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September 1984 85p

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EXCLUSIVE SONY MSX BENCHTEST

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Vol 7 No 9 September 1984

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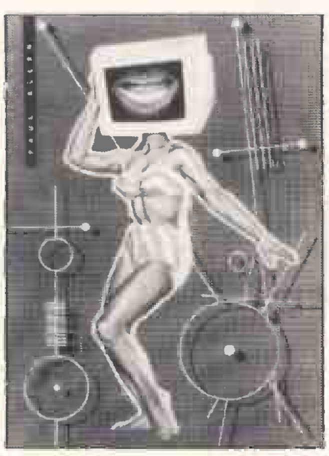

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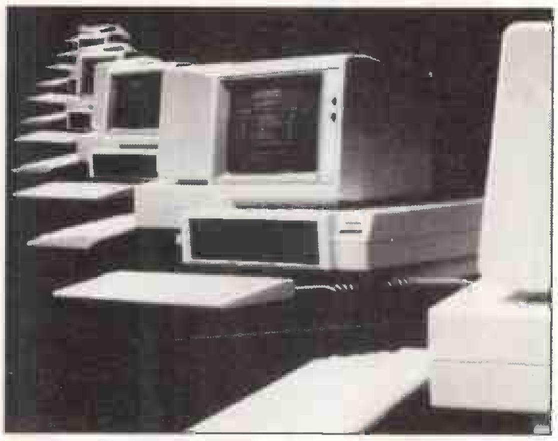

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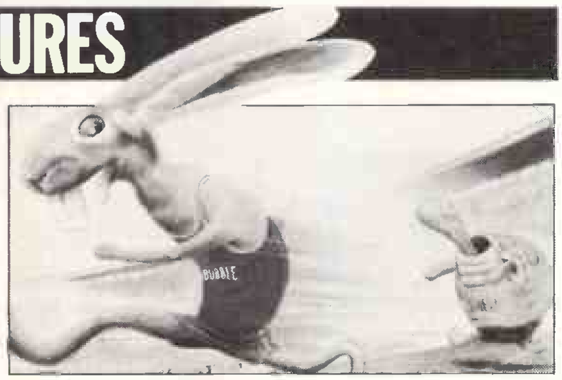

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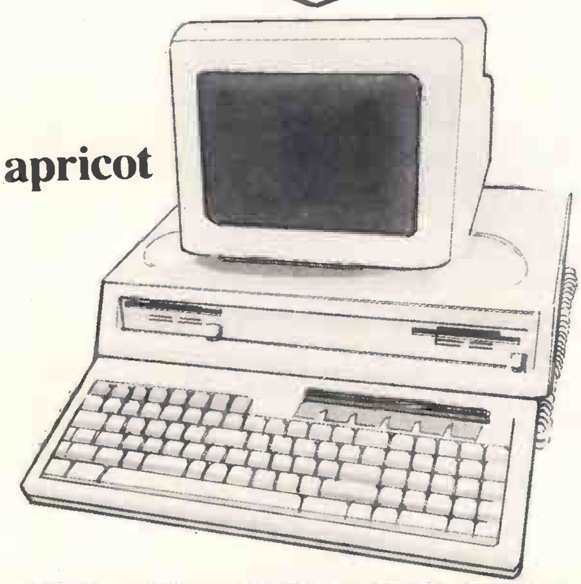

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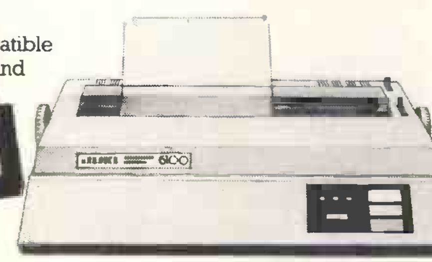

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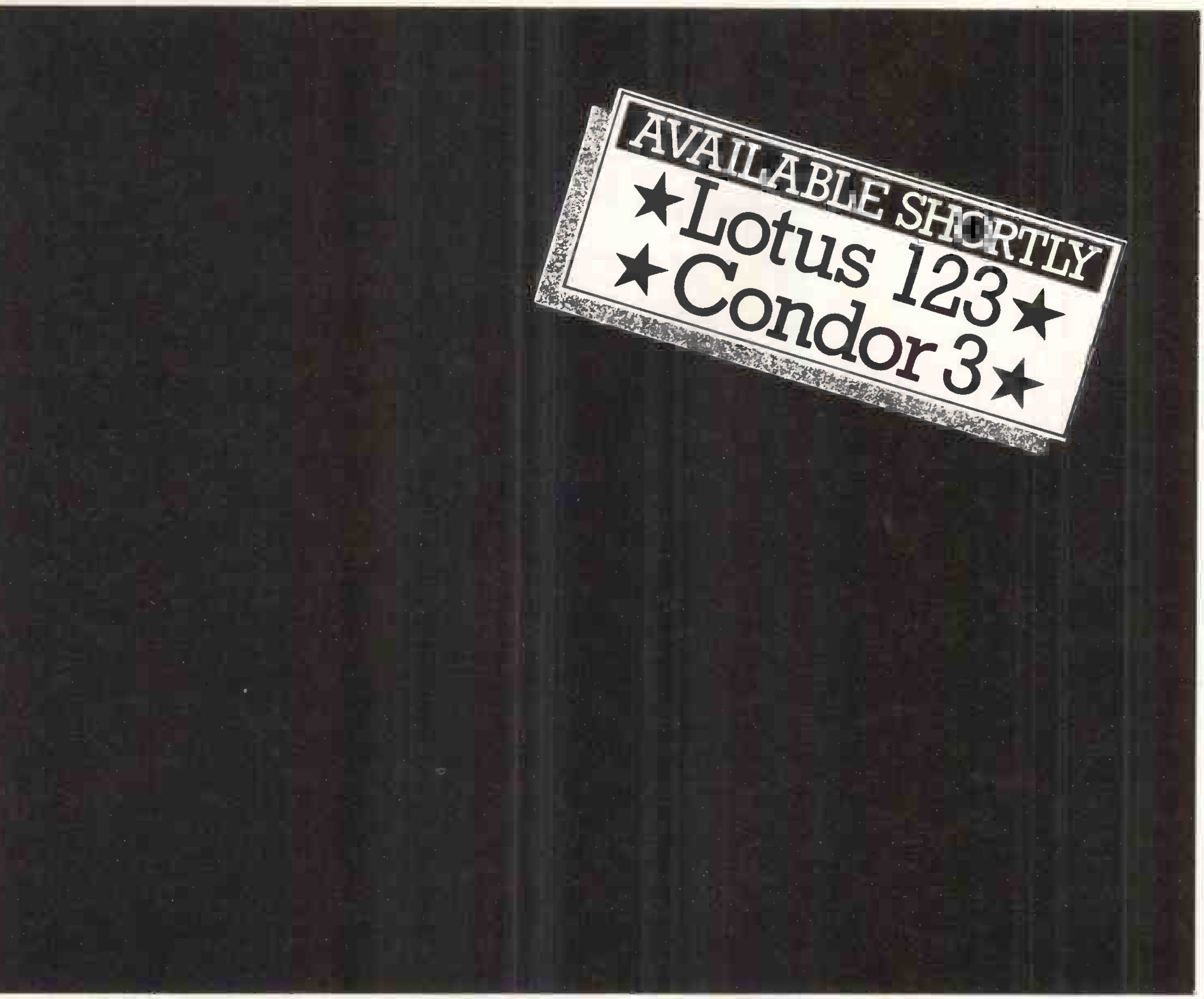

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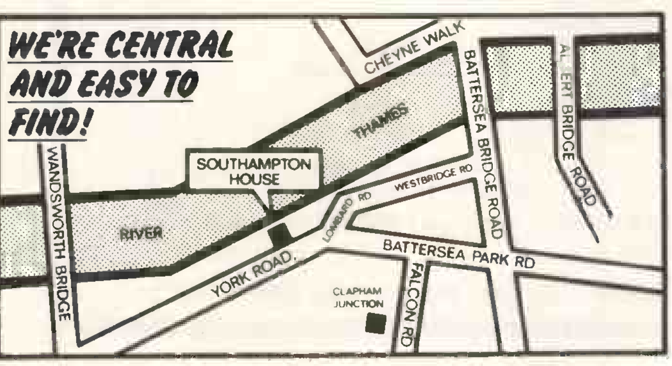

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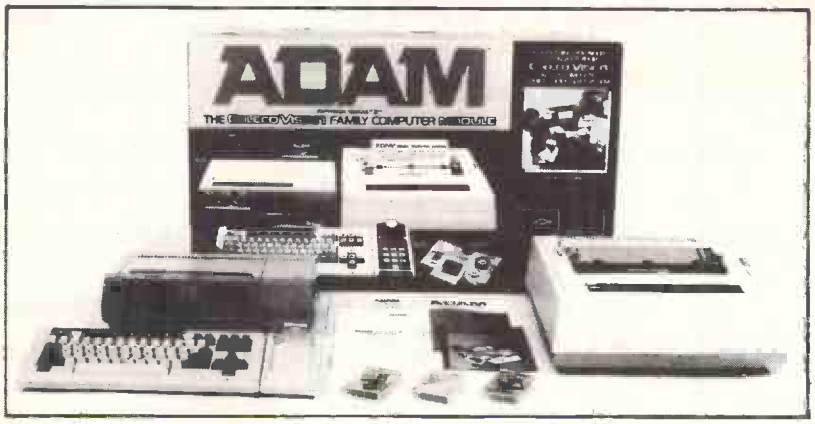

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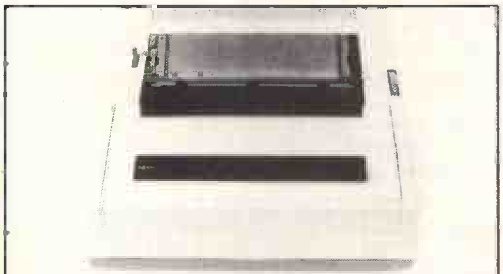
If you're looking for real value in a computer system, one which can handle anything from serious Word Processing to enhanced Colecovision style video games such as Buck Rogers, look no further. The Coleco Adam is here with a package which will make you wonder if you're dreaming when we tell you about it. A price breakthrough in computer systems, Adam is comprised of an 80K RAM memory console with a built-in 256K digital data drive; a professional quality, stepped and sculptured 75 key full-stroke keyboard; a letter quality daisywheel printer and a full word processing program built into the Console. Two additional pieces of software, Smart BASIC and also 'Buck Rogers - Planet of Zoom' (the ultimate in advanced video games), are included as well as a blank digital data pack. Adam can be used with any domestic colour Television set.*

MEMORY CONSOLE/DATA DRIVE: *The heart of the Adam system is the 40K ROM and 64K RAM memory console which combines with the 32K ROM and 16K RAM in Colecovision to give you a total of 72K ROM (including 24K cartridge ROM) and 80K RAM (expandable to 144K). Built into the memory console is a digital data drive which accepts Adam's digital data packs, a fast and reliable mass storage medium that is capable of storing 256K of information, that's about 250 pages of double spaced text! The console is also designed to accomodate a second optional digital data drive.

