast sine and cosine routine, and a 16-bit multiply.

Circle plotter.

```
   10 REM ****************************
**
   20 REM **
**
   30 REM **   Circle Utility (M/C)
**
   40 REM **   by P.H.Cowley Oct 83
**
   50 REM **
**
   60 REM ****************************
**
   70
   80 REM Set up space for machine cod
e
   90 MODE1
  100 HIMEM=HIMEM-512
  110 O%=HIMEM
  120 *KEY10OLD|MMODE4|MHIMEM=HIMEM-51
2|M
  130 oswrch=&FFEE
  140 START=&70:ANGLE=&71
  150 CRAD=&72:XCENT=&74:YCENT=&76
  160 TRIG=&78
  170 RESULT=&7A
  180 SIGN=&7E
  190 FOR opt=0 TO 2 STEP 2
  200 P%=O%
  210 [
  220 OPT opt
  230 .circle     \get data from
  240 LDA &600    \parameter block
  250 CMP #5      \and put into
  260 BNE error   \zero page memory
  270 LDX #0
  280 JSR nextint
  290 LDY #0
  300 LDA (TRIG),Y
  310 STA START
  320 LDX #3
  330 JSR nextint
  340 LDY #0
  350 LDA (TRIG),Y
  360 STA ANGLE
  370 LDX #6
  380 JSR nextint
  390 LDA (TRIG),Y
  400 STA CRAD
  410 INY
  420 LDA (TRIG),Y
  430 STA CRAD+1
  440 LDX #9
  450 JSR nextint
  460 LDY #0
  470 LDA (TRIG),Y
  480 STA XCENT
  490 INY
  500 LDA (TRIG),Y
  510 STA XCENT+1
  520 LDX #12
  530 JSR nextint
  540 LDY #0
  550 LDA (TRIG),Y
  560 STA YCENT
  570 INY
  580 LDA (TRIG),Y
  590 STA YCENT+1
  600 JMP circle1
  610
  620 .nextint    \subroutine to
  630 LDA &601,X  \save address of
  640 STA TRIG    \next integer
  650 LDA &602,X  \parameter in
  660 STA TRIG+1  \zero page memory
  670 LDA &603,X  \TRIG is used as
  680 CMP #4      \scratch pad
  690 BNE error1
  700 RTS
  710
  720 .error1     \entry for branch
  730 PLA         \from subroutine
  740 PLA         \ditch return addres
s
  750 .error      \normal entry
  760 LDA #7
  770 JMP OSWRCH
  780 RTS
  790
  800 .circle1    \circle routine
  810 LDA START   \proper starts
  820 JSR cos     \here
  830 JSR RMULT
  840 LDX #4      \X=4 ready for plot
4
  850 JSR XPLOT   \move to circumferen
ce
  860 LDA START
  870 JSR sin
  880 JSR RMULT
  890 JSR YPLOT
  900
  910 LDA START   \main loop
  920 .LOOP       \plot 5 round the ar
c
  930 PHA
  940 JSR cos     \x=xcent+radius cos(
angle)
  950 JSR RMULT   \gives radius cos(an
gle)
  960 LDX #5
  970 JSR XPLOT   \adds on xcent and p
lots
  980 PLA
  990 PHA
 1000 JSR sin     \y=ycent+radius sin(
angle)
 1010 JSR RMULT   \gives radius sin(an
gle)
 1020 JSR YPLOT   \completes the plot
 1030 PLA
 1040 TAX
 1050 INX
 1060 TXA
 1070 DEC ANGLE   \reduce angle
 1080 BPL LOOP    \until finished
 1090 RTS         \return to BASIC
 1100
 1110 .XPLOT      \first part of
 1120 LDA #25     \VDU25,X,...
 1130 JSR OSWRCH
 1140 TXA
 1150 JSR OSWRCH
 1160 CLC
 1170
 1180 LDA XCENT   \next part of VDU
 1190 ADC RESULT+1\is x offset
 1200 JSR OSWRCH  \from centre
 1210 LDA XCENT+1
 1220 ADC RESULT+2
 1230 JSR OSWRCH  \two bytes worth ..
 1240 RTS
 1250
 1260 .YPLOT      \last part of
 1270 CLC         \VDU instruction
 1280 LDA YCENT   \is y coordinate
 1290 ADC RESULT+1\offset from
 1300 JSR OSWRCH  \centre
 1310 LDA YCENT+1
 1320 ADC RESULT+2
 1330 JSR OSWRCH  \last byte!
 1340 RTS
 1350
 1360 .MULTIPLY1  \unsigned multiply
 1370 LDA #0
 1380 STA RESULT
 1390 STA RESULT+1
 1400 STA RESULT+2
 1410 STA RESULT+3
 1420 LDX #16
 1430 .LOOP1
 1440 LSR TRIG+1  \multiplicand is
 1450 ROR TRIG    \output of trig tabl
e
 1460 BCC ZERO
 1470 LDA RESULT+2
 1480 CLC
 1490 ADC CRAD    \multiplyer is
 1500 STA RESULT+2\circle radius
 1510 LDA RESULT+3
 1520 ADC CRAD+1
 1530 STA RESULT+3
 1540 .ZERO
 1550 ROR RESULT+3
 1560 ROR RESULT+2
 1570 ROR RESULT+1
 1580 ROR RESULT
 1590 DEX
 1600 BNE LOOP1
 1610 RTS
 1620
```

(continued from facing page)

```
1630 .RMULT      \signed multiply
1640 LDA #0
1650 STA SIGN
1660 BIT TRIG+1
1670 BPL PLUS
1680 DEC SIGN    \make negative
1690 SEC
1700 SBC TRIG
1710 STA TRIG
1720 LDA #0
1730 SBC TRIG+1
1740 STA TRIG+1
1750 CLC
1760 .PLUS
1770 ADC TRIG
1780 JSR MULTIPLY1
1790 BIT SIGN    \test sign
1800 BPL return
1810 SEC
1820 LDA #0
1830 SBC RESULT  \complement if
1840 STA RESULT  \negative
1850 BPL pos
1860 LDA #1
1870 BPL neg
1880 .pos
1890 LDA #0
1900 .neg
1910 LDA #0
1920 SBC RESULT+1
1930 STA RESULT+1
1940 LDA #0
1950 SBC RESULT+2
1960 STA RESULT+2
1970 LDA #0
1980 SBC RESULT+3
1990 STA RESULT+3
2000 .return
2010 RTS
2020
2030 .OSWRCH
2040 PHP
2050 JSR oswrch
2060 PLP
2070 RTS
2080
2090 .cos        \trig look up
2100 CLC         \add 90 degrees
2110 ADC #9      \for cos
2120 .sin
2130 CMP #37     \make sure angle
2140 BCC continue\is in range
2150 SBC #36
2160 JMP sin
2170 .continue
2180 ASL A       \multiply by 2
2190 TAY
2200 LDA TABLE,Y \and get value
2210 STA TRIG    \from tables
2220 INY         \and save in zero
2230 LDA TABLE,Y \page TRIG
2240 STA TRIG+1  \in 2 bytes
2250 RTS
2260 .TABLE      \set pointer for BAS
IC
2270 ]
2280 NEXT
2290
2300 REM Set up trig table
2310 FOR I%=0 TO 72 STEP2
2320 sin%=256*SINRAD(5*I%)+0.5
2330 TABLE!I%=sin%
2340 NEXT
2350
2360 REM End of circle utility.
2370 REM Demonstration follows.
2380 T=0
2390 CLS
2400 FOR I=1 TO 100
2410 GCOL0,RND(4)
2420 s%=RND(37)-1 :REM start angle 0-
360
2430 a%=RND(37)-1 :REM arc angle 0-36
0
2440 r%=RND(500)  :REM radius 1-500
2450 x%=RND(1200) :REM x coordinate o
f centre
2460 y%=RND(1000) :REM y coordinate o
f centre
2470 TIME=0
2480 CALLcircle,s%,a%,r%,x%,y%
2490 T=T+TIME
2500 NEXT
2510 PRINT T/10000
2520 END
```

De-Rem

The De-Rem routine from N Whitfield of Winchester removes Rem statements from listings and replaces them with three back-spavce characters. This has the effect of printing the Basic tokenised Rem and them printing the text on top of it.

Any Rem statements in your program that are followed by three or more spaces, such as

10 REM This is testing De-REM

will be replaced with

10 This is testing De-REM

The program asks how many Rems you wish to change then changes them, reporting at the end as to how many it managed to change. The program runs terribly slowly, so if you have a long program to De-Rem, set the program running and sit back and relax.

De-Rem.

```
  10 REM   PROGRAM TO 'REMOVE' REM ST
ATEMENTS
  20 INPUT"CHANGE HOW MANY REMS",RR
  30 R=0
  40 FOR N=PAGE TO TOP
  50 IF ?N=&F4 AND N?1 = 32 AND N?2 =
 32 AND N?3 = 32 THEN FOR N1=1 TO 3: N
?N1=127:NEXT N1: R=R+1
  60 IF R=RR THEN N=TOP
  70 NEXTN
  80 PRINTR;" REMS CHANGED"
  90 END
```

Vultures

J R Gallimore of Ashorne, Warwick has come up with a particularly gory game. You are the controller of a gun which you move anti-clockwise by pressing Z and clockwise by pressing X.

At first you are busy trying to keep a coin in the air until suddenly from the top right-hand corner of the screen comes a vulture which swoops over to the left-hand corner where it builds a nest. The vulture then proceeds to hatch chicks. From now on, the coin must be looked after, the vultures shot in order to gain points and the chicks blasted out of the sky as they descend from the nest. You must not allow three chicks to reach the ground. To fire at the vultures you hit Return.

The coin gets heavier each time you hit it so it is best not to pepper it with shots but rather to hit it occasionally while waiting to pot the vultures. When the vultures have been shot, they fall to the ground and litter the bottom of the screen with a red sludge. Fortunately the sludge does not accumulate beyond one level so you can be sure of still having enough space to hit the coin.

The program will run in a 32K machine with Page set to &E00. Disc users can load it from disc with Page at &1900 and relocate the program to &E00 before running it.

Vultures.

```
  10 REM   V U L T U R E S
  20 REM   <<<<<<<>>>>>>>
  30 REM
  40 REM J R Gallimore   29/6/83
  50 MODE7:PROCINSTRUCTIONS:PROCDEFINE
  60 REPEATMODE2:COLOUR4:VDU23;8202;0;0
;0;
  70 PROCINIT:PROCSCREEN
  80 PROCLOOP:SOUND1,4,100,30
  90 IFCHNO%=3 PROCCHICKATTACK
 100 FORI=1TO5000:NEXT:MODE7:PROCEND
 110 UNTILTRUE=FALSE
 120 END
 130 REM  *** MAIN LOOP ***
 140 DEFPROCLOOP:REPEAT
 150 PROCCOIN:PROCAIM:PROCFIRE
 160 IFRND(100)=1 AND CHICK%=0 VULT%=1
 170 IFRND(100)=1 AND VULT%=0 AND NEST%
CHICK%=1
 180 IF VULT% PROCVULTURE
 190 IF CHICK% PROCCHICK
 200 UNTILDEAD%
 210 ENDPROC
 220 REM  **************
 230 DEFPROCDEFINE
 240 VDU23,224,60,126,255,255,255,255,1
26,60
 250 VDU23,225,7,15,30,60,120,240,224,1
92
 260 VDU23,226,224,240,120,60,30,15,7,3
 270 VDU23,227,60,126,255,255,255,255,1
26,60
 280 VDU23,228,0,0,0,31,31,31,159,255
 290 VDU23,229,0,0,0,248,248,248,249,25
5
 300 VDU23,230,16,22,16,8,7,0,7,9
 310 VDU23,231,8,104,8,16,224,0,224,144
 320 VDU23,232,16,16,16,20,20,20,20,20
 330 VDU23,233,8,8,8,40,40,40,40,40
 340 VDU23,234,28,28,28,28,4,4,8,16
 350 VDU23,235,63,63,32,32,32,32,16,8
 360 VDU23,236,17,18,20,28,28,28,124,12
4
 370 VDU23,237,136,72,40,56,56,56,62,62
 380 VDU23,239,0,0,0,7,28,112,224,224
 390 VDU23,238,24,36,66,153,153,66,36,2
4
 400 VDU23,240,0,0,56,248,252,6,3,1
 410 VDU23,241,0,15,31,127,127,255,191,
0
 420 VDU23,242,0,0,192,224,248,254,128,
0
 430 VDU23,243,36,36,60,24,24,153,219,2
19
 440 VDU23,244,219,255,255,126,60,60,24
,24
 450 VDU23,245,24,24,24,24,60,60,24,24
 460 VDU23,246,0,0,0,0,0,15,31,255
 470 VDU23,247,36,36,189,219,255,255,25
5,255
 480 VDU23,248,0,0,0,0,0,240,248,255
 490 VDU23,254,159,81,34,116,184,79,32,
60
 500 VDU23,255,132,76,41,158,156,234,9,
120
 510 VDU23,253,6,15,8,104,248,216,176,2
24
```

(continued on next page)