MEMORY CONSOLE & DATA DRIVE

FULL STROKE KEYBOARD: The Adam keyboard has been designed as a professional quality keyboard that combines ease of use with an impressive array of features. It is stepped and sculptured for maximum efficiency and has 75 full stroke keys which include 6 colour coded Smart Keys which are redefined for each new application; 10 command keys which are dedicated to the word processing function, and 5 cursor control keys for easy positioning of the cursor at any point on the screen. You can attach a Colecovision controller to the keyboard to function as a numeric keypad for easy data entry. It can also be held like a calculator, a feature which makes working with numbers particularly easy. The joystick part of the hand controller can be used in the same way as the cursor control keys, to move the cursor around the screen.

LETTER QUALITY PRINTER: The Smart Writer letter quality daisywheel printer is a bi-directional 80 column printer which prints at a rate of 120 words per minute. It uses standard interchangeable daisywheels, so a variety of typestyles are available. The printer has a 9.5 inch wide carriage for either single sheets or continuous fan fold paper and uses standard carbon ribbons. It is comparable to many printers which cost as much as the total Adam package. The printer can be used either with the Adam's Smart Writer word processing program or as a stand alone electronic typewriter.



DAISYWHEEL PRINTER

BUILT-IN WORD PROCESSOR: Adam comes with Smart Writer word processing built-in. This program is so easy to use that you only have to turn the power on and the word processor is on line and ready to go. Detailed instruction books are not necessary as the Computer guides you step by step, working from a series of Menu commands. It enables you to type in text, then completely edit or revise it with the touch of a few keys. Changes are readily made and a series of queries from the computer confirm your intentions, so that you can continuously double check your work as you type.

COMPATIBILITY WITH COLECOVISION: By using high speed interactive microprocessors in each of the modules, the Coleco Adam is designed to take additional advantage of both the 32K ROM and 16K RAM memory capability in the Colecovision. If you do not already own a Colecovision Console (£99 inc VAT), then you will need to purchase this when you initially purchase your Adam Computer package (£499 inc VAT), making a total purchase price of (£598 inc VAT).

WHAT IS COLECOVISION: Colecovision is one of the worlds most powerful video game systems, capable of displaying arcade quality colour graphics of incredible quality on a standard Colour TV set. The console (see picture bottom left) accepts 24K ROM cartridges such as Turbo and Zaxxon and is supplied with the popular Donkey Kong cartridge and a pair of joystick controllers. Colecovision has a range of licenced arcade hits available such as: Gorf, Carnival, Cosmic Avenger, Mouse Trap, Ladybug, Venture, Smurf, Pepper II, Space Panic, Looping, Space Fury, Mr Do, Time Pilot, Wizard of Wor and many others. So there you have it, Adam plus Colecovision the unbeatable combination. Send the coupon below for your FREE copy of our 12 page Colour brochure giving details on the complete Adam system.

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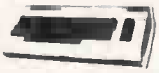
COMMODORE 64



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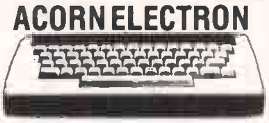
ACORN ELECTRON



AT under £174, the Acorn Electron is the first micro in its price range to use BBC BASIC, the leading computer language in British schools.
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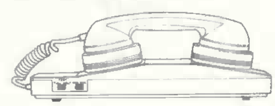

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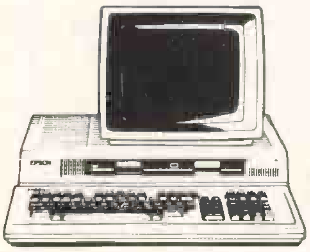

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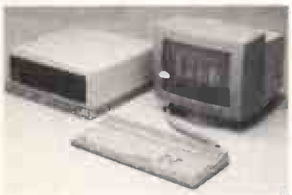

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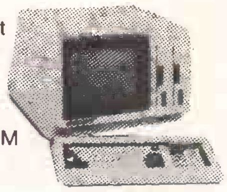

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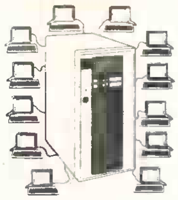

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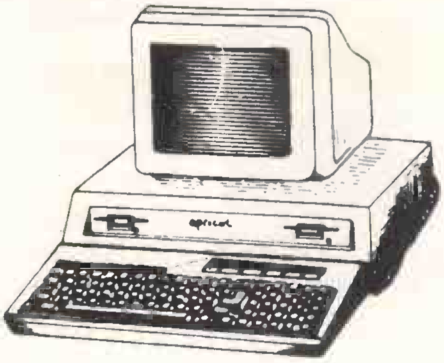

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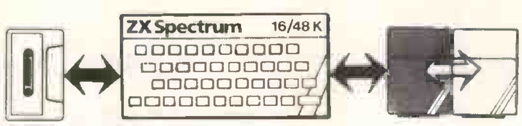

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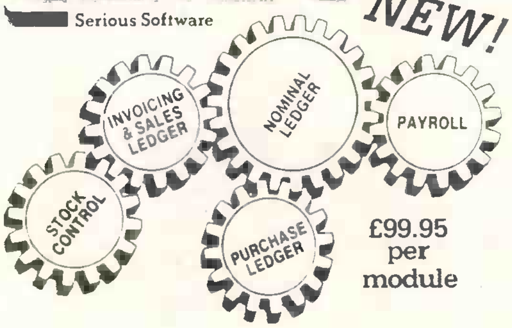

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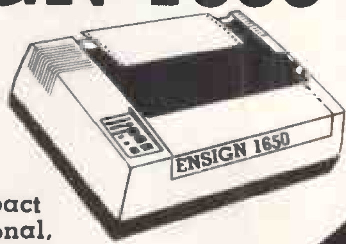

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A massive purchase of these desk top printer -terminals enables us to offer you these quality 30 cps printers at a SUPER LOW PRICE against their original cost of over £1000. Unit comprises of full QWERTY, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width – up to 13.5" 120 column paper, upper - lower case, standard RS232 serial interface, internal vertical and horizontal tab settings, standard ribbon adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working £130.00 or untested £85.00, optional floor stand £12.50
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Current, quality, professional product of a major computer company, comprising 2 x 40 track MPI or Shugart FULLY BBC COMPATIBLE single sided drives in a compact, attractively styled, grey ABS structured case with internal switched mode PSU. The PSU was intended to drive both drives and an intelligent Z80 controller with over 70 ic's. The controller has been removed leaving ample space and current on the +, −5, +12 and −12 supply for all your future expansion requirements. Supplied tested with 90 day guarantee in BRAND NEW condition with cable for BBC micro. Ex Stock at only £259.00 + £10.00 carr. Limited Quantity Only

TELETYPE ASR 33

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Industry standard combined ASCII 110 baud printer, keyboard and 8 hole paper tape punch and reader. Standard RS232 serial interface. Ideal as cheap hard copy unit or tape prep. for CNC and NC machines. TESTED and in good condition. Only £235.00 floor stand 10.00
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TTL 74 Series A gigantic purchase of an "across the board" range of 74 TTL series I.C.'s enables us to offer 100+ mixed "mostly TTL" grab bags at a price which two or three chips in the bag would nnormally cost to buy. Fully guaranteed all I.C.'s full spec. 100+ £6.90 200+ £12.30 300+ £19.50

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Join the communications revolution with our range of EX TELECOM data modems. Made to most stringent spec and designed to operate for 24 hrs per day. Units are made to the CCITT tone spec. With RS232 i/o levels via a 25 way 'D' skt. Units are sold in a tested and working condition with data. Permission may be required for connection to PO lines.
MODEM 2B "Hackers Special" fully fledged up to 300 baud full duplex, ANSWER or CALL modes. AUTO ANSWER. Data i/o via standard RS232 25 way 'D' socket. Just 2 wire connection to comms line. Ideal networks etc. Complete with data, tested, ready to run at a NEW SUPER LOW PRICE of ONLY £65.00 + VAT + Carr.
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For further data or details on other EX STOCK modems contact sales office.
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THE BENEFITS OF INSURANCE

Almost four months ago, on the 29th of February 1984, we, DISPLAY ELECTRONICS were unfortunate enough to have a serious fire at our main location, reducing a substantial part of our stock, warehouse and offices to a pile of ashes and rubble. HOWEVER, we had seen the adverts about the "Benefits of Insurance" and some years ago had taken comprehensive insurance cover to protect against an event such as this.
The day after the fire we did not even have a single pen to write with, to say nothing of the non existant showroom and burnt out warehouse with direct access to the stars via our now non existant roof!!
The loss of stock and damage to the premises has resulted in losses in excess of £400,000 pounds in real money – no price can value time and effort.
We are still, although working under great difficulties, VERY MUCH in business. We owe this to supreme efforts by all our staff – perhaps knowing their jobs could have been at stake, stock being located at several different locations, help from business colleagues and our bank.
To these people, I say a very loud THANK YOU.
To both the mighty PRUDENTIAL and GENERAL ACCIDENT Insurance Companies who from the date of our fire have NOT even offered or paid A SINGLE PENNY in compensation or have not even offered an ounce of moral support . . .
To both the mighty PRUDENTIAL and GENERAL ACCIDENT Insurance Companies who only answer our requests for help and information with "We are still looking at reports . . ." I say "STRONG STUFF THIS INSURANCE????"
David Fisher, Managing Director, DISPLAY ELECTRONICS

EX STOCK

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BA11-MB 3.5" Bax, PSU, LTC	£385.00
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Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s, Transistors, Relays, Cap's, P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads, we are packing all these items into the *'BARGAIN PARCEL OF A LIFETIME'*. Thousands of components at giveaway prices! Guaranteed to be worth at least 3 times what you pay. Unbeatable value!! Sold by weight.

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- 4,000 bytes per record (fixed length).
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dBASE III runs on IBM PC's with 256k RAM and 100% compatibles.