(continued from previous page)

```
  520 VDU23,252,132,73,46,20,58,73,140,1
30
  530 VDU23,251,0,96,224,44,63,63,8,28
  540 DIMCHICK%(3),SC(8),SC$(8):FORI=1TO
8:SC(I)=100:NEXT
  550 ENDPROC
  560 REM  **************
  570 DEFPROCSCREEN
  580 VDU31,1,26
  590 COLOUR3
  600 VDU228,229,8,8,10,230,231,8,8,10,2
32,233,8,8,10,234,235,8,8,10,236,237
  610 VDU5:MOVEXAIMPOS%,YAIMPOS%:GCOL3,3
:PRINTCHR$238;
  620 GCOL0,2:MOVE64,999:DRAW1216,999:DR
AW1216,32:DRAW64,32:DRAW64,999
  630 ENDPROC
  640 REM  **************
  650 DEFPROCCOIN
  660 GCOL3,6:MOVEXCOIN%,YCOIN%:PRINTCOI
N$;
  670 YVEL=YVEL+GRAV:YCOIN%=YCOIN%+YVEL
  680 XCOIN%=XCOIN%+XVEL%
  690 IFXCOIN%>1136 XCOIN%=1137
  700 IFYCOIN%>993 YCOIN%=994
  710 IFYCOIN%<64 DEAD%=1:ENDPROC
  720 XVEL%=XVEL%+2*((XCOIN%<96)+(XCOIN%
>1136))*XVEL%
  730 YVEL=YVEL+2*(YCOIN%>985)*YVEL
  740 COIN$=CHR$(RND(4)+223)
  750 MOVEXCOIN%,YCOIN%:PRINTCOIN$
  760 ENDPROC
  770 REM  **************
  780 DEFPROCINIT
  790 ENVELOPE1,1,127,-4,0,1,10,20,127,0
,-2,-4,100,126
  800 ENVELOPE2,1,50,10,-1,3,10,100,127,
1,0,-3,100,126
  810 ENVELOPE3,1,127,-1,0,1,250,0,10,0,
0,-2,50,100
  820 ENVELOPE4,1,10,-5,-5,10,5,5,127,0,
0,-2,75,75
  830 XCOIN%=640:YCOIN%=128:XVEL%=20:YVE
L=15:GRAV=-.1:DEAD%=0:COIN$="":VULT%=0
  840 VULTDEAD%=0:YVULT%=992:VULTDEAD$=C
HR$243+CHR$8+CHR$10+CHR$244+CHR$8+CHR$10
+CHR$245:NAME$="":NEST%=0
  850 XAIMPOS%=1216:YAIMPOS%=128:XVULT%=
1087:VULT$=CHR$240+CHR$241+CHR$242
  860 SPLODGE$=CHR$246+CHR$247+CHR$248:V
=0:TIME=0:T=0:SC=0:CHICK%=0:CHNO%=0
  870 ENDPROC
  880 REM  **************
  890 DEFPROCAIM
  900 IFNOT(INKEY(-98)+INKEY(-67)) ENDPR
OC
  910 IF(INKEY(-98)ANDXAIMPOS%=256)OR(IN
KEY(-67)ANDYAIMPOS%=128) ENDPROC
  920 GCOL3,3:MOVEXAIMPOS%,YAIMPOS%:VDU2
38
  930 IFINKEY(-98) XAIMPOS%=XAIMPOS%+64*
(YAIMPOS%=1024):YAIMPOS%=YAIMPOS%-64*(XA
IMPOS%=1216)
  940 IFINKEY(-67) YAIMPOS%=YAIMPOS%+64*
(XAIMPOS%=1216):XAIMPOS%=XAIMPOS%-64*(YA
IMPOS%=1024)
  950 MOVEXAIMPOS%,YAIMPOS%:VDU238
  960 ENDPROC
  970 REM  **************
  980 DEFPROCFIRE
  990 IF(NOTINKEY(-74)) OR TIME<T ENDPRO
C
 1000 T=TIME+25
 1010 MOVE192,128:GCOL3,7:PRINTCHR$239;
 1020 M=(YAIMPOS%-134)/(XAIMPOS%-224):X%
=XCOIN%+32:A%=XAIMPOS%+32:B%=YAIMPOS%-16
:Y%=YCOIN%-16
 1030 YC=M*(X%-A%)+B%:XC=1/M*(Y%-B%)+A%
 1040 IF(Y%<YC+18 AND Y%>YC-18)OR(X%<XC+
36 AND X%>XC-36) PROCHIT:ENDPROC
 1050 IFCHICK% Y%=YVULT%-16:X%=XVULT%+32
:YC=M*(X%-A%)+B%:XC=1/M*(Y%-B%)+A%:IF(Y%
<YC+18 AND Y%>YC-18)OR(X%<XC+36 AND X%>X
C-36) PROCHITCHICK:ENDPROC
 1060 IF VULT%=1 ANDVULTDEAD%=0 ANDXAIMP
OS%<1216 AND XAIMPOS%>=XVULT% AND XAIMPO
S%<XVULT%+192 PROCVULTHIT:V=V+1
 1070 SOUND1,1,10,1:FORI%=1TO2:MOVE256,1
18:DRAWXAIMPOS%+32,YAIMPOS%-16:NEXT
 1080 GCOL3,7:MOVE192,128:PRINTCHR$239;
 1090 ENDPROC
 1100 REM  **************
 1110 DEFPROCHIT
 1120 FORI%=1TO2:MOVE256,150:DRAWXCOIN%+
32,YCOIN%:NEXT
 1130 SOUND1,1,50,1:YVEL=15:XVEL%=RND(30
)-10:GRAV=GRAV-.01
 1140 MOVE192,128:PRINTCHR$239;
 1150 ENDPROC
 1160 REM  **************
 1170 DEFPROCHITCHICK
 1180 FORI%=1TO2:MOVE256,150:DRAWXVULT%+
32,YVULT%-16:NEXT
 1190 SOUND2,2,100,5:MOVEXVULT%,YVULT%:V
DU253:FORI=1TO16:VDU8,252:NEXT
 1200 CHICK%=0:XVULT%=1087:YVULT%=992
 1210 MOVE192,128:PRINTCHR$239;:ENDPROC
 1220 REM  **************
 1230 DEFPROCVULTURE
 1240 IFVULTDEAD% PROCVULTDEAD:ENDPROC
 1250 IFXVULT%=1087 MOVE1024,992:GCOL3,5
:PRINTVULT$;:XVULT%=1024:ENDPROC
 1260 IFXVULT%<>256 MOVEXVULT%,992:GCOL3
,5:PRINTVULT$;:XVULT%=XVULT%-64:MOVEXVUL
T%,992:PRINTVULT$;:ENDPROC
 1270 MOVE256,992:GCOL3,5:PRINTVULT$;:XV
ULT%=1087:VULT%=0
 1280 IFNEST% ENDPROC:ELSENEST%=1:GCOL0,
5:MOVE64,992:VDU254,255,254:SOUND2,4,0,3
 1290 GCOL0,7:MOVE64,1024:VDU253,253,253
:SOUND1,1,100,30:ENDPROC
 1300 REM  **************
 1310 DEFPROCVULTHIT
 1320 SOUND2,2,53,4:SOUND2,3,53,25:GCOL3
,5:MOVEXVULT%,992:PRINTVULT$;:VULTDEAD%=
1
 1330 ENDPROC
 1340 REM  **************
 1350 DEFPROCVULTDEAD
 1360 IFYVULT%=992 MOVEXVULT%+64,961:GCO
L3,5:PRINTVULTDEAD$:YVULT%=961:XVULT%=XV
ULT%+64:ENDPROC
 1370 MOVEXVULT%,YVULT%:GCOL3,5:PRINTVUL
TDEAD$;
 1380 YVULT%=YVULT%-48:IFYVULT%=97 MOVEX
VULT%-64,64:GCOL1,1:PRINTSPLODGE$;:SOUND
0,-15,150,6:VULTDEAD%=0:VULT%=0:XVULT%=1
087:YVULT%=992:ENDPROC
 1390 MOVEXVULT%,YVULT%:PRINTVULTDEAD$;
 1400 ENDPROC
 1410 REM  **************
 1420 DEFPROCCHICK
 1430 IFXVULT%=1087 YVULT%=992:XVULT%=32
0:GCOL3,7:MOVEXVULT%,YVULT%:VDU253:ENDPR
OC
 1440 GCOL3,7:MOVEXVULT%,YVULT%:VDU253
 1450 IFYVULT%<96 CHICK%=0:SOUND3,2,200,
1:MOVEXVULT%,64:GCOL0,7:VDU253:YVULT%=99
2:CHNO%=CHNO%+1:DEAD%=(CHNO%=3):CHICK%(C
HNO%)=XVULT%:XVULT%=1087:ENDPROC
 1460 XVULT%=XVULT%+10:YVULT%=YVULT%+125
*GRAV:MOVEXVULT%,YVULT%:VDU253
 1470 ENDPROC
 1480 REM  **************
 1490 DEFPROCCHICKATTACK
 1500 GCOL3,6:MOVEXCOIN%,YCOIN%:PRINTCOI
N$
 1510 FORA=3TO1 STEP-1:MOVECHICK%(A),64:
GCOL0,0:VDU253:GCOL3,7
 1520 FORI=CHICK%(A)TO448-A*64 STEP-4:FO
RJ=1TO2:MOVEI,64:VDU251:B=INKEY(.5):NEXT
J,I:VDU8,251:NEXTA
 1530 FORA=2TO1 STEP-1:MOVE448-A*64,64:V
DU251
 1540 FORI=1TO32:FORJ=1TO2:MOVE448-64*A-
2*(3-A)*I,64+(3-A)*I:VDU251:NEXTJ,I:VDU8
,251:NEXTA
 1550 MOVE256,128:VDU251:FORI=1TO32:FORJ
=1TO2:MOVE256-4*I,128+I:VDU251:NEXTJ,I:V
DU8,251
 1560 ENDPROC
 1570 REM  **************
 1580 DEFPROCEND
 1590 VDU23;8202;0;0;0;:MIN=INT(TIME/600
0)
 1600 SEC=INT(TIME/100-MIN*60)
 1610 IFCHNO%=3 FORI=1TO2:PRINTCHR$141;C
HR$131;"  THE CHICKS HAVE ATTACKED!":NEX
T:ELSEFORI=1TO2:PRINTCHR$141;CHR$131;"
THE COIN HAS DROPPED!":NEXT
 1620 IFMIN=1 PRINT''''"You kept the coi
n in the air for"'"1 minute & ";SEC;" se
conds."ELSEIFMIN=0 PRINT''''"You kept th
e coin in the air for "';SEC;" seconds."
ELSEPRINT''''"You kept the coin in the a
ir for "';MIN;" minutes & ";SEC;" second
s."
 1630 IFV=0 PRINT'"In that time you didn
't hit one vulture."ELSEIFV=1 PRINT'"In
that time you only shot 1 vulture."ELSEP
RINT'"In that time you shot ";V;" vultur
es."
 1640 SC=60*MIN+SEC+V*50:PRINT'"This gi
ves you a score of ";SC;" points."
 1650 IFSC>SC(1) PRINT'CHR$136"CONGRATUL
ATIONS!";CHR$137;"You have a Hiscore.":E
LSEPRINT'CHR$136CHR$134SPC7"Hit H to see
 hiscores":GOTO1710
 1660 PRINT'"Enter your name."'':*FX15,1
 1670 REPEATA$=GET$:IFA$=CHR$127:NAME$="
":VDU7:ELSENAME$=NAME$+A$
 1680 IFLEN(NAME$)=16 ANDA$<>CHR$13 VDU7
:NAME$=LEFT$(NAME$,15)
 1690 PRINTTAB(0,19)CHR$129NAME$;"
       ":UNTILA$=CHR$13
 1700 PROCTABLE:ENDPROC
 1710 *FX15,1
 1720 PRINT''SPC9"Hit P to play again."
:REPEATA$=GET$:UNTILA$="P" OR A$="H"
 1730 IFA$="P" ENDPROC:ELSEPROCTABLE:END
PROC
 1740 REM  **************
 1750 DEFPROCINSTRUCTIONS
 1760 VDU23;8202;0;0;0;
 1770 FORI=1TO2:PRINTTAB(8)CHR$133;CHR$1
57;CHR$132;CHR$141;"V u l t u r e s   ";
CHR$156:NEXT
 1780 PRINT'"     The object of the game
 is to shoot down as many vultures as po
ssible while keeping a coin in the air.
  The coin iskept up by shooting it."
 1790 PRINT"     The vultures are busy b
uilding     their nest and then feeding
their chickswhich hop out of the nest ev
ery now and then.   These must be destro
yed since 3 chicks on the ground means d
eath.";
 1800 PRINT"   As  time passes the chick
s grow and become  heavier and heavier..
."
 1810 PRINT"     Beware, do not fill the
 coin with  lead as its weight increases
 every time it is hit."
 1820 PRINT"     Aim the gun using 'X' f
or          clockwise & 'Z' for anticloc
kwise       movements."
 1830 PRINT"     Hit RETURN to fire."
 1840 PRINT"HAPPY HUNTING!"
 1850 PRINT'CHR$136;"    Hit any key to
start"
 1860 *FX15,1
 1870 *FX220,0
 1880 A$=GET$:ENDPROC
 1890 REM  **************
 1900 DEFPROCTABLE
 1910 CLS
 1920 IFNAME$<>"" SC(0)=SC:SC$(0)=NAME$:
FORA=0TO7:FORB=A+1 TO8:IFSC(A)>SC(B)THEN
STORE=SC(A):STORE$=SC$(A):SC(A)=SC(B):SC
$(A)=SC$(B):SC(B)=STORE:SC$(B)=STORE$
 1930 IFNAME$<>"" NEXTB,A
 1940 FORI=1TO2:PRINTSPC3;:VDU129,141:PR
INT"    Vulture Hiscores":NEXTI
 1950 PRINT':FORI=8TO1 STEP-1:PRINT9-I;
SPC(3);SC(I);STRING$((10-LEN(STR$(SC(I))
)),".");SC$(I):NEXT
 1960 PRINT'CHR$136"Hit P to play again"
 1970 REPEATUNTILGET$="P":ENDPROC
```



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Introduction to MS™-DOS

The Graduate offers two levels of upgrade, the G400 and the G800, both with 128K on board user memory as standard (optionally 256K). This can be increased to 1.2 Mbytes with an IBM compatible expansion board. The G400, contains a single, double sided 320K formatted disc drive and provides the low cost introduction to MS™-DOS for the user who wants real 16 bit power from his Model B.

TECHNICAL SPECIFICATION

- 8088 16-bit processor running at 5 Mhz
- 128K or 256K RAM
- MS™-DOS operating system customised to IBM compatibility
- Model G400 – Single, double sided, high density disc drive (320K formatted)
- Model G800 – Twin, double sided, high density disc drives (640K formatted)
- Integral stabilised power supply
- 2 IBM PC compatible hardware expansion buses
- Software compatibility allows Lotus 1-2-3 and all popular IBM PC business programs to run without modification, subject to the constraints of the BBC keyboard and display
- Disc interface is not required

Keyboard text and graphics supplied by BBC Model B

• THE GRADUATE •

More data storage

A step up from the G400 is the G800 which offers twin, double sided 320K disc drives for extra data storage. Both the G400 and the G800 provide the possibility of further expansion for networking, modems, etc., via the IBM compatible hardware slots provided by the Graduate models. Each model comes complete with a well written user/technical manual and connecting leads.

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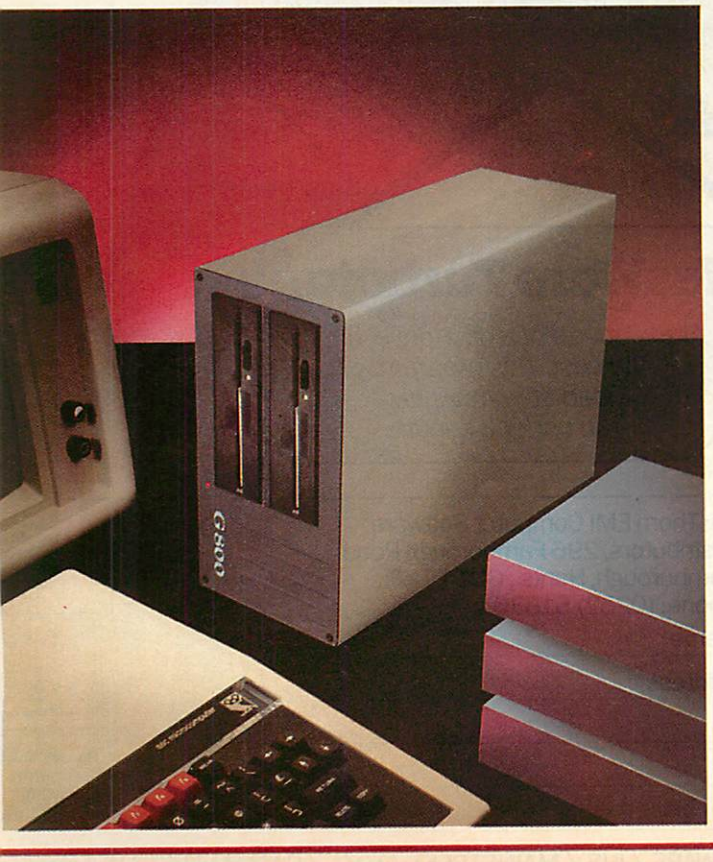
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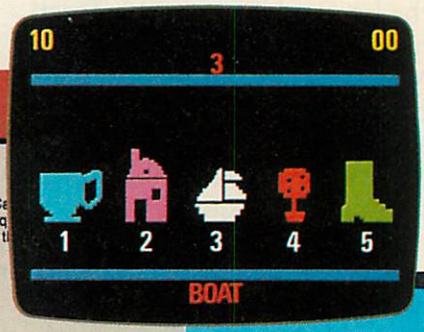
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● Circle No. 1

Vocabulary test

A PAIR of programs, one for storing a vocabulary list in any language and another for applying it as a test, has been submitted by one Jack Schofield of Alicante. The Vocabulary Maker prepares a test-file of words translated from one language to another. It allows corrections to be made after each six words are entered and terminated by No More. Vocabulary Test then tests the victim with the prepared lists. Word batches of 50 to 60 are recommended, and many such test-files may be prepared in order to provide a comprehensive teaching aid.

An independent verb learning program with the language built into Data statements, is also offered, with about 90 Spanish conjugations embedded. The number of these may be varied by adjusting N in line 122. While in the word test two chances are offered per word before moving, in the verb test the conjugation must be completed correctly before passing on.

Vocabulary Maker.

```
]LOAD VOCABULARY MAKER
]LIST

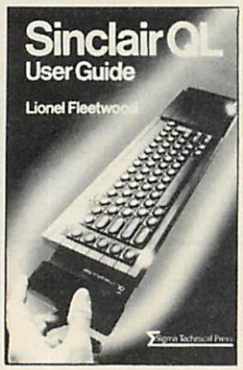
1990  HOME
2000  PRINT "     VOCABULARY MAKER
      "
2001  PRINT "     ---------- -----
      "
2005  REM PROGRAM TO MAKE UP A TE
      XT FILE
2006  REM OF WORDS AND THEIR TRAN
      SLATIONS
2010  DIM A$(100),B$(100)
2012 I = 0
2020 D$ =  CHR$ (4): REM CRTLD
2030  PRINT "ABOUT 50 WORDS ARE A
       SUITABLE NUMBER"
2032  PRINT
2034  PRINT "TO HAVE ON EACH FILE
      . TYPE IN EACH"
2036  PRINT
2038  PRINT "WORD FOLLOWED BY 'RE
      TURN' THEN ITS"
2040  PRINT
2042  PRINT "TRANSLATION. TYPE 'N
      O MORE' WHEN"
2044  PRINT
2046  PRINT "SUFFICIENT WORDS FOR
       A FILE. GIVE THE"
2048  PRINT
2050  PRINT "FILE A SUITABLE NAME
      "
2052  PRINT : PRINT
2070 I = I + 1
2090  PRINT "TYPE WORD NO.";I;":
      ";
2100  INPUT " ";A$(I)
2101  IF A$(I) = "NO MORE" GOTO 2
      200
2105  PRINT
2110  PRINT "TYPE THE TRANSLATION
      : ";
2115  INPUT " ";B$(I)
2125  IF I / 5 =  INT (I / 5) THEN
       GOSUB 3000: GOTO 2070
2126  PRINT : GOTO 2070
2200 I = I - 1
2201  PRINT : PRINT
2300  PRINT "WHAT FILE NAME? E.G.
      SPANISH VOCABULARY-1"
2305  PRINT
2310  INPUT N$
2340  PRINT D$;"OPEN";N$
2350  PRINT D$;"DELETE";N$
2360  PRINT D$;"OPEN";N$
2370  PRINT D$;"WRITE";N$
2380  PRINT I
2390  FOR J = 1 TO I
2400  PRINT A$(J)
2405  PRINT B$(J)
2410  NEXT J
2420  PRINT D$;"CLOSE";N$
2450  END
3000  HOME
3010  FOR J = (I - 5) TO I
3020  PRINT J;". ";A$(J)
3030  PRINT "....";B$(J)
3040  NEXT J
3050  INVERSE : PRINT "ARE THEY O
      K?-TYPE 'Y' OR 'N'": NORMAL
      : INPUT AN$
3060  IF AN$ <  > "Y" AND AN$ <  >
      "N" THEN 3050
3070  IF AN$ = "Y" THEN  RETURN
3080  PRINT "WHICH NUMBER IS WRON
      G?": INPUT NU
3090  IF NU < (I - 5) OR NU > I THEN
      3080
3100  HOME
3110  PRINT "TYPE WORD NO.";NU;"
      ";
3120  INPUT " ";A$(NU)
3130  PRINT "TYPE THE TRANSLATION
      : ";
3135  INPUT " ";B$(NU)
3140  GOTO 3000
```

Vocabulary Test.

```
]LOAD VOCABULARY TEST
]LIST
50  HOME
52  PRINT "          VOCABULARY TES
      T"
53  PRINT "          ---------- ---
      -"
54  PRINT
56  PRINT "TYPE IN THE NAME OF TH
      E APPROPRIATE"
57  PRINT
58  PRINT "VOCABULARY FILE WHEN R
      EQUESTED"
59  PRINT
60  PRINT "YOU WILL BE GIVEN 10 W
      ORDS-"
63  PRINT
64  PRINT "TYPE IN THEIR TRANSLAT
      ION (THEN RETURN)"
65  PRINT
66  PRINT "TYPE '-' IF YOU DO NOT
       KNOW THE ANSWER"
67  PRINT : PRINT
90  DIM A$(100),B$(100)
91  DIM C(100)
100 D$ =  CHR$ (4): REM CTRLD
110  INPUT "NAME OF VOCABULARY FI
      LE? ";Z$
120  PRINT D$;"OPEN";Z$
130  PRINT D$;"READ";Z$
140  INPUT I
160  FOR J = 1 TO I
170  INPUT A$(J)
180  INPUT B$(J)
190  NEXT J
200  PRINT D$;"CLOSE";Z$
300  PRINT : PRINT "PRESS 'Q' AND
       'RETURN' TO CONTINUE": INPUT
      Q$: IF Q$ <  > "Q" THEN 300
310  HOME : GOTO 930
415  FOR J = 1 TO I:C(J) = 0: NEXT
      J
419 T = 0
420  FOR K = 1 TO 10
430 N =  INT ( RND (1) * I) + 1
432  IF C(N) = 1 THEN 430
434 C(N) = 1
450  HOME : VTAB 10: HTAB 5: PRINT
      K"  "A$(N)
460  VTAB 12: HTAB 5: INPUT "....
      ";B$
470  IF B$ = B$(N) THEN  GOSUB 10
      00: GOTO 520
471  IF B$ = "-" THEN  GOTO 495
475  VTAB 14: HTAB 5: PRINT "SORR
      Y,THAT IS WRONG.TRY AGAIN"
480  VTAB 16: HTAB 5: INPUT "....
      ";B$
485  IF B$ = B$(N) THEN  GOSUB 10
      00: GOTO 520
486  IF B$ = "-" THEN  GOTO 495
490  VTAB 18: HTAB 5: PRINT "WRON
      G AGAIN,I AM AFRAID"
495  VTAB 20: HTAB 5: PRINT "THE
      ANSWER IS..."B$(N)
500  FOR L = 1 TO 3000: NEXT
520  NEXT K
900  HOME
910  IF T = 10 THEN  VTAB 10: HTAB
      5: PRINT "10 OUT OF 10,WELL
      DONE"
920  IF T <  > 10 THEN  VTAB 10: HTAB
      5: PRINT T" OUT OF 10"
930  VTAB 12: PRINT "DO YOU WANT:
      -"
931  VTAB 14: HTAB 5: PRINT "1.TO
       BE TESTED ON THIS FILE?"
932  VTAB 16: HTAB 5: PRINT "2.AN
      OTHER FILE?"
933  VTAB 18: HTAB 5: PRINT "3.TO
       SEE THE WORDS ON THIS FILE?
      "
935  VTAB 20: HTAB 5: PRINT "4.NO
       MORE?"
937  VTAB 22: HTAB 5: INPUT "TYPE
       1,2,3 OR 4 ";G$
939  IF G$ > "4" THEN 937
2000  HOME
2010  FOR J = 1 TO I
2020  PRINT J;: HTAB 4: PRINT A$(
      J);: HTAB 25: PRINT B$(J)
2030  IF J / 20 =  INT (J / 20) THEN
       PRINT : PRINT "PRESS 'Q' AN
      D'RETURN'TO CONTINUE": INPUT
      Q$: IF Q$ <  > "Q" THEN 2030
2040  NEXT J
2050  PRINT : PRINT "PRESS 'Q' AN
      D 'RETURN' TOCONTINUE": INPUT
      Q$: IF Q$ <  > "Q" THEN 2050
2060  RETURN
941  IF G$ = "1" THEN 415
943  IF G$ = "2" THEN 110
945  IF G$ = "3" THEN  GOSUB 2000
      : HOME : GOTO 930
950  END
1000 T = T + 1: VTAB 18: HTAB 5: FLASH
      : PRINT "CORRECT": NORMAL
1010  FOR L = 1 TO 3000: NEXT : RETURN
```

(continued on page 139)

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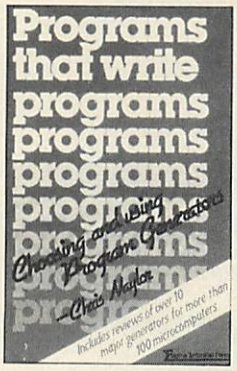
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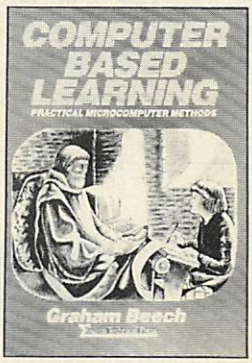




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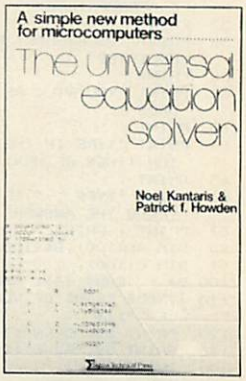
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● **Circle No. 168**

(continued from page 137)