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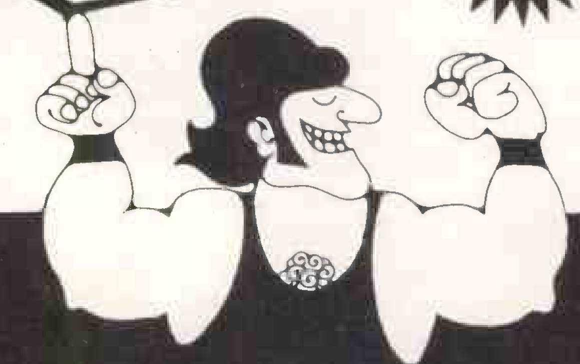

Your Commodore 64 can print like a pro!

The Grappler offers a complete answer to printer interfacing, with many capabilities unique in the Commodore market place. Complete signal transmission allows many popular name brand printers to operate perfectly with the Commodore 64. Even Commodore's graphic character set can be reproduced on Epson, Star, Oki, Brother, Prowriter and other popular printers.

- Prints screen graphics without software
- Graphics screen dump routines include rotated, inversed, enhanced, and double sized graphics
- Complete emulation of the 1525 printer for printing Commodore's special characters
- Text screen dump and formatting commands
- 22 unique text and graphics commands

If you don't own a Commodore, but need an interface...

We have interfaces and cables for all types of computers including: ATARI, NEW BRAIN, IBM, ADVANCE, VIC 20, MEMOTECH, SINCLAIR QL, SPECTRUM, AMSTRAND, SAGE, DRAGON, PET, TANDY, TEXAS INSTRUMENTS, APRICOT, APPLE, SHARP, MACINTOSH, BBC, SANYO, OSBORNE.

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NEW! The Complete Printer Interface for the Commodore 64

The Grappler gives you the print out you need from Epson, Star, Oki, Brother, Prowriter and other popular printers. Graphics screen dumps including inversed, double-sized, rotated/enhanced graphics with special features for Epson FX and RX printers.

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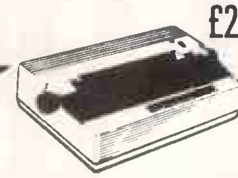

18cps; Bi-directional logic seeking; 10, 12, 15cps; Wordstar compatible; 13 inch platen; 12 inch print line; auto underscore; bold and shadow printing; subscripts and superscripts; Qume compatible daisy ribbons; Qume compatible daisy wheel; optional tractor and sheet feeder; optional RS 232C; serial interface; low noise; low cost; high reliability.

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Printer Supplies Seven days a week Phone 0730 68521

ADMATE DP-80

£169.00 + VAT = £194.50

The Admate DP-80 has a large range of features and a low price. Ideal for the first time user. 80 CPS; 80 column; Bi-directional logic seeking; block and dot addressable graphics; sub/superscript, auto underline, condensed, emphasised, expanded and italic print.

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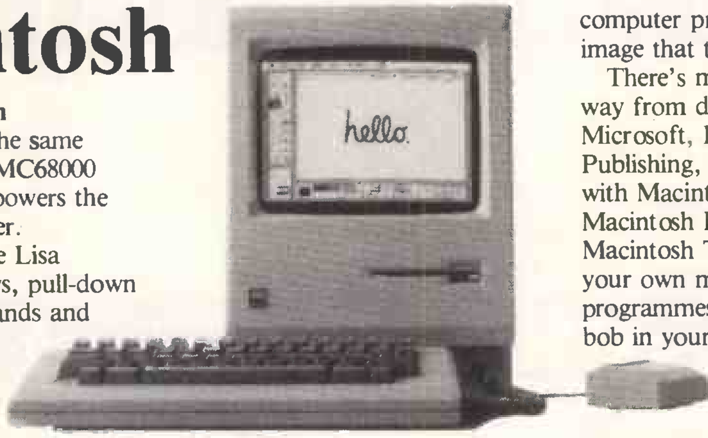
Apple taught Macintosh about man. Now man wants Macintosh

IT'S SO GOOD WE LOVE IT!



Introducing Macintosh
Macintosh's brain is the same blindingly-fast 32 bit MC68000 micro-processor that powers the Lisa personal computer.

Its heart is the same Lisa technology of windows, pull-down menus, mouse commands and icons. All of which make that 32-bit power more useful by making Macintosh far easier to use.

Now for some small talk
If the problem won't come to Macintosh, you can always take Macintosh to the problem - it weighs 9 pounds less than the most popular portable computer.

Just pick Macintosh up by its built-in handle, and carry it.

A miracle of miniaturisation is Macintosh's built-in 3½" drive. Its discs store 400K - more than conventional 5¼" floppies.

Programmes
There are already plenty of remarkable programmes available to keep Macintosh busy. Like MacPaint a programme that, for the first time, lets a personal computer produce virtually any image that the hand can create.

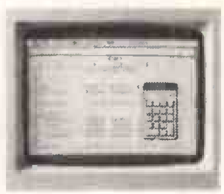
There's more software on the way from developers like Microsoft, Lotus and Software Publishing, to mention a few. And with Macintosh BASIC, Macintosh PASCAL and our own Macintosh Toolbox for writing your own mouse driven programmes, you could turn a few bob in your spare time.

All the right connections
On the back of the machine, you'll find built-in RS232 and RS422 Applebus serial communication ports for connecting printers, modems, and other peripherals without adding expensive cards. If you wish to double Macintosh's storage with an external disc drive, you don't have to pay for a disc controller card - that's built in too.

Talking of extras
Macintosh has a built-in polyphonic sound generator capable of producing high-quality speech and music.

Macintosh automatically makes room for illustrations in text.

MacPaint - virtually any image the human hand can create.



Microsoft's Multiplan for Macintosh.

We wish to acknowledge the several well known trade marks used in this advertisement.

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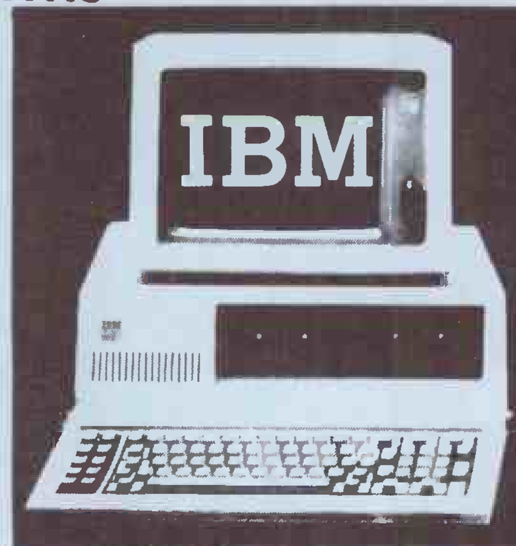

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	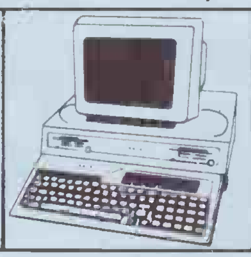	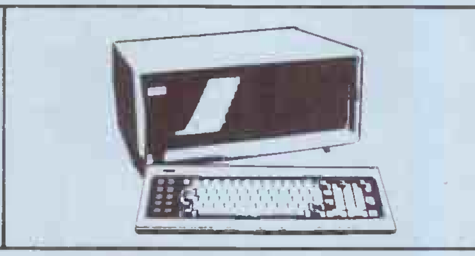		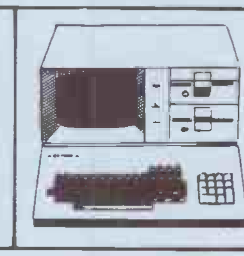
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KEMPSTON
KEMP 1

NEC PC-8023-N

HIGH QUALITY DOT MATRIX PRINTER

£199 +VAT

Economical all-purpose printing for your computer

- Centronics-compatible parallel interface.
- Bidirectional logical seek operation for high-speed printing (120 cps).
- Output to printer can be on character-by-character or even dot-by-dot basis.
- Many character sizes; fan-fold and single-sheet paper.
- Automatic reversal of ribbon gives clear, crisp impressions for a long period of time.

Here is the opportunity to obtain a dot matrix printer of proven quality and superb performance at an unbeatable price.

From the manufacturers of the renowned Spinwriter and Pinwriter printers, NEC's 8023-N must represent the best buy of 1984. Recently selling at prices up to £399, the special offer price allows personal computer users the luxury of a quality printer at a budget price, and the business system user to enjoy a rare bargain.

Available ex-stock or contact us for details of your nearest dealer.

SPECIFICATION

PRINT FUNCTIONS
Print Method: Impact dot-matrix; Bidirectional logical seek print
Print Speeds: 120 cps (10-pitch spacing)
Print Format: 7 (horizontal) x 9 (vertical): alphanumerics and symbols; 8 (horizontal) x 8 (vertical): dot-image graphics
Character Sets: ASCII – 96; JIS – 160; Graphic/Character – 64
Carriage Return Direction: Forward and backwards
Carriage Return Spacing: 1/6 inch, 1/8 inch; programmable at every 1/144 inch

PAPER
Width: 4.5 inch to 10 inch
Thickness: 0-05 mm to 0.28 mm
Number of Copies: Original + 3 copies (should not exceed the above width or thickness limits
Form: Fan-fold paper; single-sheet

PAPER FEED
Feed: Friction feed, sprocket pin feed
Direction: Up and Backward
Drive Method: Stepping Motor

INK RIBBON: Special ribbon cartridge (black)

DIMENSIONS AND WEIGHT
Dimensions: 398 (W) x 285 (D) x 121 (H) mm
Weight: 8.5 kg

INTERFACE: Centronics 8 bit parallel

Max. Line Width	Print Spacing	Remarks
136 characters	17 cpi	Reduced characters
68 characters	8.5 cpi	Reduced and enlarged characters
80 characters	10 cpi	Pica
40 characters	5 cpi	Enlarged pica
96 characters	12 cpi	Elite
48 characters	6 cpi	Enlarged elite

Trade Enquiries contact Mick Barton.

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- ★ Integral power supply
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The microcomputer was supposed to enhance this process by making it faster, more accurate and more efficient.

By an odd quirk, however, many microcomputer users lose their freedom to exchange information. By acquiring inflexible 'stand alone' systems they, in effect, put their information into solitary confinement.

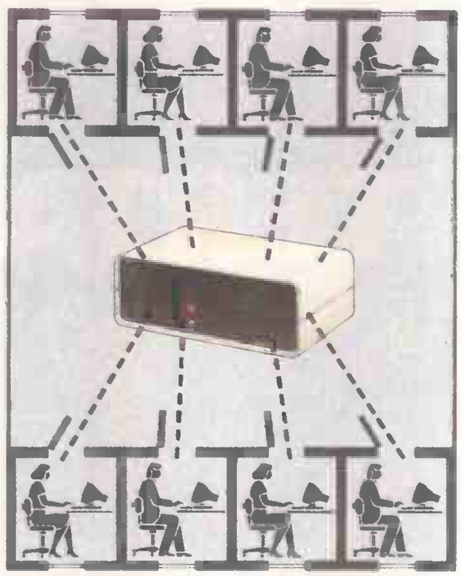
The astonishing success of Comart Communicator multi-user systems is largely because they *don't* imprison you in this way and allow you to share computer power and performance among all the key members of your staff.