Spanish Verb Test.

```
]LOAD SPANVERBTEST
]LIST
80 S =  - 16336
90  DIM B$(100,7)
100  HOME
101  PRINT "(IF ADDING MORE DATA,
     REMEMBER TO"
102  PRINT "CHANGE N IN LINE 122)
     ": FOR K = 1 TO 1000: NEXT K

103  HOME
110 Z$ = "
120 Z = 50
121 Y = 800
122 N = 77
140  FOR I = 1 TO N
142  FOR J = 1 TO 7
150  READ B$(I,J)
160  NEXT J
162  NEXT I
169  SPEED= 100
170  VTAB 10: PRINT "A LIST OF TH
     E VERBS IN DATA FOLLOWS    "

171  PRINT : PRINT "THERE ARE ";N
     ;" VERBS IN DATA"
172  PRINT : PRINT "IF YOU WANT A
      PARTICULAR VERB-"
173  PRINT : PRINT "THEN REMEMBER
      ITS NUMBER"
175  SPEED= 255
189  HOME
190  FOR I = 1 TO N
192  IF I / 20 =  INT (I / 20) THEN
      PRINT : PRINT "PRESS'Q'AND'
     RETURN'TO CONTINUE": INPUT C
     $: IF C$ <  > "Q" THEN 192
195  PRINT I;: HTAB 5: PRINT B$(I
     ,1)
199  NEXT I
210  PRINT : PRINT "PRESS'Q'AND'R
     ETURN'TO CONTINUE"
211  INPUT C$: IF C$ <  > "Q" THEN
     211
290  HOME : VTAB 10: SPEED= 100: PRINT
     "DO YOU WANT:-"
292  PRINT : PRINT : HTAB 5: PRINT
     "1.A PARTICULAR VERB?"
294  PRINT : HTAB 5: PRINT "2.A R
     ANDOM CHOICE?"
296  PRINT : PRINT "TYPE '1' OR '
     2' (AND 'RETURN')"
297  INPUT B: IF B > 2 OR B < 0 THEN
     297
298  IF B = 2 THEN A =  INT ( RND
     (1) * N) + 1: GOTO 305
299  HOME : VTAB 10: SPEED= 100: PRINT
     "WHICH NO. DO YOU WANT?
      "
300  INPUT A
305  IF A < 1 OR A > N THEN 300
310  SPEED= 255
320  HOME
330  PRINT B$(A,1)
340  FOR J = 2 TO 7
345  VTAB 5 + J: HTAB 5: INPUT A$
     (J): IF A$(J) <  > B$(A,J) THEN
      GOSUB 1000: GOTO 345
350  NEXT J
360  VTAB 15: PRINT "FOR THE SAME
      AGAIN TYPE '1'"
362  VTAB 17: PRINT "TO SEE THE L
     IST OF VERBS TYPE '2'"
364  VTAB 19: PRINT "IF FED-UP TY
     PE '3'"
366  VTAB 21: PRINT "FOR VERB CHO
     SEN AT RANDOM TYPE '4'"
380  PRINT : INPUT B: IF B > 4 THEN
     380
390  IF B = 1 THEN 320
400  IF B = 2 THEN 189
405  IF B = 4 THEN A =  INT ( RND
     (1) * N) + 1: GOTO 305
410  HOME : PRINT "HASTA LUEGO !"
420  END
1000  FOR K = 1 TO Z:SOUND =  PEEK
     (S) -  PEEK (S) +  PEEK (S) -
      PEEK (S) +  PEEK (S) -  PEEK
     (S): NEXT K: VTAB 5 + J: HTAB
     30: PRINT "NO!": FOR K = 1 TO
     Y: NEXT K: VTAB 5 + J: PRINT
     Z$: RETURN
2001  DATA PRES.INDIC.OF MIRAR,MI
     RO,MIRAS,MIRA,MIRAMOS,MIRAIS
     ,MIRAN
2002  DATA PRES.INDIC.OF COMER,CO
     MO,COMES,COME,COMEMOS,COMEIS
     ,COMEN
2003  DATA PRES.INDIC.OF VIVIR,VI
     VO,VIVES,VIVE,VIVIMOS,VIVIS,
     VIVEN
2004  DATA PRES.INDIC.OF MOSTRAR(
     UE),MUESTRO,MUESTRAS,MUESTRA
     ,MOSTRAMOS,MOSTRAIS,MUESTRAN
2005  DATA PRES.INDIC.OF PEDIR(I)
     ,PIDO,PIDES,PIDE,PEDIMOS,PED
     IS,PIDEN
2006  DATA PRES.INDIC.OF DAR(TO G
     IVE),DOY,DAS,DA,DAMOS,DAIS,D
     AN
2007  DATA PRES.INDIC.OF DECIR(TO
     SAY),DIGO,DICES,DICE,DECIMO
     S,DECIS,DICEN
2008  DATA PRES.INDIC.OF ESTAR(TO
     BE),ESTOY,ESTAS,ESTA,ESTAMO
     S,ESTAIS,ESTAN
2009  DATA PRES.INDIC.OF HABER(TO
     HAVE),HE,HAS,HA,HEMOS,HABEI
     S,HAN
2010  DATA PRES.INDIC.OF HACER(TO
     DO),HAGO,HACES,HACE,HACEMOS
     ,HACEIS,HACEN
2011  DATA PRES.INDIC.OF IR(TO GO
     ),VOY,VAS,VA,VAMOS,VAIS,VAN
2012  DATA PRES.INDIC.OF OIR(TO H
     EAR),OIGO,OYES,OYE,OIMOS,OIS
     ,OYEN
2013  DATA PRES.INDIC.OF PONER(TO
      PUT),PONGO,PONES,PONE,PONEM
     OS,PONEIS,PONEN
2014  DATA PRES.INDIC.OF SABER(TO
     KNOW),SE,SABES,SABE,SABEMOS
     ,SABEIS,SABEN
2015  DATA PRES.INDIC.OF SALIR(TO
      GO OUT),SALGO,SALES,SALE,SA
     LIMOS,SALIS,SALEN
2016  DATA PRES.INDIC.OF SER(TO B
     E),SOY,ERES,ES,SOMOS,SOIS,SO
     N
2017  DATA PRES.INDIC.OF TENER(TO
      HAVE),TENGO,TIENES,TIENE,TE
     NEMOS,TENEIS,TIENEN
2018  DATA PRES.INDIC.OF TRAER(TO
      CARRY),TRAIGO,TRAES,TRAE,TR
     AEMOS,TRAEIS,TRAEN
2019  DATA PRES.INDIC.OF VENIR(TO
      COME),VENGO,VIENES,VIENE,VE
     NIMOS,VENIS,VIENEN
2020  DATA PRES.INDIC.OF VER(TO S
     EE),VEO,VES,VE,VEMOS,VEIS,VE
     N
2021  DATA PRES.SUBJ.OF MIRAR,MIR
     E,MIRES,MIRE,MIREMOS,MIREIS,
     MIREN
2022  DATA PRES.SUBJ.OF COMER,COM
     A,COMAS,COMA,COMAMOS,COMAIS,
     COMAN
2023  DATA PRES.SUBJ.OF VIVIR,VIV
     A,VIVAS,VIVA,VIVAMOS,VIVAIS,
     VIVAN
2024  DATA PRES.SUBJ.OF MOSTRAR,M
     UESTRE,MUESTRES,MUESTRE,MOST
     REMOS,MOSTREIS,MUESTREN
2025  DATA PRES.SUBJ.OF PENSAR,PI
     ENSE,PIENSES,PIENSE,PENSEMOS
     ,PENSEIS,PIENSEN
2026  DATA PRES.SUBJ.OF PEDIR,PID
     A,PIDAS,PIDA,PIDAMOS,PIDAIS,
     PIDAN
2027  DATA PRES.SUBJ.OF DORMIR,DU
     ERMA,DUERMAS,DUERMA,DORMAMOS
     ,DORMAIS,DUERMAN
2028  DATA PRES.SUBJ.OF SENTIR,SI
     ENTA,SIENTAS,SIENTA,SENTAMOS
     ,SENTAIS,SIENTAN
2029  DATA PRES.SUBJ.OF CAER,CAIG
     A,CAIGAS,CAIGA,CAIGAMOS,CAIG
     AIS,CAIGAN
2030  DATA PRES.SUBJ.OF DAR,DE,DE
     S,DE,DEMOS,DEIS,DEN
2031  DATA PRES.SUBJ.OF DECIR,DIG
     A,DIGAS,DIGA,DIGAMOS,DIGAIS,
     DIGAN
2032  DATA PRES.SUBJ.OF ESTAR,EST
     E,ESTES,ESTE,ESTEMOS,ESTEIS,
     ESTEN
2033  DATA PRES.SUBJ.OF HABER,HAY
     A,HAYAS,HAYA,HAYAMOS,HAYAIS,
     HAYAN
2034  DATA PRES.SUBJ.OF HACER,HAG
     A,HAGAS,HAGA,HAGAMOS,HAGAIS,
     HAGAN
2035  DATA PRES.SUBJ.OF IR,VAYA,V
     AYAS,VAYA,VAYAMOS,VAYAIS,VAY
     AN
2036  DATA PRES.SUBJ.OF MORIR,MUE
     RA,MUERAS,MUERA,MORAMOS,MORA
     IS,MUERAN
2037  DATA PRES.SUBJ.OF OIR,OIGA,
     OIGAS,OIGA,OIGAMOS,OIGAIS,OI
     GAN
2038  DATA PRES.SUBJ.OF OLER,HUEL
     A,HUELAS,HUELA,OLAMOS,OLAIS,
     HUELAN
2039  DATA PRES.SUBJ.OF PODER,PUE
     DA,PUEDAS,PUEDA,PODAMOS,PODA
     IS,PUEDAN
2040  DATA PRES.SUBJ.OF PONER,PON
     GA,PONGAS,PONGA,PONGAMOS,PON
     GAIS,PONGAN
2041  DATA PRES.SUBJ.OF QUERER,QU
     IERA,QUIERAS,QUIERA,QUERAMOS
     ,QUERAIS,QUIERAN
2042  DATA PRES.SUBJ.OF SABER,SEP
     A,SEPAS,SEPA,SEPAMOS,SEPAIS,
     SEPAN
2043  DATA PRES.SUBJ.OF SALIR,SAL
     GA,SALGAS,SALGA,SALGAMOS,SAL
     GAIS,SALGAN
2044  DATA PRES.SUBJ.OF SER,SEA,S
     EAS,SEA,SEAMOS,SEAIS,SEAN
2045  DATA PRES.SUBJ.OF VER,VEA,V
     EAS,VEA,VEAMOS,VEAIS,VEAN
2046  DATA IMPERFECT OF MIRAR,MIR
     ABA,MIRABAS,MIRABA,MIRABAMOS
     ,MIRABAIS,MIRABAN
2047  DATA IMPERFECT OF COMER,COM
     IA,COMIAS,COMIA,COMIAMOS,COM
     IAIS,COMIAN
2048  DATA IMPERFECT OF VIVIR,VIV
     IA,VIVIAS,VIVIA,VIVIAMOS,VIV
     IAIS,VIVIAN
2049  DATA IMPERFECT OF SER,ERA,E
     RAS,ERA,ERAMOS,ERAIS,ERAN
2050  DATA IMPERFECT OF IR,IBA,IB
     AS,IBA,IBAMOS,IBAIS,IBAN
2051  DATA IMPERFECT OF VER,VEIA,
     VEIAS,VEIA,VEIAMOS,VEIAIS,VE
     IAN
2052  DATA PRET.OF MIRAR,MIRE,MIR
     ASTE,MIRO,MIRAMOS,MIRASTEIS,
     MIRARON
2053  DATA PRET.OF COMER,COMI,COM
     ISTE,COMIO,COMIMOS,COMISTEIS
     ,COMIERON
2054  DATA PRE.OF VIVIR,VIVI,VIVI
     STE,VIVIO,VIVIMOS,VIVISTEIS,
     VIVIERON
2055  DATA PRET.OF PEDIR,PEDI,PED
     ISTE,PIDIO,PEDIMOS,PEDISTEIS
     ,PIDIERON
2056  DATA PRET.OF DORMIR,DORMI,D
     ORMISTE,DURMIO,DORMIMOS,DORM
     ISTEIS,DURMIERON
2057  DATA PRET.OF SENTIR,SENTI,S
     ENTISTE,SINTIO,SENTIMOS,SENT
     ISTEIS,SINTIERON
2058  DATA PRET.OF ANDAR,ANDUVE,A
     NDUVISTE,ANDUVO,ANDUVIMOS,AN
     DUVISTEIS,ANDUVIERON
2059  DATA PRET.OF CAER,CAI,CAIST
     E,CAYO,CAIMOS,CAISTEIS,CAYER
     ON
2060  DATA PRET.OF CONDUCIR,CONDU
     JE,CONDUJISTE,CONDUJO,CONDUJ
     IMOS,CONDUJISTEIS,CONDUJERON

2061  DATA PRET.OF DAR,DI,DISTE,D
     IO,DIMOS,DISTEIS,DIERON
2062  DATA PRET.OF DECIR,DIJE,DIJ
     ISTE,DIJO,DIJIMOS,DIJISTEIS,
     DIJERON
2063  DATA PRET.OF ESTAR,ESTUVE,E
     STUVISTE,ESTUVO,ESTUVIMOS,ES
     TUVISTEIS,ESTUVIERON
2064  DATA PRET.OF HABER,HUBE,HUB
     ISTE,HUBO,HUBIMOS,HUBISTEIS,
     HUBIERON
2065  DATA PRET.OF HACER,HICE,HIC
     ISTE,HIZO,HICIMOS,HICISTEIS,
     HICIERON
2066  DATA PRET.OF IR,FUI,FUISTE,
     FUE,FUIMOS,FUISTEIS,FUERON
2067  DATA PRET.OF MORIR,MORI,MOR
     ISTE,MURIO,MORIMOS,MORISTEIS
     ,MURIERON
2068  DATA PRET.OF OIR,OI,OISTE,O
     YO,OIMOS,OISTEIS,OYERON
2069  DATA PRET.OF PODER,PUDE,PUD
     ISTE,PUDO,PUDIMOS,PUDISTEIS,
     PUDIERON
2070  DATA PRET.OF PONER,PUSE,PUS
     ISTE,PUSO,PUSIMOS,PUSISTEIS,
     PUSIERON
2071  DATA PRET.OF QUERER,QUISE,Q
     UISISTE,QUISO,QUISIMOS,QUISI
     STEIS,QUISIERON
2072  DATA PRET.OF SABER,SUPE,SUP
     ISTE,SUPO,SUPIMOS,SUPISTEIS,
     SUPIERON
2073  DATA PRET.OF SER,FUI,FUISTE
     ,FUE,FUIMOS,FUISTEIS,FUERON
2074  DATA PRET.OF TENER,TUVE,TUV
     ISTE,TUVO,TUVIMOS,TUVISTEIS,
     TUVIERON
2075  DATA PRET.OF TRAER,TRAJE,TR
     AJISTE,TRAJO,TRAJIMOS,TRAJIS
     TEIS,TRAJERON
2076  DATA PRET.OF VENIR,VINE,VIN
     ISTE,VINO,VINIMOS,VINISTEIS,
     VINIERON
2077  DATA PRET.OF VER,VI,VISTE,V
     IO,VIMOS,VISTEIS,VIERON
```

Fruit machine

THIS GAME by Paul McPherson of Aberdeen is, if anything, a little too fast. Suspense is 90 percent of the fun of gambling, and if it is all over in a flash the attraction is greatly diminished.

Paul McPherson has stored his data for the user-defined graphics as binary values, which take up about four times the space of decimal values and are not really necessary for user-defined graphics. The main advantage of using binary is the ease of defining the effect.

An easy way of translating binary into decimal is to enter the variable as binary and then execute a

Print<variable>

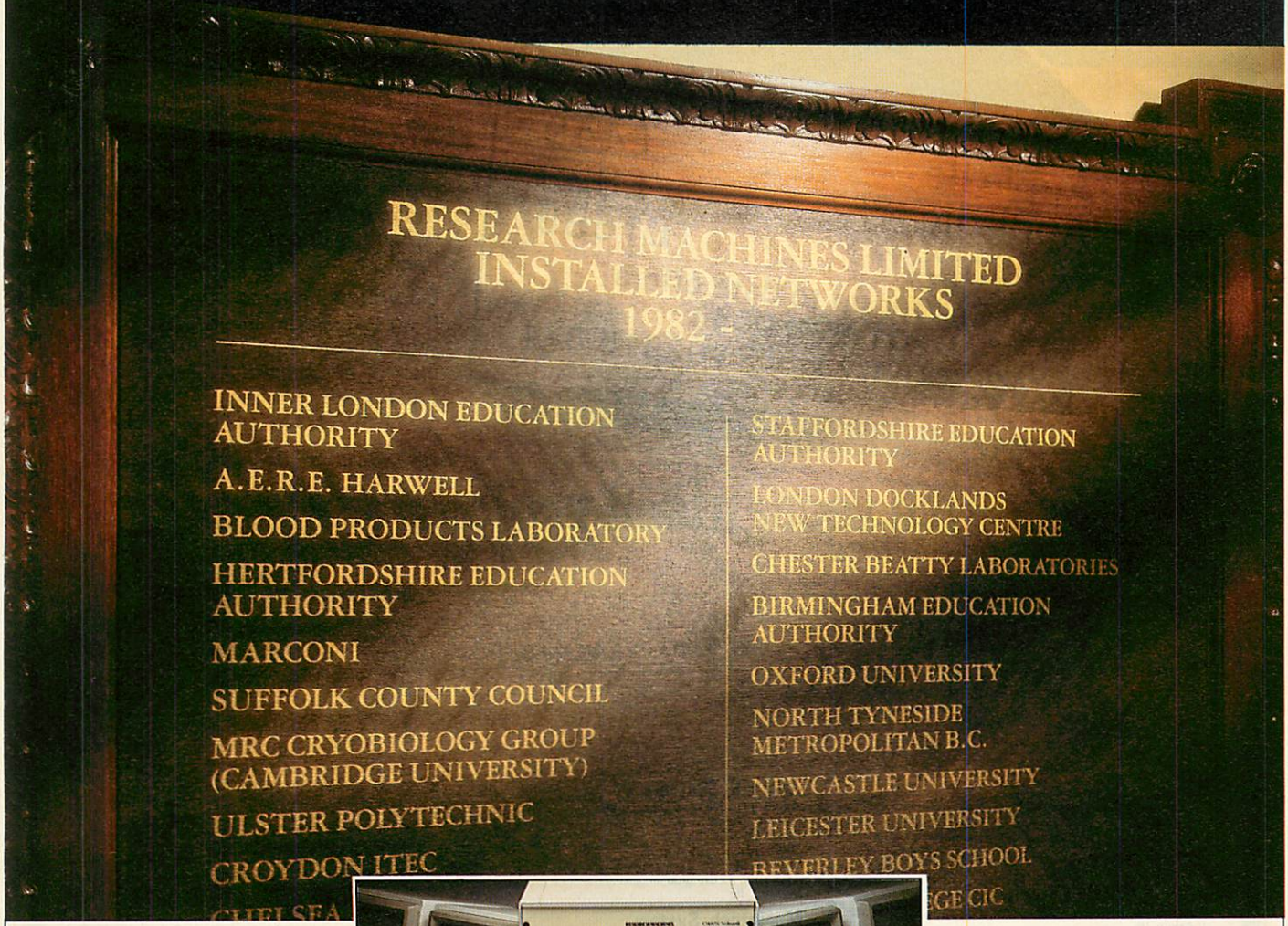
You can use this and the other seven values to define the graphic.

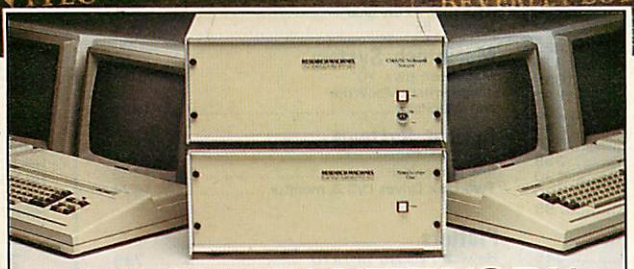
Fruit machine.

```
   1 REM
   3 REM
   4
   5 REM
   6
  10 GO SUB 9500: REM GRAPHICS
  15 GO SUB 8000: REM VARIBLES
  17 GO SUB 6000: REM TITLE
  20 GO SUB 7000: REM SCREEN
  30 INPUT "": PAUSE 0
  40 IF INKEY$="n" OR INKEY$="N"
 THEN CLS : PRINT AT 11,0; INK 3
;"        YOU TAKE ";mon;"p HOME
!": GO SUB 4020
  50 LET mon=mon-5
  60 PRINT AT 19,7; INK 7;"    ";
 PRINT AT 19,10-LEN STR$ mon; IN
K 7;mon
  65 IF s$(1)<>"n" THEN LET b$(1
)=a$(INT (RND*4)+1)
  66 IF s$(2)<>"n" THEN LET b$(2
)=a$(INT (RND*4)+1)
  67 IF s$(3)<>"n" THEN LET b$(3
)=a$(INT (RND*4)+1)
  70 GO SUB 1000
1000 FOR r=1 TO 3: FOR h=1 TO 4
1005 IF s$(r)="n" THEN GO TO 103
0
1010 INK 6: PRINT AT 6,2+2*r;a$(
h)
1015 NEXT h
1020 PRINT AT 6,2+2*r;b$(r)
1030 NEXT r
2010 IF b$(1)="B" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET mon=m
on+20: GO TO 3000
2020 IF b$(1)="C" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET mon=m
on+30: GO TO 3000
2040 IF b$(1)="E" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET mon=m
on+40: GO TO 3000
2050 IF b$(1)="F" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET mon=m
on+200: GO TO 3000
3000 IF b$(1)="B" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET m=2
3002 IF b$(1)="C" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET m=3
3004 IF b$(1)="E" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET m=4
3006 IF b$(1)="F" AND b$(2)=b$(1
) AND b$(3)=b$(1) THEN LET m=20
3007 IF m>0 THEN GO SUB 3499
3010 PRINT AT 19,2; INK 7;"CASH
";AT 19,10-LEN STR$ mon;mon: IF
mon=0 THEN GO TO 4000
3020 BEEP .1,RND*50: BEEP .1,RND
*50: GO TO 30
3499 IF m=20 THEN GO TO 3510
3500 CIRCLE 52,76,15: PRINT AT 1
2,5;m;"0p": FOR f=1 TO 50: BEEP
.01,f: NEXT f: PRINT AT 12,5;"
  ": OVER 1: CIRCLE 52,76,15: OVE
R 0: LET m=0
3505 RETURN
3510 PRINT AT 6,4; FLASH 1; OVER
 1;"        ": CIRCLE 52,76,15: PRI
NT AT 12,5;"£ 2": FOR f=-50 TO 5
0: BEEP .01,f: NEXT f: PRINT AT
12,5;"    ": OVER 1: CIRCLE 52,76
,15: OVER 0: LET m=0: PRINT AT 6
,4; OVER 0;"        ": GO TO 3010
3999
4000 REM
4001
4010 CLS : PRINT AT 11,8;"YOU'RE
 BROKE !": BEEP 1,-10: BEEP 1,-2
0: BEEP 1,-30
4020 INPUT "DO YOU WANT ANOTHER
GAME ?";x$
4030 IF x$(1)="y" THEN RUN
4040 CLS : PRINT AT 11,3;"I HOPE
 YOU ENYOYED PLAYING": PAUSE 100
: CLS : BORDER 7: PAPER 7: INK 0
: CLS
6988 STOP
6999
6000 REM
6001
6005 BORDER 5: PAPER 5: INK 1: C
LS
6010 PRINT AT 1,9; PAPER 6;"FRUI
T MACHINE"
6020 PRINT AT 5,0;"  IN FRUIT MA
CHINE YOU TRY TO   WIN AS MUCH M
ONEY AS YOU CAN"
6030 PRINT "ON THE ONE ARMED BAN
DIT.
                EACH GO COSTS 5p.
                PRESS ANY KEY TO ROL
L
                OR "N" TO STOP "
6040 PRINT ,,,,,"PRESS A KEY TO
START": PAUSE 0
6500 PAUSE 200
6600 RETURN
6999
7000 REM
7001
7010 BORDER 0: PAPER 0: INK 7: C
LS : PRINT AT 1,10; INK 6; PAPER
 3;"FRUIT MACHINE"
7020 PRINT AT 5,17; INK 4; PAPER
 0;AT 7,17; INK 6;" B B B   =  20
p ";AT 9,17; INK 3;" C C C   =  3
0p ";AT 11,17; INK 4;" E E E   =
 40p "
7030 PRINT AT 17,21; FLASH 1;"JA
CKPOT"; FLASH 0;AT 18,17;AT 19,1
7; PAPER 0; INK 5;" F F F   =  £
2 "
7070 PLOT 20,48: DRAW 0,88: DRAW
 63,0,-PI: DRAW 0,-88: PLOT 12,4
8: DRAW 79,0: DRAW 0,-7: DRAW 7,
0: DRAW -93,0: PLOT 12,48: DRAW
0,-7: DRAW -7,0: DRAW 0,-7: DRAW
 93,0: DRAW 0,7
7080 PLOT 0,34: DRAW 103,0: DRAW
 0,-23: DRAW -103,0: DRAW 0,23
7090 PLOT 24,112: DRAW 55,0: DRA
W 0,23: DRAW -55,0: DRAW 0,-23
7100 PRINT AT 19,2;"CASH ";mon;"
p"
7110 PLOT 32,95: DRAW 39,0: DRAW
```

(continued on page 145)

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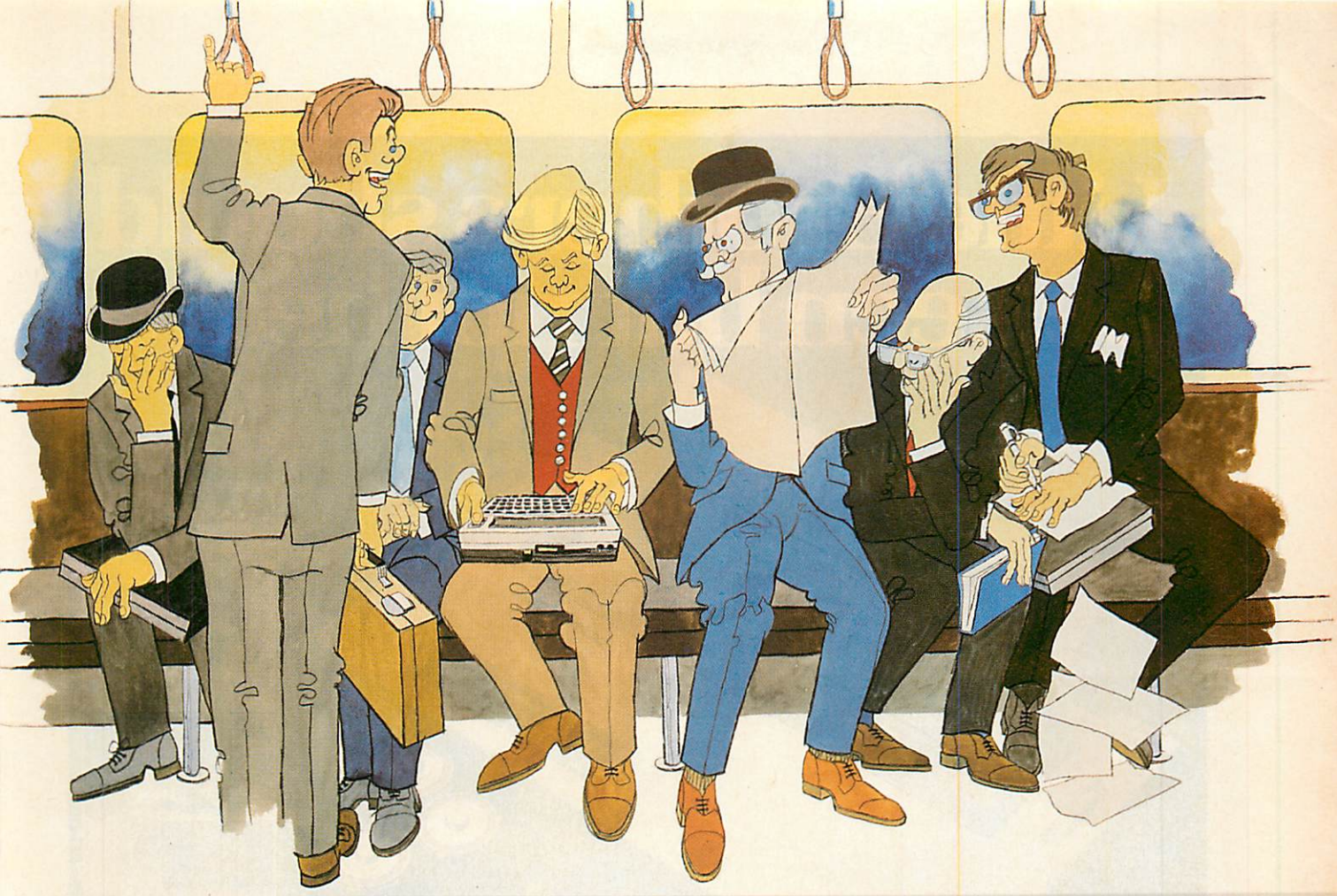
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(continued from page 140)

```
 0,-39: DRAW -39,0: DRAW 0,39
7200 PLOT 84,53: DRAW 0,20,PI: D
RAW 12,23: DRAW 7,0: DRAW 0,40:
DRAW -7,0,PI: DRAW 0,-40: DRAW 7
,0: DRAW -8,-33
7210 RETURN
7999

8000 REM [illegible]
8001
8003 DIM b$(3)
8005 LET m=0
8010 LET a$="BCEF"
8020 LET mon=150
8025 LET s$="    "
8030 RETURN
8999

9000 REM [illegible]
9001
9010 DATA BIN 00000100,BIN 00001
000,BIN 00111110,BIN 01111111,BI
N 01111111,BIN 01111111,BIN 0011
1110,BIN 00011100
9020 DATA BIN 00000011,BIN 00000
011,BIN 00000111,BIN 00000111,BI
N 00001110,BIN 00111110,BIN 1111
1100,BIN 11110000
9030 DATA BIN 01000100,BIN 01101
000,BIN 00010100,BIN 00010110,BI
N 00110000,BIN 01111000,BIN 0111
1000,BIN 00110000
9040 DATA 0,BIN 00001000,BIN 001
11110,BIN 01111111,BIN 01111111,
BIN 00111110,BIN 00011100,BIN 00
001000
9050 DATA 0,0,BIN 00111100,BIN 0
1111110,255,BIN 01111110,BIN 001
11100,0
9060 DATA BIN 00001000,BIN 00011
100,BIN 00111100,BIN 00111110,BI
N 01111111,BIN 00001000,BIN 0000
1000,0
9499

9500 REM [illegible]
9501
9505 FOR F=USR "a" TO USR "f"+7
9510 READ z: POKE F,z
9515 NEXT F: RETURN
9998 SAVE "F/MACHINE" LINE 1: ST
OP
```