To be specific, up to nine users can share the same processing unit and data storage facilities whilst making economic use of expensive peripherals such as printers, plotters and tape back-up units. Each extra user shares access to the system merely by the addition of a simple VDU and keyboard. All of which represents a big saving over buying a complete computer for each.

The Communicator range of 15 models provides everything you could want in a microcomputer system. Depending on the number of users, the complexity of your applications and the memory size and storage capacities required, you can be assured of finding precisely the system you need – and pay only for that. The Communicator now comes with the new Intel 286 powerhouse 32-bit processor as well as the established 8 and 16 bit models. There's also a choice of memory from 64K-1Mb and of storage capacities on floppy disks or 5, 20 or 40Mb integral Winchester disk drives.

The great difference with the Communicator range, of course, is its modular design.

You can stay right up with the latest technologies or expand and upgrade your current systems, simply with the change of a circuit board or two. Add-on modules can also provide additional storage and back-up. The Communicator's modularity ensures your investment is safe, because when in the future you decide you want to share computer power with more users, you can simply expand your system without writing off the cost and starting all over again.



From 1-9 users can share a Communicator 'multi-user' system.

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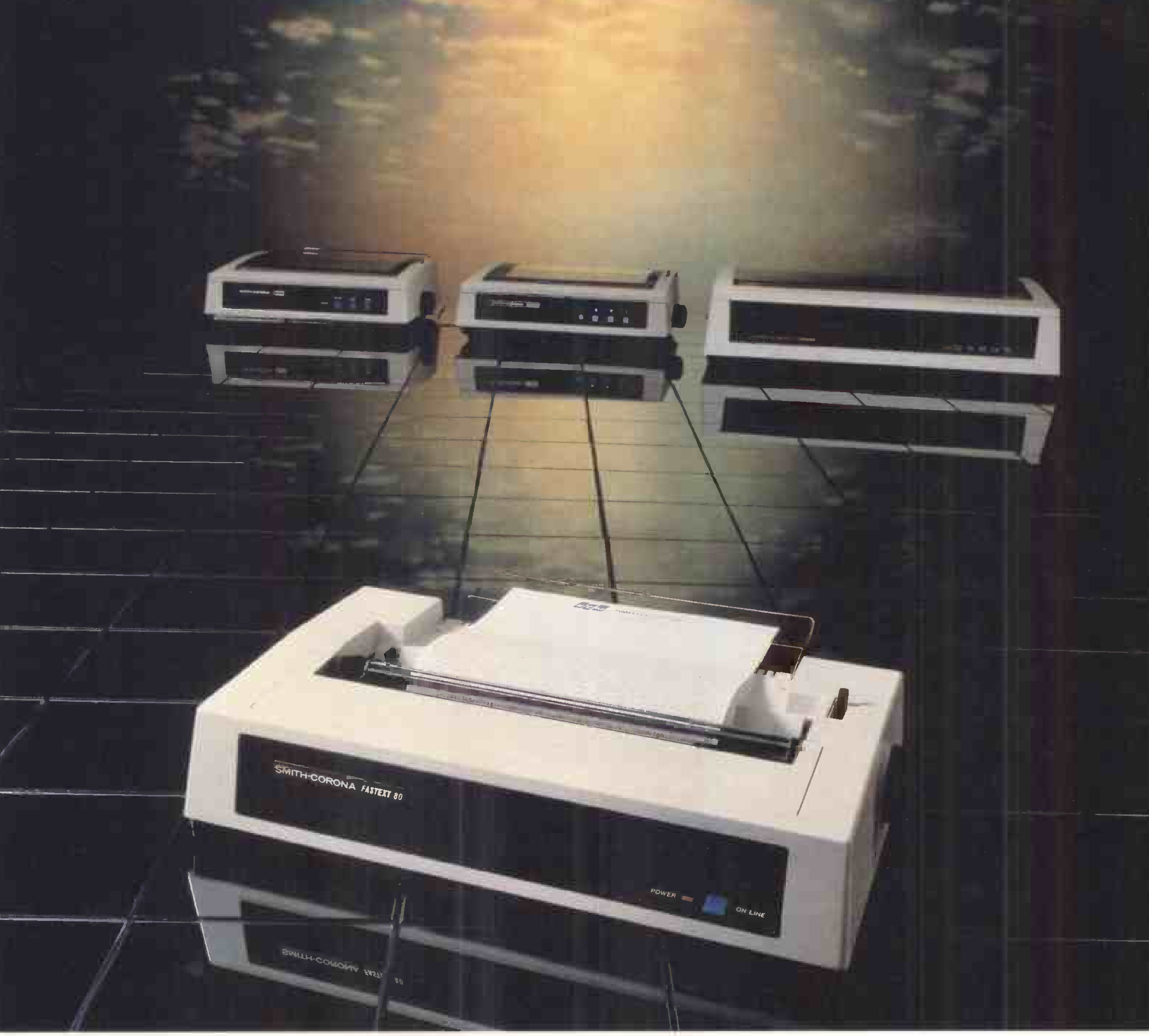

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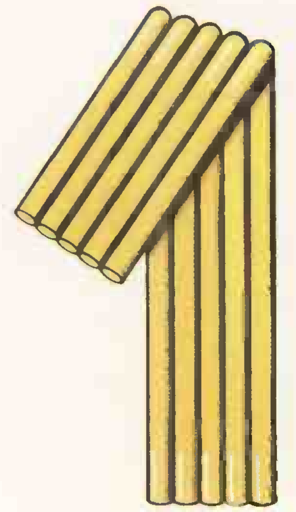
At the top of the range, THE UNICORN, offers the power and sophistication of System III UNIX® whilst other channels make available the flexibility of languages such as FORTRAN, PASCAL, BCPL and COBOL. All models, with the exception of the HDP240, provide BBCBASIC(Z80) on the Z80 rather than the Model B's 6502.

Tune in to the Channel that most suits your requirements. Whichever level you choose you can be sure of a system with infinitely expandable potential for a confident future in the world of computing.



The ZEP 100

- Z80 Extension Processor
- 4MHz Z80A
- 64K RAM
- 24K ROM

The object of any upgrade kit is to improve processing ability and to increase data storage capacity. The UNICORN ZEP100 is the first stage upgrade which opens channels into the world of serious computing.

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The 64K ZEP100 is supplied with full software support including word processing, spreadsheet, database and utilities. **The ZEP100 around £299 (ex. VAT).**

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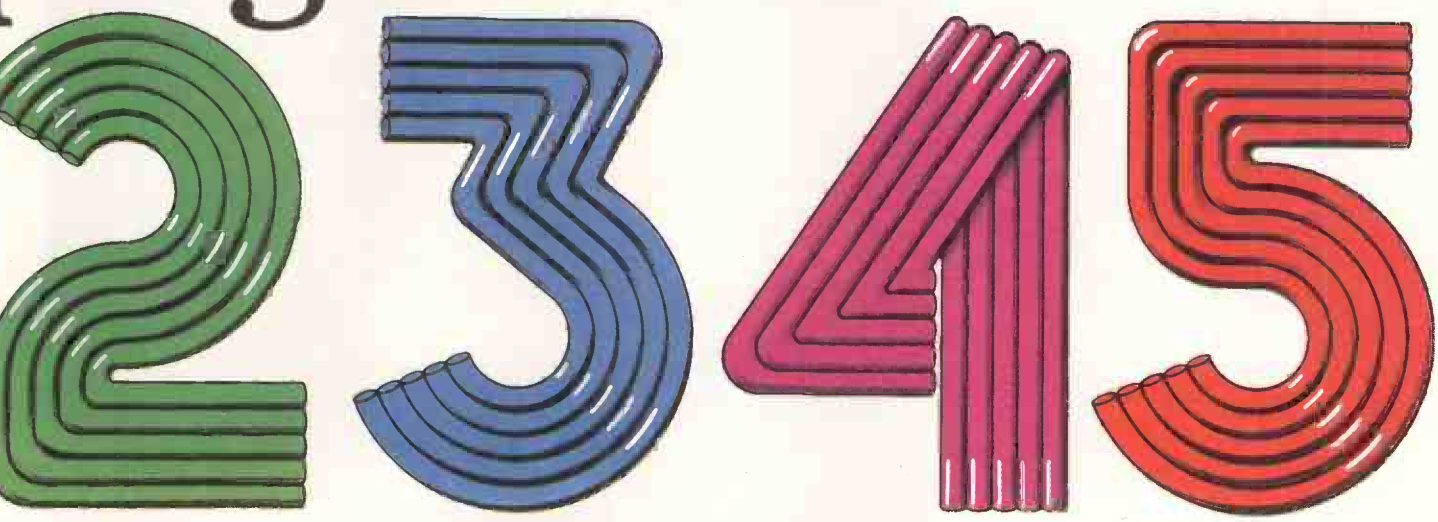

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4MHz Z80A ● 64K RAM
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Twin, double sided 400K floppy discs
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54 upgraded Model B's on a local
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lubs and Schools it is a simple and
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cilities.
The discs can be used for
orage under the Acorn DFS system
r for CP/M® programs and data.
A comprehensive software pack-
ge is provided with the disc pack. It
ncludes word and data processing
nd a spreadsheet program, along
ith utility programs and manuals.
The TORCH Z80 Disc pack is
ecommended by the CCTA for
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The HDP 240

● 20Mbyte hard disc Winchester
● Double sided 400K floppy disc
● Integral power supply

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● 20 Mbyte hard disc Winchester
● Double sided 400K floppy disc
● Integral power supply

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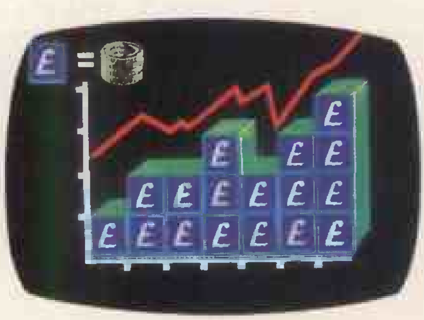
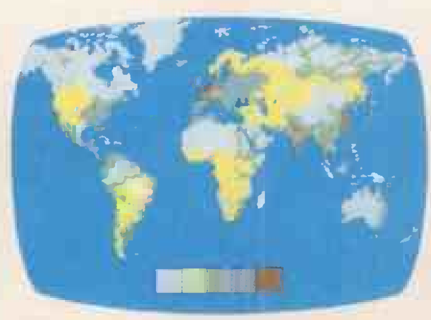
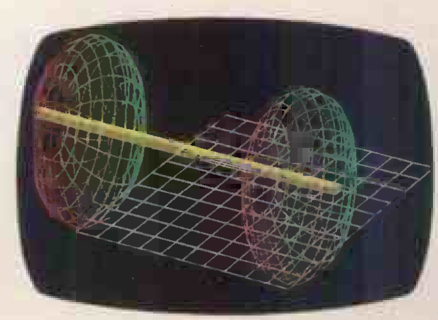
UK version Model B necessary.
Disc interfaces are necessary for use with the Unicorn range.
Text and Graphics provided by BBC Model B.
Keyboard provided by BBC Model B.