Precise characters

Normally, ASCII or user-defined characters can only be printed on the screen in text positions by Tabbing. When used in conjunction with graphics, the positioning becomes imprecise. Mark Sanderson of St. Andrews, Scotland has sent a machine-code program, suitable for any Spectrum, which will print any ASCII or user-defined character on the screen at pixel co-ordinates.

The routine is in the form of a Basic machine-code loader. Having typed in the Basic code, save it before running it. If you have made a mistake, the program may crash and you will have to type it in again.

When you run the program the first question it asks is for the starting address of the machine-language code. If you have no other requirements, for 16K use 32300 and for 48K machines use 65000.

You will then be asked if you want to save the program and the machine code. You should have already saved the Basic program so answer No until you know that you have entered it correctly.

The program then shows five memory locations. Into the first two Poke the Y and X co-ordinates respectively of the screen position. The maximum Y co-ordinate is 191 and the maximum X co-ordinate is 255. Point 0,0 is in the top left-hand corner.

The third value is the code of the character that is to be printed. The fourth and fifth values relate to the way the program prints the character.

There are three different numbers you can Poke into these addresses: 0, 168 or 176. It is best to experiment with them to find the different effects. To set the colour of the character, use the Basic colour commands before you run the machine-code program.

Precise characters.

```
  10 DATA 243,33,0,91,6,16,54,0,
35,16,251,58,16,91,230,7,17,0,91
,95,42,18,91,125,41,41,41,254,14
4,48,6,237,75,54,92,24,3,1,216,2
50,9,1,8,0

  20 DATA 237,176,58,17,91,230,7
,79,62,8,145,79,58,17,91,203,63,
203,63,203,63,50,22,91,58,16,91,
203,63,203,63,203,63,50,21,91,24
5,197,60,71,245,58,141

  30 DATA 92,79,58,22,91,17,32,0
,38,0,111,25,16,253,17,224,87,25
,113,254,31,40,3,35,113,43,71,24
1,254,24,40,12,17,32,0,25,113,12
0,254,31,40,2,35

  40 DATA 113,193,241,33,0,91,6,
2,197,229,205,158,14,58,22,91,95
,22,0,25,235,225,6,8,197,229,126
,111,36,0,121,254,0,40,4,65,41,1
6,253,124,235,70,176

  50 DATA 235,18,58,22,91,254,31
,40,9,125,213,19,235,70,176,235,
18,209,20,225,35,193,16,213,58,2
1,91,254,23,40,9,60,33,8,91,193,
16,183,251,201,193,251,201

  60 PRINT "What is the starting
 address of the code ?"
  70 INPUT a
  80 LET b=INT (a/256): LET c=a-
(256*b): POKE 23730,(c-1): POKE
23731,b
  90 FOR f=0 TO 215
 100 READ b
 110 POKE (a+f),b
 120 NEXT f
 130 PRINT ,,"Do you want to sav
e this programand the code ?(y/n
)"
 140 INPUT a$
 150 IF a$="y" THEN GO TO 230
 160 CLS
 170 PRINT "  The addresses to P
OKE are"
 180 PRINT ,,,,"23312 with Y coo
rdinate of                 character"
 190 PRINT "23313 with X coordin
ate of                     character"
 200 PRINT "23314 with code numb
er of                      character"
 210 PRINT a+172;" & ";a+187;" w
ith the printing           type numb
er"
 220 STOP
 230 PRINT ,,"Input program name
"
 240 INPUT a$
 250 SAVE a$ LINE 0
 260 SAVE a$CODE a,215
 270 PRINT ,,"reposition the tap
e for          verification"
 280 VERIFY a$
 290 VERIFY a$CODE a,215
 300 GO TO 160
```

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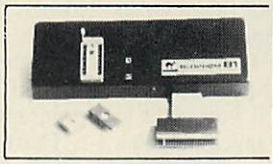
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RAM START ADDR —4000
EPROM ST. ADDR — 0000
JOB LENGTH — 4000
TASK — CHECK

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W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
Y) BLOW AN EPROM WITH DATA FROM RAM
Z) VERIFY THAT EPROM DATA IS THE SAME AS IN RAM
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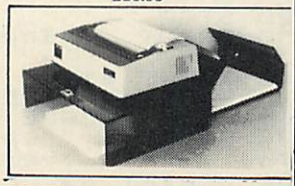
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Pet Pokes problem

Pet problem.

```
100 :REM ***  CBM64 TO PET (BASIC4) ***

1000 S=32700
1010 READ A: IF A>255 THEN 1030
1020 POKE S,A: C=C+A: S=S+1: GOTO 1010
1030 IF A<>C THEN PRINT"CHECKSUM ERROR":END

1050 POKE 52,187: POKE 53,127
1060 A=FRE(0)
1070 NEW

2000 DATA 169,1,162,4,133,31,134
2010 DATA 32,162,8,133,33,134,34
2020 DATA 160,0,165,33,197,42,208
2030 DATA 17,165,34,197,43,208,11
2040 DATA 32,182,180
2050 DATA 165,43,56,233,4,133,43,96
2060 DATA 177,33,145,31,230,31,230
2070 DATA 33,208,223,230,32,230,34
2080 DATA 76,204,127
2090 DATA 6091
```

Keyboard bleep.

```
1 REM ********************************
2 REM *                              *
3 REM *  KEYBOARD BLEEP FOR THE 64   *
4 REM *                              *
5 REM ********************************

10 POKE 52,159: POKE 56,159
20 S=40704
30 FOR I=S TO S+73
40 READ A: POKE I,A: C=C+A
50 NEXT

60 READ A
70 IF A<>C THEN PRINT"DATA ERROR":STOP

80 SYS40765

90 NEW

100 DATA 64,8,72,138,72,152,72,165
101 DATA 197,205,0,159,240,38,141,0
102 DATA 159,169,8,141,24,212,169,2
103 DATA 141,6,212,169,65,141,1,212
104 DATA 169,75,141,0,212,169,33,141
105 DATA 4,212,169,32,141,4,212,169,4
106 DATA 141,24,212,104,168,104,170
107 DATA 104,40,76,72,235,120,169,1
108 DATA 141,143,2,169,159,141,144,2
109 DATA 88,96
110 DATA 8266
```

THERE ARE a variety of techniques available to allow programs written on the Commodore 64 to be loaded into a Pet but they require some awkward Pokes or other fiddling around that becomes tedious if needed frequently.

F Halliday provides a solution in the form of a simple machine-code program which requires only a single command to do the necessary adjustments to allow 64 programs to be listed on a Pet.

The program in the listing is run on a Pet and then any 64 programs, once loaded, just require

SYS 32700

to make them available for listing or modifying.

The program may not work on programs which have been tampered with to protect them, nor will it work on machine-code programs. In addition, the program is written for Basic 4 Pets, but by changing lines 2040 and 2090 as follows, it will work with Basic 2.

2040 DATA 32,66,196
2090 DATA 5991

Keyboard bleep for the 64

A program for the Commodore 64 which provides a simple keyboard bleep every time a key is pressed comes from Mr Rawalls of Chepstow.

It places the necessary machine code into memory starting at 40704 and resets the top of memory pointers, hooks the routine in and then erases itself leaving the machine-code program operating. The program intercepts the keyboard routine vectored through locations 655 and 656 and works reasonably well, although there are times when a double bleep is sounded.

Formatting listings

While Basic is a fairly easy language to use, the resulting programs can be cluttered and difficult to read. This is especially true when the program contains lines with many statements. But now Rune Nordberg has helped matters by writing a formatter program which reads the program from a disc file and prints it out suitably formatted.

The listing of the program itself has been formatted to show how easy the result is to read. Each separate statement is printed on a new line, with each For loop indented two spaces. Obviously, the program would be entered in the normal way.

There are no Gotos in the program.

(continued on page 149)

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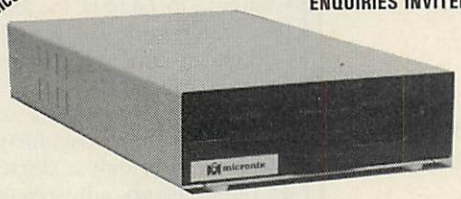
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(continued from page 147)

stead, For-Next loops are used to simulate Do-Until or Do-Forever with the start and finish values set to a value greater than the maximum complete integer that can be represented. This is set in the variable A to a value of 1E10; when it is incremented in the For-Next loop its value remains 1E10 and the loop continues.

To exit, the loop variable is set to a number higher than 1E10. Selecting the variable B, which is initialised to 2E10, forces the loop to exit on encountering Next.

The Data statements in lines 9910 to 9950 contain the Basic keywords. The list omits the Basic 4 keywords Concat, DOpen, DClose, Record, header, Collect, Backup, Copy, Append, DSave, DLoad, Catalog, Rename, Scratch and Directory. They could be added fairly easily if you need them, in which case the constant 75 in lines 1010 and 1200 must be changed to 90.

Formatting listings.

```
01000 REM *** LIST
01010 C0$ = CHR$(0):
      C1$ = ":":
      L% = 6:
      A = 1E10:
      B = 2E10:
      DIM C$(75)
01100 PRINT "■LIST":
      PRINT "■■ENTER NAME OF PROGRAM TO BE LISTED.":
      INPUT "PGM NAME";N$
01110 PRINT "■ENTER TODAYS DATE.":
      INPUT "DATE";D$
01120 PRINT "■■THE PGM TO BE LISTED MUST BE ON THE"
01130 PRINT "DISC IN DRIVE 0 AND THE PRINTERS PAPER"
01140 PRINT "MUST BE FITTED SO THAT THE PRINTER HEAD"
01150 PRINT "IS ON TOP OF PAGE.":
      PRINT "■HIT RETURN WHEN READY."
01160 FORI=ATOA:
        GET IN$:
        IF IN$ = CHR$(13) THEN I = B
01170 NEXT
01200 FOR I = 0 TO 75:
        READ C$(I):
      NEXT
01300 OPEN 4,4:
      OPEN 15,8,15:
      PRINT#15,"I0":
      GOSUB 9710
01310 OPEN 8,8,8,"0:"+N$+",P,R":
      GOSUB 9710:
      GOSUB 9610
01400 FOR I = 1 TO 4:
        PRINT#4:
      NEXT
01410 PRINT#4,SPC(8);CHR$(1);N$;CHR$(129),D$:
      PRINT#4
02000 FORI=ATOA:
        I% = 0:
        GOSUB 9610
02010   GOSUB 9510:
        X% = ASC(IN$):
        GOSUB 9510:
        LN$ = STR$(X%+ASC(IN$)*256)
02020   PRINT#4,SPC(8);RIGHT$("0000"+RIGHT$(LN$,LEN
        (LN$)-1),5);" ";
02030   FORJ=ATOA:
          OP$ = "":
          Q% = 0:
          F1% = 0:
          I1% = 0
02040     FORK=ATOA:
            GOSUB 9510:
            X% = ASC(IN$)
02050       IF NOT(X% > 127 AND X% <> 255 AND Q% = 0)
            GOTO 2130
02060       OP$ = OP$+C$(X%-128):
            IF X% = 139 THEN I% = I%+2:
              I1% = I1%+2
02070       IF X% = 129 THEN F% = F%+2:
              F1% = F1%+2
02080       IF NOT(X% = 130) GOTO 2120
02090       F% = F%-2:
            FORL=ATOA:
              GOSUB 9510:
              OP$ = OP$+IN$:
              IF IN$ = "," THEN F% = F%-2
02100         IF IN$ = C0$ OR IN$ = C1$ THEN L = B
02110       NEXT
02115       IF F% < 0 THEN F% = 0
02120       GOTO 2140
02130       OP$ = OP$+IN$
02135       IF IN$ = CHR$(34) THEN Q% = NOT Q%
02140       IF IN$ = C0$ OR IN$ = C1$ AND Q% = 0 THEN
            K = B
02150     NEXT
02160     X% = F%-F1%+I%-I1%:
          IF IN$ = C0$ THEN OP$ = LEFT$(OP$,LEN(OP$)
          -1)
02170     PRINT#4,SPC(X%);LEFT$(OP$,58-X%):
          GOSUB 9410
02180     IF NOT(LEN(OP$) > 58-X%) GOTO 2195
02190     PRINT#4,SPC(14+F%+I%);RIGHT$(OP$,LEN(OP$)
          -58+X%): GOSUB 9410
02195     IF IN$ = C1$ THEN PRINT#4,SPC(14);
02200     IF IN$ = C0$ THEN J = B
02210   NEXT:
      NEXT

09400 REM *** LINECOUNT
09410 L% = L%+1
09420 IF NOT(L% > 67) GOTO 9440
09430 FOR I = 1 TO 8:
        PRINT#4:
      NEXT:
      L% = 4
09440 RETURN

09500 REM *** READ-1
09510 GET#8,IN$:
      GOSUB 9710:
      IF IN$ = "" THEN IN$ = C0$
09520 RETURN

09600 REM *** READ-2
09610 GET#8,IN$:
      GOSUB 9710:
      GET#8,IN$:
      GOSUB 9710:
      IF IN$ <> "" THEN RETURN
09620 GOSUB 9810:
      END

09700 REM *** ERROR
09710 INPUT#15,EN$,EM$,ET$,ES$:
      IF EN$ = "00" THEN RETURN
09720 PRINT "■DISK ERROR":
      PRINT "■■ERRORNR:  ";EN$:
      PRINT "ERROR:    ";EM$
09730 IF NOT(EN$ > "19" AND EN$ < "30" OR EN$ = "65")
      GOTO 9750
09740 PRINT "■TRACK:    ";ET$:
      PRINT "SECTOR:   ";ES$
09750 GOSUB 9810:
      END

09800 REM *** CLOSE-CH
09810 CLOSE 4:
      CLOSE 8:
      CLOSE 15:
      RETURN

09900 REM *** COMMANDS
09910 DATA END,FOR,NEXT,DATA,INPUT#,INPUT,DIM,READ,
      LET,GOTO,RUN,IF,RESTORE
09920 DATA GOSUB,RETURN,REM,STOP,ON,WAIT,LOAD,SAVE,
      VERIFY,DEF,POKE,PRINT#,PRINT
09930 DATA CONT,LIST,CLR,CMD,SYS,OPEN,CLOSE,GET,NEW,
      TAB(,TO,FN,SPC(,THEN,NOT
09940 DATA STEP,+,-,*,/,↑,AND,OR,>,=,<,SGN,INT,ABS,
      USR,FRE,POS,SQR,RND,LOG,EXP
09950 DATA COS,SIN,TAN,ATN,PEEK,LEN,STR$,VAL,ASC,
      CHR$,LEFT$,RIGHT$,MID$,GO
```

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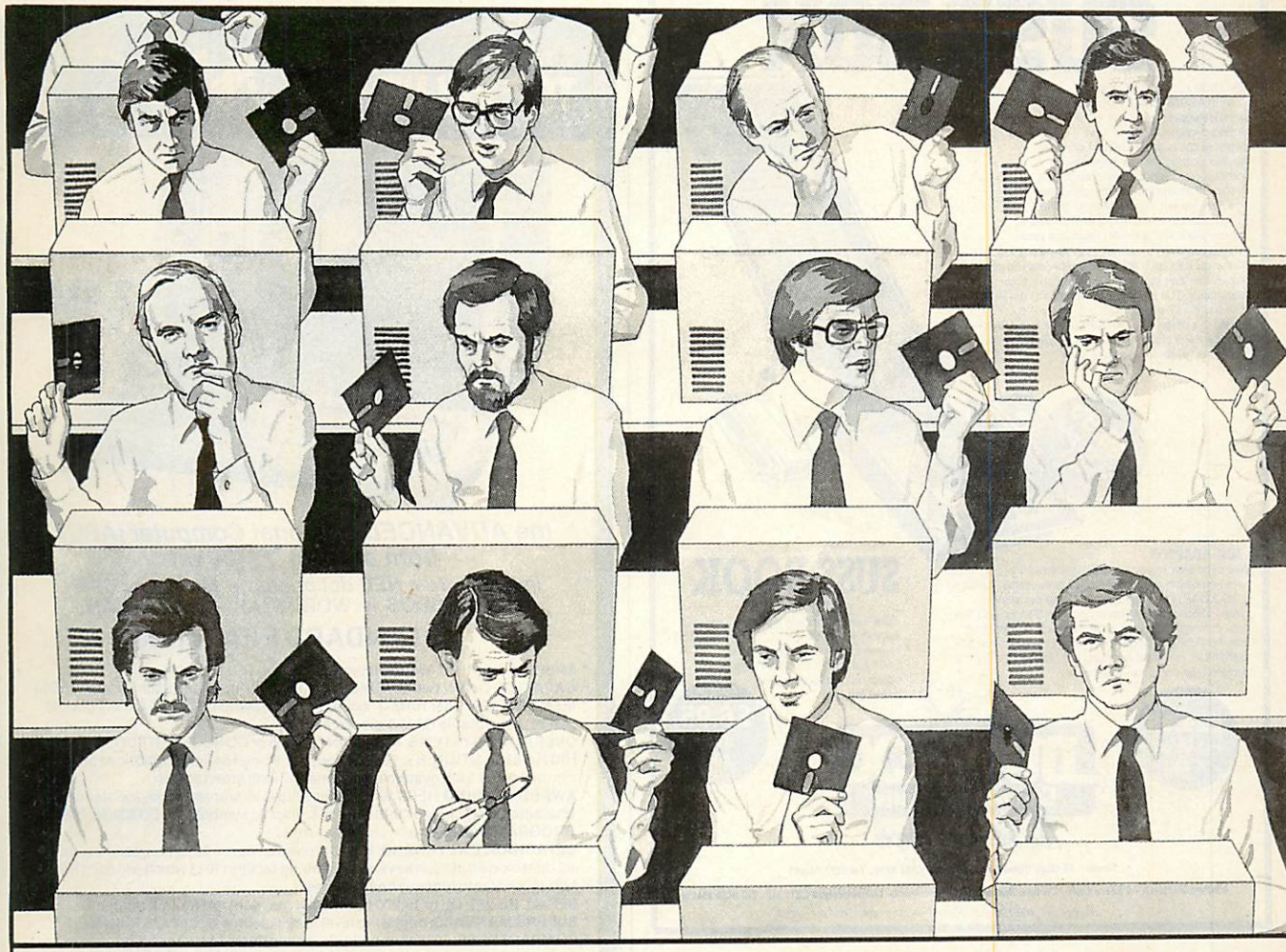
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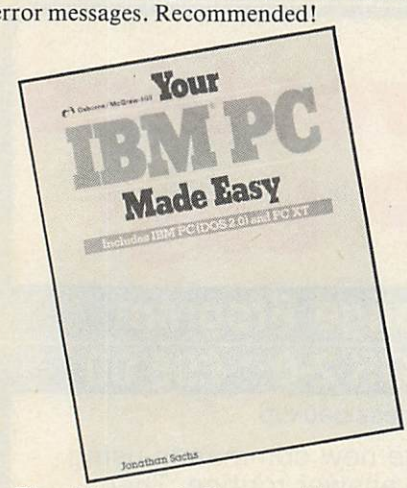
Second opinions on the IBM PC

IBM's micro has attracted authors by the hundred. Paul Myerscough samples some of their efforts.

DESPITE the high standard of documentation that accompanies the IBM PC, a secondary text can be a big help in becoming familiar with the machine. A year ago there were few books to choose from, but now the situation is quite different. From January to May 1984 more than 150 IBM PC books were published in the United States, and the prospect is of a further 300 before the year-end.

Leo Scanlon's *The IBM PC Made Easy* is aimed at the naive user and skips through discussions of the PC's components and the use of Basic and DOS. Like Scanlon's work on assembler programming, this book lacks imagination: it is short on explanatory diagrams and long on information copied from the IBM manuals. *The ABC's of the IBM PC* by Joan Laselle and Carol Ramsey is aimed at the same audience, but its style makes for easier reading. A discussion on WordStar and VisiCalc edges Basic out of the contents.

Not every Osborne/McGraw-Hill book is outstanding, but often they are way ahead of the crowd. *Your IBM PC Made Easy* by Jonathan Sachs is no exception. Space forbids the description this book warrants: expect 160 pages of practical lessons for the new user, 100 pages on resources from RAM chips to software to consultants, and a further 100 pages of reference information with topics like "Moving your PC", "Dealing with Disk Errors", and a good chapter on system error messages. Recommended!



The biggest challenge with a new computer is in learning about the operating system. *The IBM PC-DOS Handbook* by Richard King is written for those who already know computer essentials and plan to make use of DOS interrupts in their programming. This book provides a comprehensive guide to the system at this level, as well as providing a few chapters on the DOS commands.

Peter Norton, as an American magazine columnist, must hold a record for the fewest facts per thousands words of any popular technical writer. Despite this, *MS-DOS and PC-DOS User's Guide* is a useful book that will appeal to those with a non-technical background who might appreciate his cheerful style. His earlier book, *Inside the IBM PC,* despite some printing errors, successfully describes for programmers a selective tour of hardware and operating-system features using Pascal, Basic and assembler. Discs containing many of the applications described may be bought separately, but are overpriced and not entirely compatible with DOS-2.

The first edition of the Goldsteins' book simply entitled *IBM PC* became a moderately popular Basic tutor. Now slightly improved and packaged with a disc containing the example programs, it is still aimed at the new programmer. With regular reviews and exercises to test understanding, it is a reasonable starting point for the beginner. *Advanced Basic and Beyond* by Larry Goldstein follows the same format and, word-for-word, duplicates parts of the last book.

IBM PC Basic Programming by Haskell and Jackson is a good introduction to the subject. With the authority of a student text, its only drawback — for those without a colour monitor — will be the emphasis on graphics programming. *IBM Basic* by Payne and Beck highlights the problem-solving aspects of programming. Its condescending, wordy style may suit someone new to computing but this book is not much use as reference work as it lacks an alphabetic index.

Rodnay Zaks has produced many computer books of varying quality. *Your First IBM PC Program,* with the yellow-brick road of the keyboard leading to a distant fairy castle on the cover, looks like something from the nursery. Inside you meet the cartoon characters Dino the Programmer, the Programming Snake, various Bugs, Instructions, Variables and other friends. If this appeals, then the many illustrations will help you relive your childhood and learn a little Basic at the same time.

Debugging a program without a cross-reference of variables and line numbers is an unnecessarily arduous task. *The IBM PC Guide* by James Kelly is a cheerful introduction to the IBM PC and Basic programming and comes complete with a disc containing example programs from the text and some useful utilities, including a cross-referencing program. Alongside this, the Basic cross-reference utility CRF from Sumar Corporation, seems poor value at £29.27.

Assembler for the IBM PC and PC-XT by Peter Abel is a welcome addition to those books reviewed in the February 1984 issue of *Practical Computing,* providing a well-paced tutorial for those new to assembler programming. Each chapter builds on the previous one, adding a few more instructions, and ends with excercises to test the reader's understanding. The emphasis is on the task of learning assembler instructions and the use of the IBM Macro assembler, rather than on the system hardware or on building useful applications.

Those planning to use Pascal for the first time could do worse than consult *Pascal for the IBM Personal Computer* by Ted Lewis. The most popular versions on the IBM PC are IBM's own product and UCSD Pascal, which is reputedly poorly documented, and IBM's own product. Like most versions of Pascal these two have their own idiosyncrasies, and the author successfully holds them apart. There is a tutorial which takes the reader



from basics like "What is a Pascal Program?" to coding for some useful applications, including a file-sort program and a simple accounts-receivable program.

Communications and interfacing are subjects of interest to the technically curious as well as to those with a scientific problem to solve. James Coffron in *The IBM PC Connection* addresses the computer novice with a little understanding of Basic programming. His vehicle for introducing I/O is the CMS I/O board which, using a set of LEDs, provides a visual confirmation of the results of I/O programming. Through discussion of simple projects for computer-controlled home security, speech synthesis and analogue-digital applications he describes basic hardware and software design requirements.

Lewis Eggebrecht was involved as a team leader in the design of the IBM PC. His book *Interfacing to the IBM Personal Computer* is, as one would expect, an authoritative guide to the resources and requirements of the machine. His style is concise, and for the experienced designer or for those with a particular project in mind this is an excellent reference book.

Communications and Networking for the IBM PC by Jordan and Churchill aims to "bridge the gap between the fundamentals of communication and the practical aspects of making it work". With quite a different emphasis from the previous two books, this provides a broad introduction to the subject in non-technical terms that any newcomer to the subject should understand, answering questions such as What is a modem?, How

(continued on next page)

The IBM PC Made Easy by Leo J Scanlon. Published by Prentice-Hall International, £14.35. ISBN 0 13 448465 7

The ABC's of the IBM PC by Joan Lasselle and Carol Ramsey. Published by Sybex, £9.95. ISBN 0 89588 102 0

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The IBM PC Connection by James W Coffron. Published by Sybex ISBN 0 89588 127 6

(continued on next page)

Second opinions on the IBM PC

(continued from previous page)

does serial transfer work?, What is Lan?