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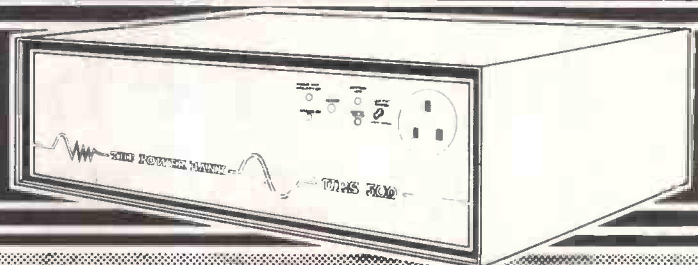

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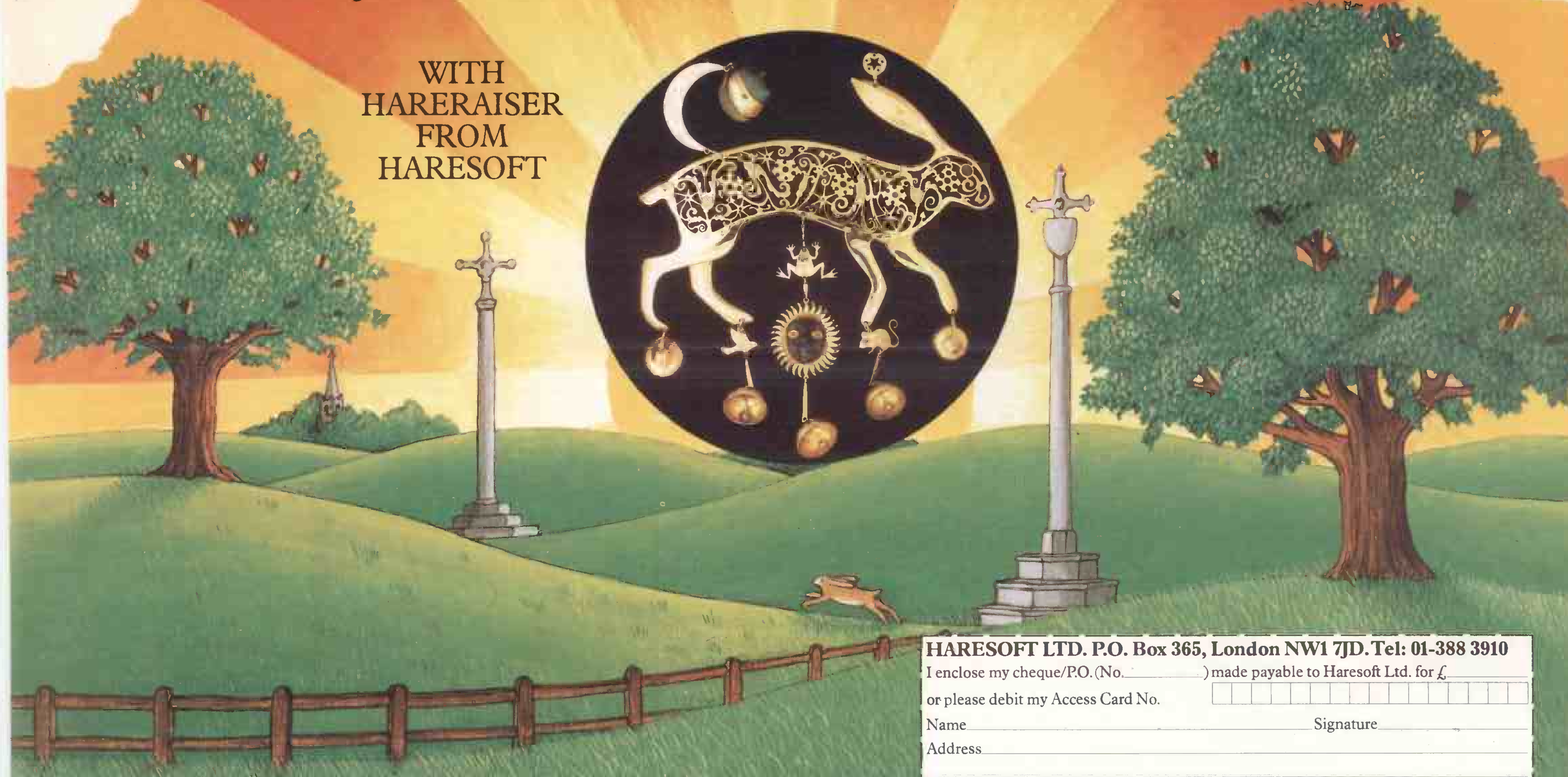

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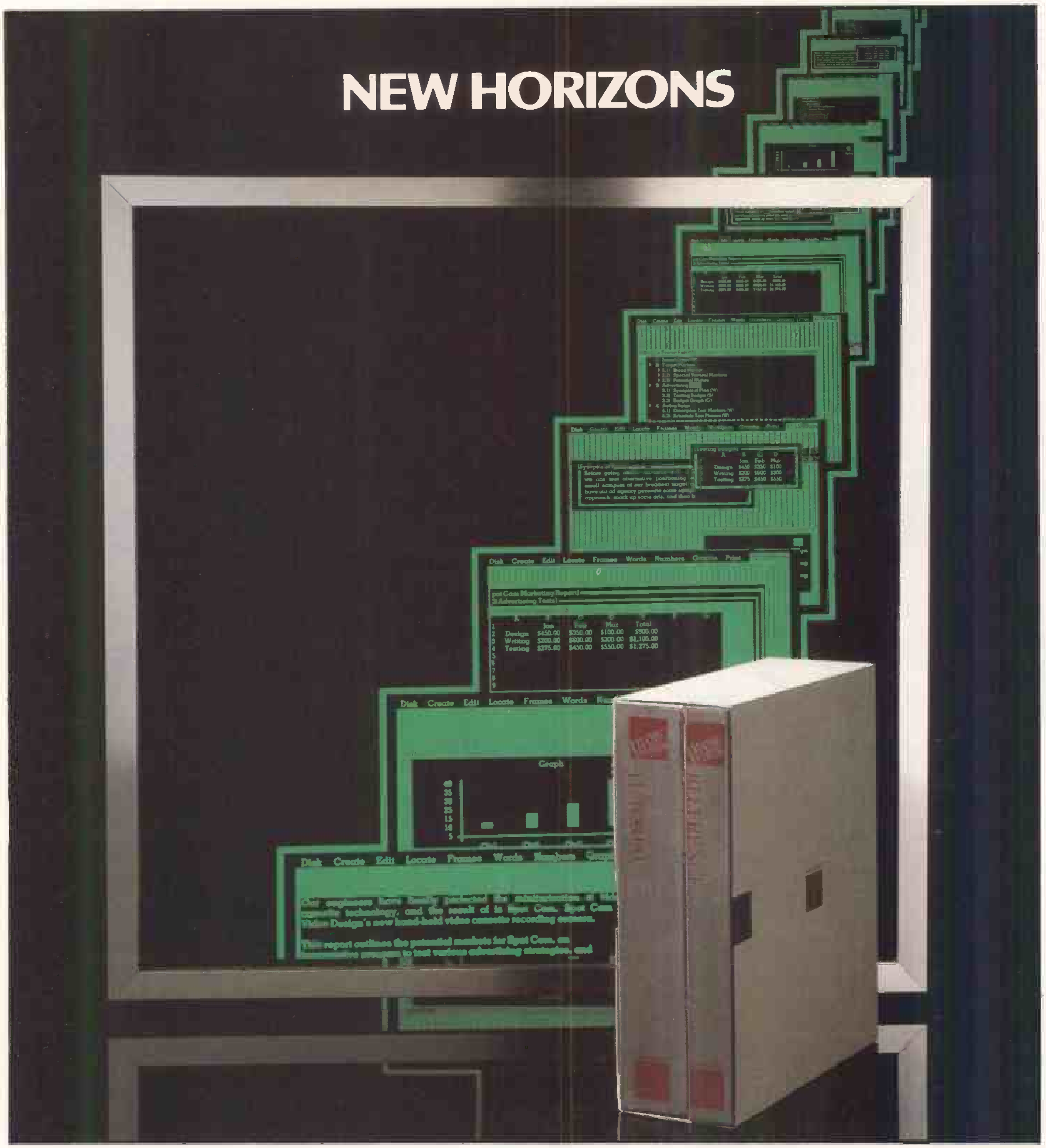

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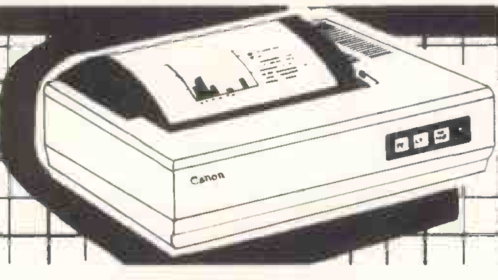

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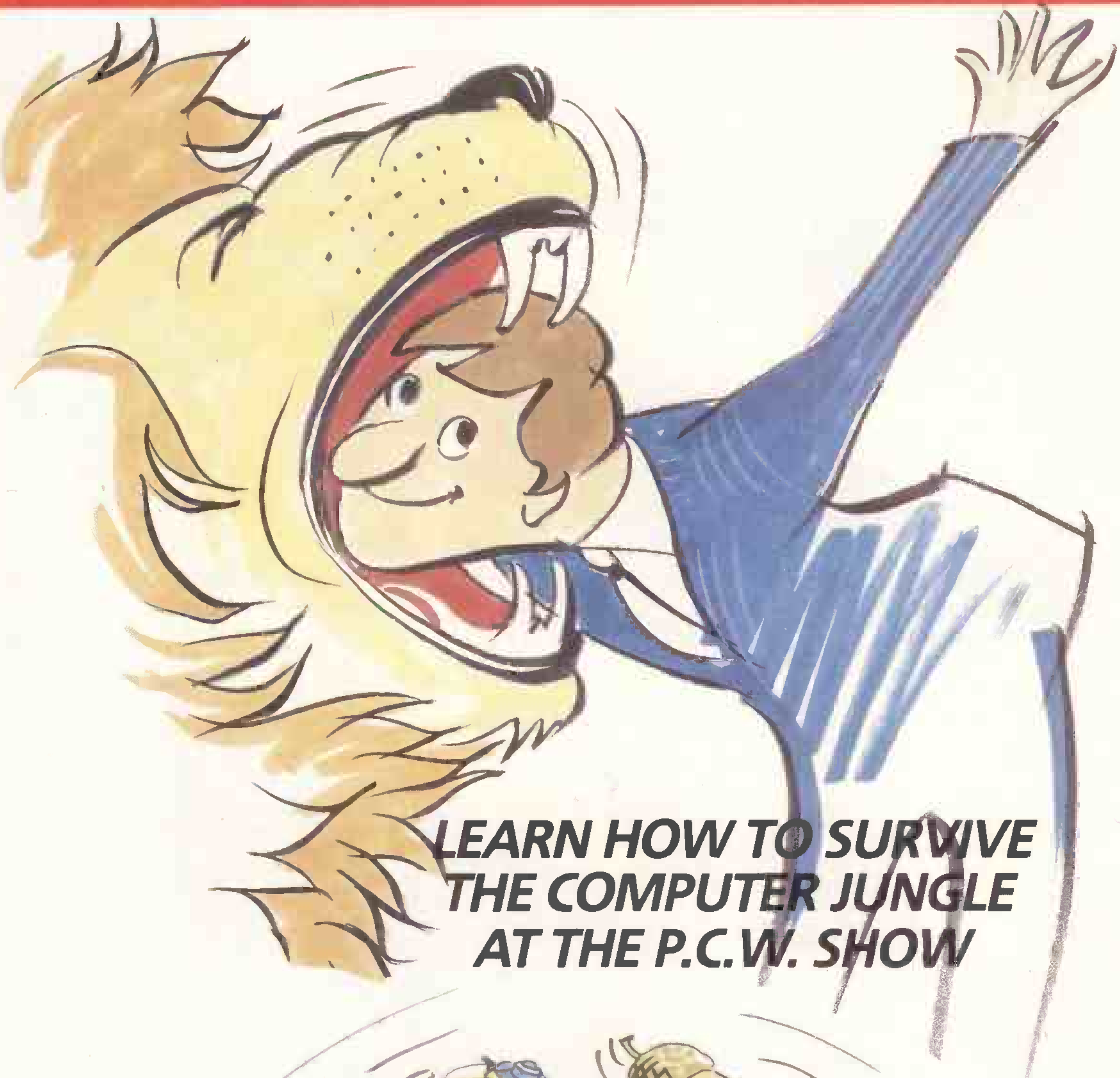

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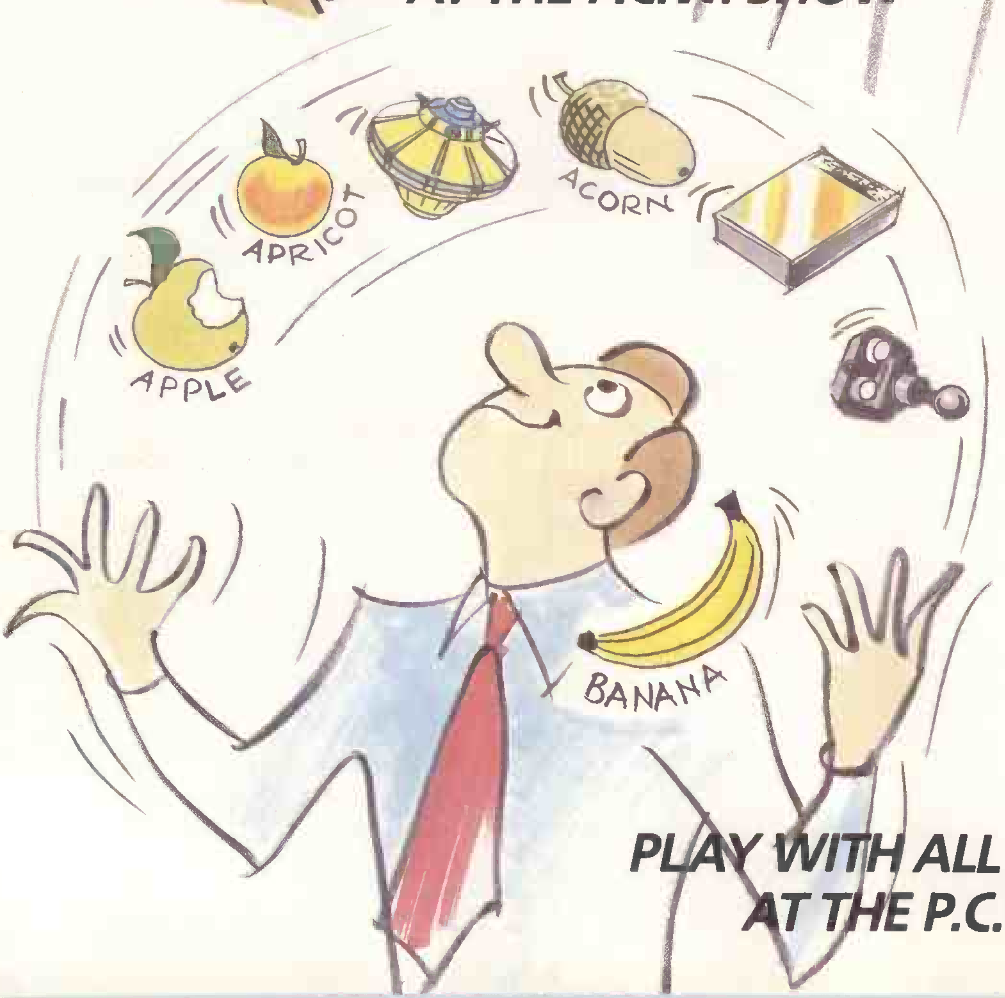

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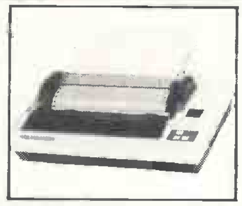

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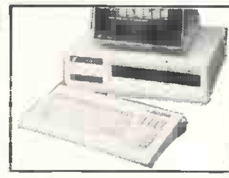

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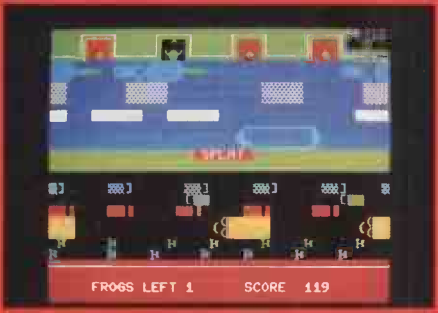

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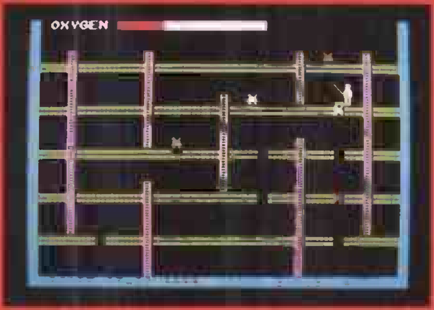

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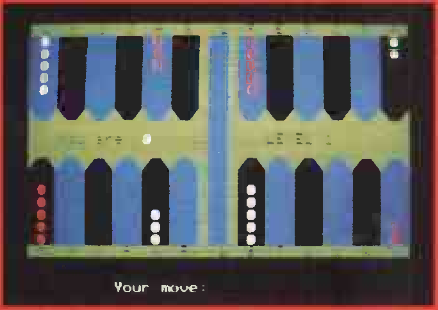

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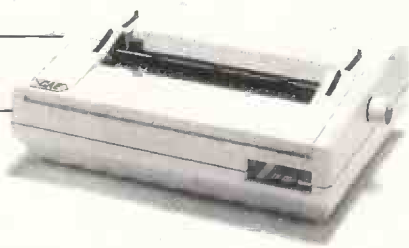

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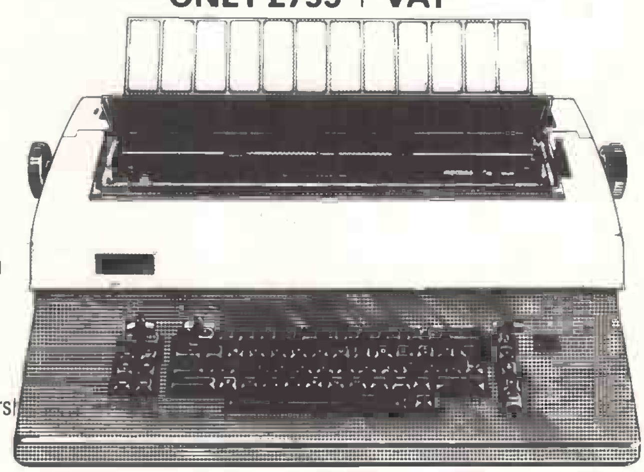

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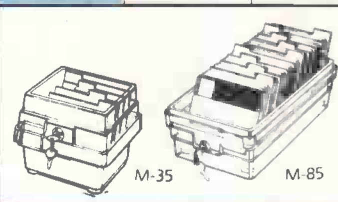

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NEWSPRINT

Strange goings-on at Imagine Software have left that company in financial turmoil but over in the US Osborne has decided to 'come clean'. Meanwhile with Los Angeles embroiled in the 'Big Event', the official Olympic supplier's track record is not as honest as it should be. All this and more from Guy Kewney.

Drifting back into reality

The Imagine directors themselves had given up hope of preserving the company when this edition went to press — and what had been Britain's best-known micro software company looked set for collapse.

But what a sad, sorry mess it was!

For a start, nobody involved seemed inclined to tell more than a little truth at a time. This was not to say that they spoke little — far from it. I endured long and bitter speeches from various directors of Imagine, detailing the amazing deceit of each other.

Naturally, the person who was speaking was always innocent of any evil.

Now: what actually happened?

Nobody denies that Imagine ran out of cash. The question is: Who spent it? And on what?

Most reports which you might have read will have emphasised the 'high living' aspects of the Liverpool whizz kids. Lotus cars, Ferraris, superbikes, and other badges of lavish spending featured in the 'hype' of Imagine before its crash — so it wasn't surprising to see all these tales revived afterwards.