By page 70 of *Basic Programming for the IBM Personal Computer with Technical Applications,* Victor Kassab has covered not only most of the Basic commands but also an introduction to computers, flow charting and structured programming. He continues with functions, complex numbers, processing arrays, plotting data, three-dimensional graphics, string manipulation, files and interfacing. His terse style is refreshing in an area where repetition and long drawn-out explanations are the norm.

Among the many books aimed at the business user Dzintar Dravnieks' *IBM Personal Computer Handbook* stands out. It incorporates an absorbing 200-page directory of software, hardware, books, accessories and U.S. suppliers with a 40-page U.K. supplement, which follows sections on learning about the IBM PC, and on buying and using it. This is the first book I have seen that presents all aspects of a personal computer without demanding prior technical knowledge of the reader or a tremendous tolerance of repetition. Neither does the reader need to be sat in front of a keyboard, or even be a computer owner.

A short history of computing is followed by a discussion of the IBM PC and its main components. The chapter "What to Buy and How to Buy it" contains some excellent advice, including the recommendation: "Even though you are quite certain that you have made up your mind (to buy the IBM PC) . . . wait 100 days." The spreadsheet is possibly the most popular application on a microcomputer, but until it has been seen in operation the whole concept may be hard to grasp. The relevant chapter in Dravnieks' book gives the reader a good understanding of the principles and uses of these programs, highlighting some of the key differences between the most popular packages available.

A Guide to the Best Business Software for the IBM PC by Dorf and *The Best of IBM PC Software* by Trost both attempt to summarise the main features of a selection of software packages. In 200 pages Dorf covers around 100 items, including games and programming languages; Trost only tackles half that number in 340 pages. Inevitably the descriptions are too brief for users to make a detailed assessment of what package suits them best, although both books might help in creating a short list of possibilities.

Dorf's rather irrelevant introductory chapters leave even less space for package descriptions and he uses 130 words to describe VisiCalc whereas Trost uses 2,500 and Trost clearly wins hands down for providing better software reviews. Probably the best customer for these books is not the single systems user but the dealer or the PC support manager who needs to fend off difficult users wanting to know why they should use Lotus 1-2-3 and not Context MBA.

One of my current clients has recently standardised on the IBM PC for personal computing. The support manager's office is usually crammed with pristine machines awaiting delivery to the user departments, each one with a standard set of manuals and software: always Basic, always Lotus 1-2-3, often WordStar and occasionally dBase II. Perhaps *Software Solutions for the IBM PC* by Thomas Willmot should be there too because this book provides a guide to all these packages as well as VisiCalc and BPS Business Graphics.

Willmot's style is light and easy, and requires the reader to be sat at the computer in order to follow through the examples provided. Each chapter is a one-to two-hour tour of some of the features of one package. There are no esoteric tips about using more advanced functions, but the author presents a balanced overview that expresses a clear outline of the product.

The remaining books are for the Basic programmer or would-be programmer. *Business Applications for the IBM Personal Computer* by Zimmerman and Conrad presents a suite of simple accounting programs and a set of business routines that includes loan amortisation, depreciation, payback analysis and regression analysis. Its 200 pages of detailed discussion of the operation of the programs is perhaps excessive for the systems presented, and the seemingly obligatory introductory chapter on the IBM PC is unnecessary. The 70 pages of code may be typed in, or you can save yourself the trouble and buy the accompanying disc. While the programs may fulfil their functions they do not present a sophisticated user-view, and the programming style could be bettered.

Business Problem Solving with the IBM PC & XT by Wortman contains some 30 routines from the curious "Appraising the Performance of Employees and Managers, to the not very useful Sortlist", which orders up to 50 items of 30 characters long typed in from the keyboard. Both Basic and Pascal code is presented and the coding standard seems reasonably good. Perhaps the novice programmer may find a few lines of code to borrow from here.

Accountant's Basic Programming for the IBM PC by Parker, unlike the previous two, is a Basic tutor. The word "accountant" in the title does not mean that it provides a full suite of accounting programs, but rather that the example programs used in the text are business orientated. The chapters are structured well and use summary tables and flow charts, together with detailed discussion of the problem programs. Student exercises follow each section, and it is easy to imagine this book being used as a basis for a commercial course.

(continued from previous page)

Interfacing to the IBM Personal Computer by Lewis C Eggebrecht. Published by Sams/Prentice-Hall International, £13.55. ISBN 0 672 22027 X

Communications and Networks for the IBM PC by Larry E Jordan and Bruce Churchill. Published by Brady/Prentice-Hall International, £17.05. ISBN 0 89303 385 5

Basic Programming for the IBM Personal Computer with Technical Applications by Victor Kassab. Published by Prentice-Hall, £14.35. ISBN 0 13 066218 6

The IBM Personal Computer Handbook edited by Dzintar E Dravnieks. Published by Prism Press, £16.95 hardback, £11.95 paperback ISBN 0 907061 45 1

A Guide to the Best Business Software for the IBM PC by Richard C Dorf. Published by Addison-Wesley, £10.95. ISBN 0 201 11025 6

The Best of IBM PC Software by Stanley R Trost. Published by Sybex, £12.95. ISBN 0 89588 104 7

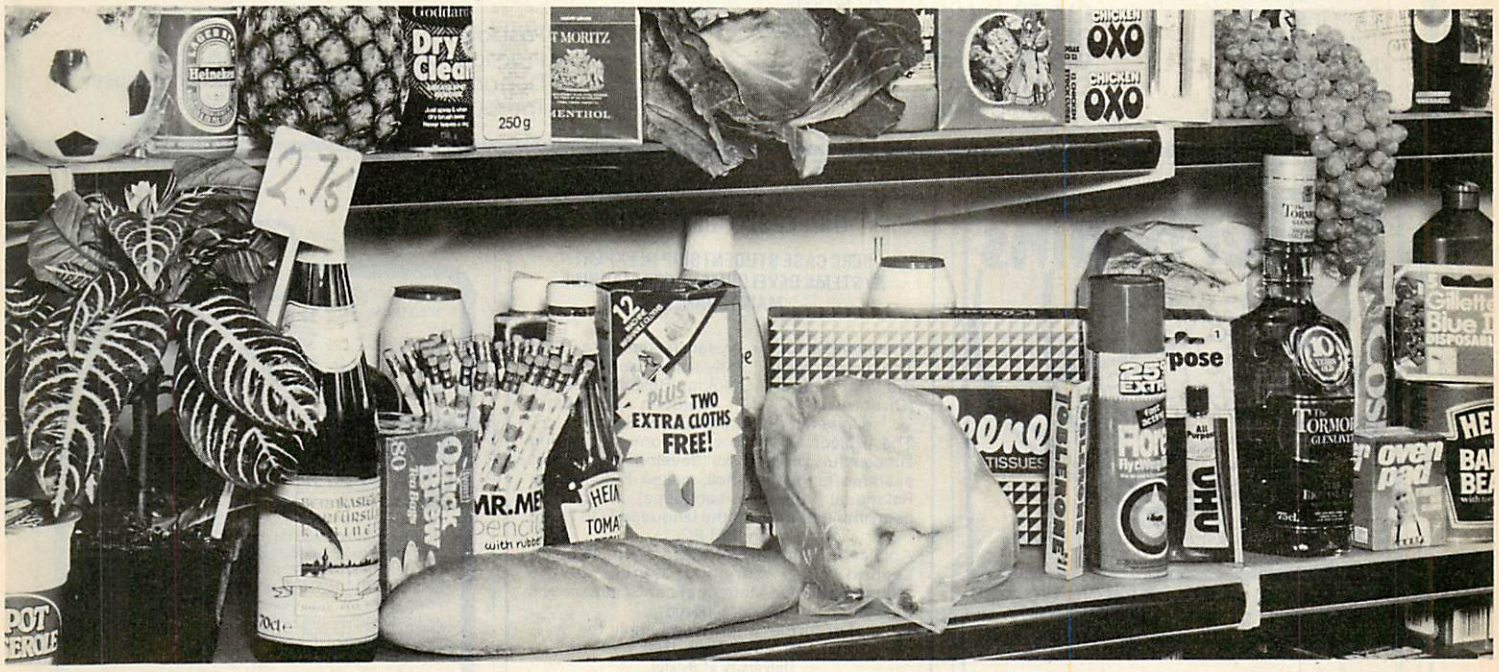
Business Applications for the IBM Personal Computer by Steven M Zimmerman and Leo M Conrad. Brady/Prentice-Hall International, £16.15. ISBN 0 89303 243 3

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Software Solutions for the IBM PC by Thomas H Willmott. Published by Spectrum/Prentice-Hall International, £13.45. ISBN 0 13 822387 4

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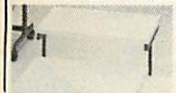
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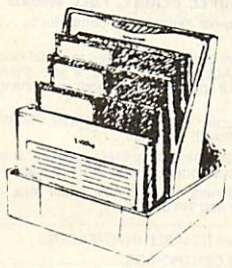
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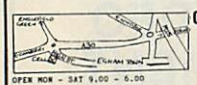
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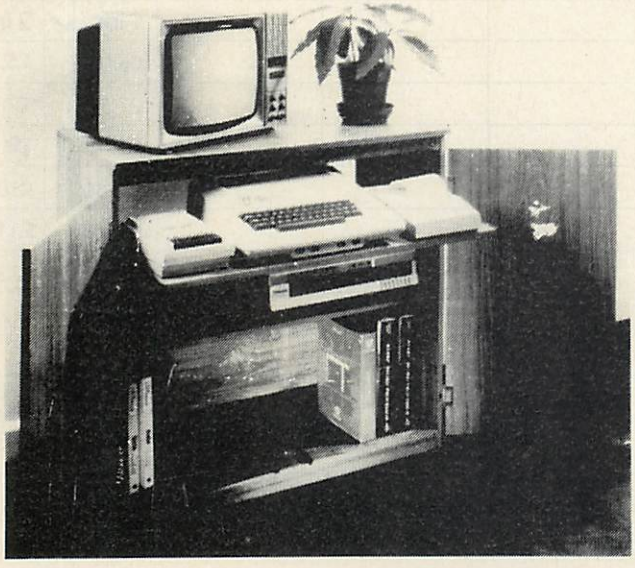
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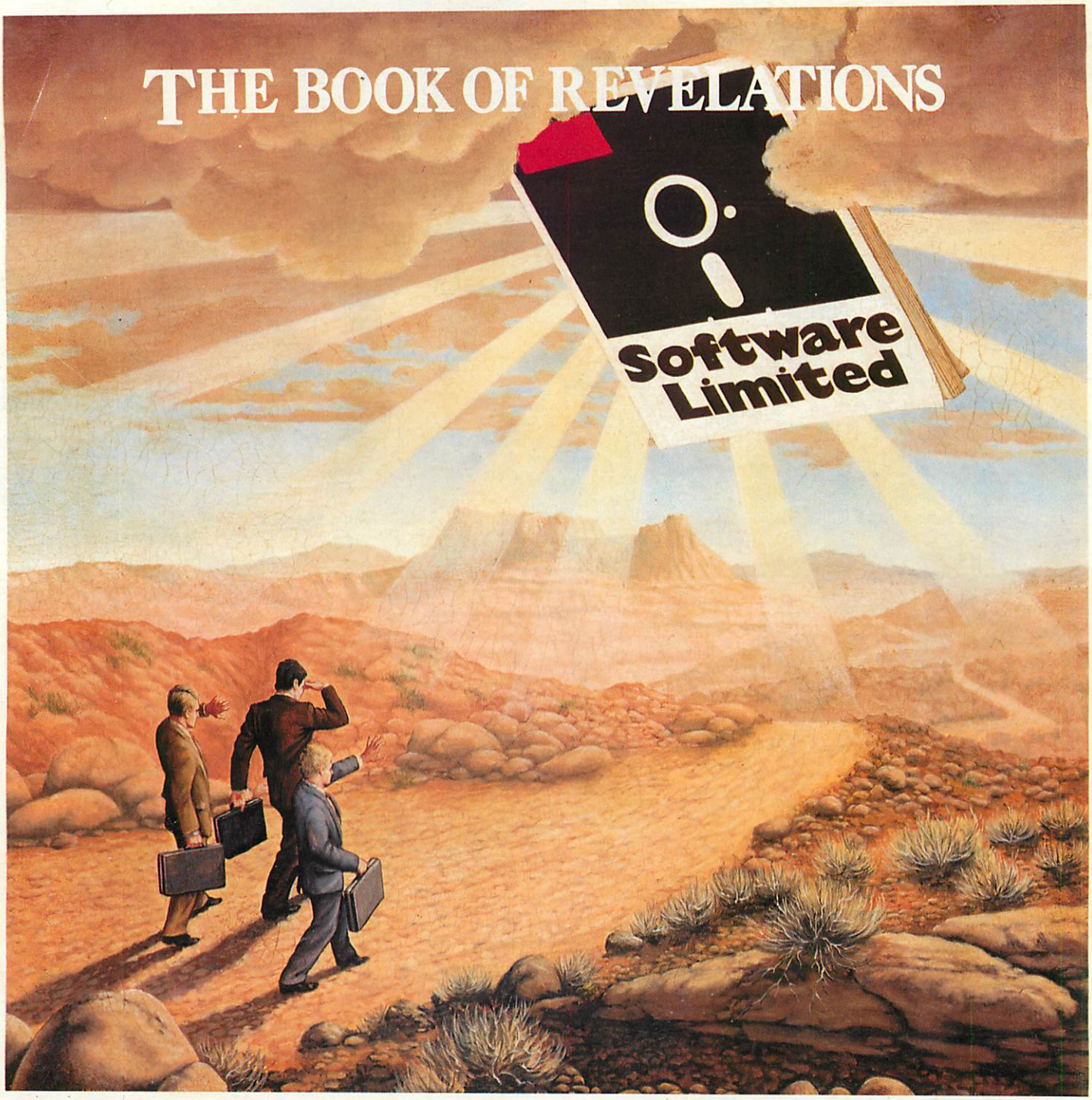
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