There was the Marshall Cavendish deal, of course. That should have got Imagine out of a lot of trouble — it involved a publishing venture. It gave Imagine a contract, for which it received a £200,000 plus advance, to write games, which Marshall Cavendish would give away with its computer partwork.

What happened then, according to Imagine people, was that the original idea was improved on. 'Originally, we had to produce simple games, but then Marshall Cavendish insisted on playtesting them to the sort of high standards that we would have required for our own top quality commercial games,' said Bruce Everiss, then marketing chief.

According to this version of events, Imagine eventually got the games (including the game launched as *Pedro*) up to top scratch — but found that all the money had been used up doing that — and there were still other games to do under the contract.

So Imagine told the world that *Pedro* (and others designed for Marshall Cavendish) would be the best-ever games from Imagine, and launched them. And a deal was agreed with Marshall Cavendish that the money would be paid back on instalments over a year or so.

If *Pedro* was the best game ever from Imagine, the general public failed to appreciate it — as both Marshall Cavendish and Imagine were left out of pocket.

Where was all the money going, then?

According to everybody inside the company, without exception or dissent, the problem was software counterfeiting. And the solution was the Megagame.

Counterfeiting is not piracy. Piracy is when I get a game, and make a copy for you, and swap it for one which you got, without asking you where you got it.

Counterfeiting is when somebody makes a cheap perfume and puts it in a Chanel bottle, and sells it through High Street chemists. Counterfeiting is when you make your own tape cassettes, and print your own inlay card, and then sell to the normal software distributors at less than half price, so that the shop manager doesn't even know that most of his stocks are fakes.

The Megagames include extra memory in ROM and RAM, and if they ever appear, will be almost like little computers on their own, together with instructions which are really short novels.

You are supposed to really *live* these games and, by all accounts, they are good.

One plugs into the Commodore 64, and the other into the Spectrum.

And they will cost £40 each.

The story from Imagine is that it needed big revenues to support the research for the Megagames. And because of counterfeiting, the company suddenly stopped selling its normal cassettes.

The other story from (some of) Imagine's directors is that one of their number was out to sabotage sales, and weaken the company to the point where he could buy it for a song from the receiver.

The other, other story from (other) Imagine directors suggests that the sabotage story is nonsense, a smokescreen put out to cover directors' fees of £40,000 a year plus directors wives' fees of £10,000 a year, plus company-paid credit card spending of £5000 a month.

In researching this story, I have had to listen to 'confidential' comments from some of Imagine's directors, telling stories of others standing outside their houses talking to their super-cars for two hours; of other directors parking their cars out in the country so that the bailiffs wouldn't seize them; of lies told to possible financial backers about bank loans which didn't exist, of trouble stirred up among creditors to

The latest public appearance of aspiring micro ventriloquist Arthur 'gottle-a-geer' Trick (and Zynar's general manager) shows that he still hasn't quite worked out where all the moving parts are (or is his right hand looking for that elusive glass of milk?). However, on a more serious note, just when it was starting to look as though Zynar was going to lose out to its networking rival, 3Com, the company has found new hope and aspiration from IBM's decision to opt out of networks for two years.

Many people had expected an official blessing from IBM on one or another network technology, and Microsoft actually went on record late last year as saying that it would wait for that announcement before making its own mind up.

Trick, however, is very pleased (or at least, says he is) that IBM has announced merely a proposed system.

'That proposed system bears a very close resemblance to many elements of the Arcnet coax cabling system that we currently use for our Plan series of networks,' says Trick.

'This means that we can easily adapt ours to be fully compatible with IBM's,' he added happily

Well, it's one thing to say the word 'easily' and another to do it. To help boost credibility, Trick has announced his half-year results at the same time, showing sales of £1.6 million for the past six months — with last year's twelve month sales being only £1.4 million.

Apparently there are now 400 Zynar networks sold in Europe and Britain.

persuade them that the money Imagine owed them would never be paid (so that the creditors would wind up the company) and of attempts to 'poach' staff to start rival companies.

Frankly, I didn't even try to make up my mind who was telling the truth.

Even the police, who I know were looking into a previous episode in Imagine's history at press time, would have trouble finding evidence to support half these tales.

The final chapter in the story of Imagine itself was probably written when three directors set up a new company, an off-the-shelf creation of the company's accountants (say the directors) which would buy the Megagames from Imagine, paying off the debts, and letting them get on with the future.

The minority stockholder and one of the directors were not included in this deal. And they didn't regard their side of the bargain as attractive — and (by coincidence, perhaps?) shortly after the deal was signed, voices of dissent began to be heard outside Imagine.

At that time, Ian Hetherington and David Lawson had flown off to Silicon Valley to raise funds for Finchspeed — the new company, which, of course, had no funds — so that it could buy Imagine's assets.

Time, they found, was not available. Offers of finance, and big finance (they tell me) were immediately forthcoming from venture backers of software houses there — but it would have taken three months to arrange.

They struck lucky with Atari, which offered to pay (an unspecified sum) for the US rights to the Megagames. It would, insists Dave Lawson, have saved Imagine — but the day they were due to go in to sign the deal was the day that the news broke of Jack Tramiel's takeover of Atari computer (for more on this particular turn of events see 'The Pied Piper of Atari takes his revenge').

Tramiel froze all deals instantly.

Since all the top people immediately started leaving Atari, I know of no way of checking this tale.

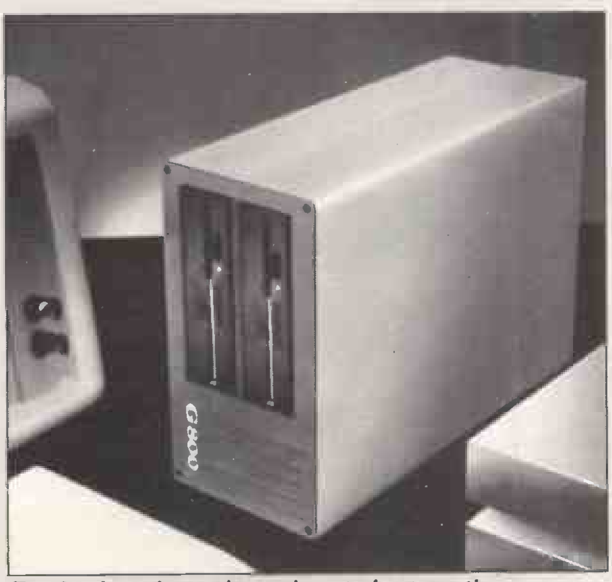
The last I heard of Lawson, he was agreeing that without the Atari money things didn't look good, and Imagine would only go ahead when somebody bought it as a going concern from the receiver.

The last I heard from Imagine, it was the switchboard operator. 'There's nobody here, and the bailiffs have taken all the furniture,' she said.

That evening, I heard from Eugene Evans, superprogrammer at Imagine, and dinner companion of Margaret Thatcher. There was no problem, he assured me.

'Where are you all working?' I asked. 'In Tithebarn House,' he replied, sounding puzzled. 'Though we are working from home a lot.'

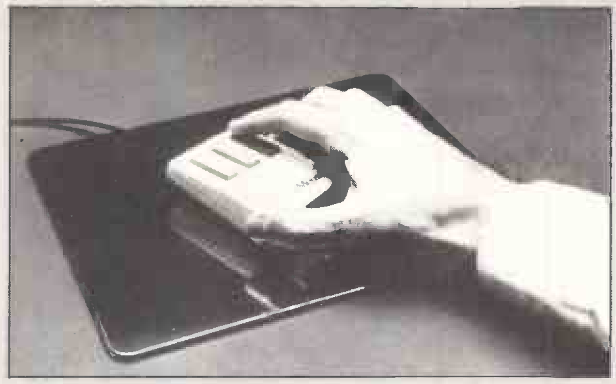
If he didn't know what was going on, how are the rest of us supposed to guess?



Torch micros have always boasted automatic communications (originally to Prestel) and the newer ones, based on the 68000 supermicro family, didn't have them when launched.

Now they do: the box shown has been given BT approval for connection to the public phone system.

Details of these Unix-based communicators on (0223) 841000.



Fans of Mouse Corporation's optical mouse will be fascinated by this illustration of something (apparently) called a SummaMouse, from Summagraphics.

It is the same mouse, and you can plug it into computers without mice, in the same way.

What is different about the SummaMouse is the way it sends data to the host micro. Mouse Corporation had planned to send more information to the computer than it does, and ended up duplicating X and Y co-ordinates. Summagraphics has cut down a lot of the duplication.

End-user sales are through Rapid Terminals, at around £300.

Sanyo's Olympic 'code of honour'

I was very entertained to be assured by a UK importer of the Sanyo that Adam Osborne was not telling the truth, and that the Sanyo really *is* IBM-compatible.

Adam, in his book (see 'Osborne: the whole truth') dropped a wicked aside about Sanyo.

He tells how he went to Japan at one stage, and was shown the machine, which uses an Intel 8088 central chip (just like the IBM).

Asked what the machine's chances in the US market would be, Osborne told Sanyo 'To succeed in the US, it must be IBM-compatible.'

And, he recalls: 'So it was. Not that they changed it — they merely announced that it was IBM-compatible, on the strength of the 8088 chip.'

One small thing puzzled me: shortly after the Sanyo dealer assured me that Osborne was fibbing, I ran into him at a software distributor's party.

He wasn't talking to me. He was addressing the distributor. He said: 'We must get together for sure, and you have to start doing versions of your software for the Sanyo.' And this forceful salesman insisted: 'The Sanyo is selling in big, big volume now, and you are missing an opportunity.'

The distributor in question, Softsel, has vast stocks of IBM software.

Let us ignore the question of what 'big, big volume' really means, in terms of dozens per month. Let us ask a simple question: If the Sanyo is compatible with the IBM, what's this need for 'versions of the software to run on Sanyo' deal, then?

Going for a smooth edge

Adam Osborne reckons he made a bad mistake in hiring a Consolidated Foods man, Robert Jaunich, to run his computer company.

Apple, on the other hand, reckons it did the smart thing in hiring a drinks company man, John Sculley of Pepsico, where (unlike Osborne, which crashed) things aren't going too badly.

Well, that's simplifying it a lot, but it does explain why industry watchers are so very interested in what happens at Apple here in the UK.

The symptoms are: Apple UK has been doing reasonably well selling micros; but Apple France has done nearly six times better.

These figures were analysed back in Cupertino, and, shortly thereafter, top people began disappearing from Apple UK.

First came the departure of the marketing manager, Keith Hall, leaving his close friends in little doubt that he preferred to run a more enterprising company, and one where local expertise was

Taking the BBC Micro one step closer to the Apple in its design concept, XCalibur has announced an expansion bus for the beast.

This expansion isn't just a philosophical similarity: the expansion bus will actually take Apple II cards. The idea isn't obvious — unless, of course, you are XCalibur, which makes a lot of expansion boards for the Apple, and can't sell them because there aren't so many Apple users.

All XCalibur Apple boards are, need one add, not only compatible with this expansion bus, but documentation on how to link them into BBC Basic is included with the expansion backplane.

Price (naked, without power supply or box, as shown) will be £200 — with a box and power source, it will 'probably' be about £260, the company says.

Details on (0604) 21051.

valued. His friends say he didn't much enjoy being told: 'Ignore Sinclair, ignore BBC Micro sales, stuff the market research; your job is to push the Apple IIe as a home micro.'

Then the managing director, Peter Cobb, beginning with a fine set of speeches about the potential that the IIe had in the home market, saw his own departure announced.

His replacement is not a food company man, nor a drinks company man. Nor, for that matter, is he a managing director.

What he is, is someone with vast experience of the razor blade business. He comes from Gillette.

And he has been appointed general manager — which means that, in the eyes of industry watchers (like me), the UK board has been downgraded.

The new man, David Hancock, will find his choices somewhat limited.

If he wants to please Cupertino, he will mount a huge marketing campaign, with expensive TV advertising, powerful trade promotions, and marvellous incentives for software houses to convert UK games for the Apple IIe.

He will then find that the IIe may cost 'only a little more than a BBC Micro with two diskettes' but that ignorant UK purchasers perversely buy BBC Micros (and Spectrums, QLs, Amstrads and Commodore 64s) because they haven't got enough cash to buy an Apple IIe with two diskettes. Actually, they can't even afford a BBC with two diskettes. The diskettes they save up for, and buy next year.

Alternatively, he will argue that the strong user base of Commodore 64, BBC and Sinclair Spectrum sales makes it necessary to sell the Apple IIe and IIc (the portable) into the business market, where it is quite strong already.

I suspect, if he does that, he will be told to get on with the job, and stop teaching his grandmother.

If he could drop the price of the IIe down to £400, of course, his troubles would be over on the sales front, because the Apple is really quite a nice micro, and there's loads of US software to run on it. Not as cheap as the sort of software that you can run on the BBC Micro, mind you, but cheap all the same.

But if he tried that, Cupertino would stop him. Not only is France (no BBC Micro, no Spectrum, just Oric and something funny from Thomson CSF) managing without cutting prices, but worse, the US is too.

The shape of the dollar (very strong) against the pound (very weak) means simply that if Hancock cut the IIe to £400, it would be cheaper for American buyers to get their Irish-built Apples from the UK, than to buy them in the US.

A reverse grey import business! Could this happen?

No. Do not expect price cuts of more than about 5 per cent in the IIe and IIc range.

IBM upstaged on home ground

One of the many exhibitions which occur around the hay-fever time of year is a newish one called the PC User Show. It is aimed exclusively at the world of the IBM micro.

Its only real attraction was the fact that it wasn't a PC user show at all, and should have been called the 'PC Rivals Show'.

Of the *new* products on show, most were new only to UK users, and have been out for months and months in the US, where the IBM PC is more of a religion than a user community.

The rest was so ordinary as to be soporific.

For examples of the rivals: ITT (wearing its STC label) was demonstrating the Xtra. That is an IBM lookalike which everybody in the US got very excited about last November when it was announced. Everyone in the trade, that is — not everyone in the street.

And despite important-sounding announcements from ITT both in the US and here, it is clear that while dealers were delighted to have the Xtra as a stick with which to beat IBM ('Give us more discount or we'll stock the Xtra'), the public was quite happy to carry on buying the real thing.

At the Show, ITT's stand was remarkable for one thing: the fact that the designers had been told 'Do what you like, as long as you eclipse IBM's stand.'

They had: they'd virtually hidden it. And IBM wasn't amused.

Nor was IBM very taken with the ACT stand (not a Rascal to be seen, just Apricots on one side, and Pulsar software running on Apricots and IBMs on the other) because ACT too, had eclipsed it.

Worse, ACT had taken two stands, one on each side of the aisle, and had then *illegally* linked them together with a bit of raised red carpet, on which the company had erected a shrine to its British Microcomputing Awards 1984 trophy.

IBM objected to the annexation of a hundred

The picture of a printed circuit board on the case of the new 'computer tape' from Agfa is meant to reassure you that the contents are 'high tech'.

Apart from that, feel free to ignore all implications in Agfa's marketing sales pitch that this tape is somehow 'better' than another tape cassette — the requirements of hi-fidelity audio are no less exacting than those of computer users.

If you use back-of-lorry tape, you may have trouble. Otherwise, tape which can record sounds will record computer sounds, and any problems you have are more likely to be the result of the cassette recorder than the tape.

But at least Agfa has produced this in fifteen minute chunks, seven and a half minutes per side, which is handy for most home computer programs.

At last: a real Ceefax and Oracle reader for your Spectrum. You can read me (Oracle channel 4, page 557) and look at the BBC's Micro software for the BBC Micro, even if you have a Spectrum. And all for only £145!

Does it download Spectrum software?

Well, no, not yet. There is some Spectrum code on Ceefax, at last. But this black box won't pull it down and load it. Not, at least, until a new ROM chip hits the market, to upgrade this to do the job.

The builders, OEL Ltd, say this ROM will be available 'shortly'. I'll let you know when I see one.

Details on (0768) 66748.

square feet of passageway, and got ACT to take it down and hide it behind the software, muttering angrily to the organisers about: 'What is ACT doing at an IBM show, anyway?'

Osborne showed an Osborne with an IBM keyboard and IBM lookalike circuitry, for which it didn't have a price yet. There was also the Encore, and a thing called the Polo, produced by the same Radofin company which gave us the wildly successful Aquarius home micro for a few months last year, through Mattel. The only surprising thing about the Polo is that you get a Z80 with your MS-DOS machine, and get printer and colour monitor for your £3000.

Another rival to shock us came from Ferrari Software, selling its Chameleon, which is actually an old Seequa Chameleon.

Ho hum, so much for the rivals.

Enthusiastic praise from enthusiasts directed me to a word processor, reputed to be the nicest ever.

It turned out to use standard screen 'escape sequences' for display. For those who have never used a remote terminal, this means that instead of just putting the character in the fifth row, fourteenth column of a screen, the computer has to send a series of instructions to tell the remote terminal to go to the top of the screen, then go down five rows, then move fourteen columns. Since the remote terminal exists only in the mind of the computer, it then has to run another complicated piece of software which interprets these escape sequences and translates them into the part of memory where it actually holds the fifth row, fourteenth column.

It all takes time, this software, and the result is that you can spend several seconds waiting for the whole page to rewrite itself.

The advantage of this sort of software is that it will work on virtually any computer that understands standard escape sequences.

This is poor compensation for the drawback — which is that the software is not worth having, whatever computer you use. It is easy to learn to use, but once learned, is it worth using?

All too much of the UK stuff at the Show was of this calibre.

The lesson, perhaps, is that IBM (like Apple before it) has overestimated its ability to dominate the UK market simply on the basis of dominating the US market.

When the IBM PC was released, over a year ago in the UK, *PCW* commented at the time that you'd be a mug to buy one, because there was nothing to run on it. But (we went on) in a year's time, you'd be a mug not to buy one.

In fact, you can still find quite a lot of UK software which is written first for the Sirius, and only then converted for the IBM. And you can find a very great deal of wonderful US software which is hard to get here, inadequately supported, and not entirely suitable for UK use.

There are people inside IBM who will tell you that they never planned to 'dominate the market' anyway, and are quite happy, thank you, just to make an inordinate profit on every PC sold. And they do sell a lot — all they can make, in fact.

But that can't disguise the fact that the company has been *very* successful in the US, and less successful here, and any theory which doesn't accept that is an excuse.

Osborne: the whole truth

Adam Osborne has been telling lies to the press.

He reveals this in a book, which tries to analyse why Osborne Computer Corporation collapsed, suddenly and dramatically, just at the point where it looked ready to take over the world.

The gist of the book is one which, he is perfectly aware, could take him straight into the libel courts — in fact he starts the book off with a letter from the lawyer of the man named as a possible culprit.

That man is Robert Jaunich — the man Adam himself brought in from Consolidated Foods to become president of his company.

Osborne did not go bust, says Adam, because of pre-announcing a machine called the Executive. That story is one which he told the *Wall Street Journal* and me, and many other journalists, knowing it to be false, a year ago.

'It was the only time I have knowingly misled the press,' Osborne says in his book, *Hypergrowth: a study of the rise and fall of Osborne Computer Corporation.*

Osborne's theory is simple, if at first incredible.

He believes that the new president might have wanted to buy a larger part of the corporation's stock than he was entitled to under his contract.

And one way of doing that, says Adam, would be to take decisions which made the company appear to be barely capable of making it through the year.

He could then watch the share price drop through the floor, pick up the shares for a song, and turn the company round. 'He would appear to be the saviour of the company, and nobody, even if suspicious, would have complained,' says Osborne.

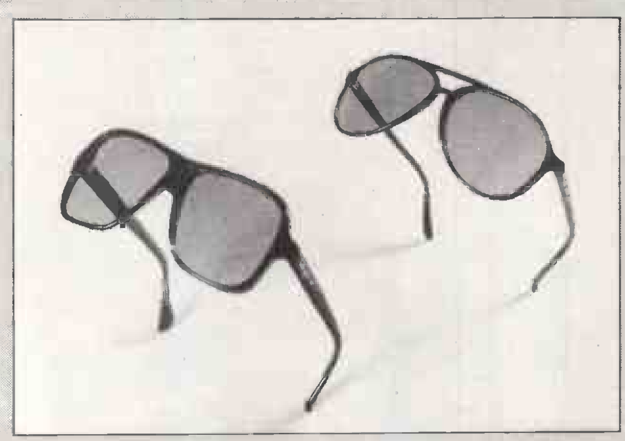
And the plan would have worked, had it not been for the unforeseen collapse of Atari and Texas Instruments just around the time when Jaunich was about to raise £30 million in private capital to finance Osborne's next few months.

With the withdrawal of TI and the announcement of Atari losses, the investment community wouldn't touch microcomputers, says Osborne. And so the whole plot was undone, and the company went into bankruptcy.

Evidence provided in the book for this theory is thick, but all circumstantial.

Osborne is at pains, throughout the text, to show that his examples of 'mismanagement' could be interpreted as sensible reactions to a genuine crisis. It's just that he doesn't believe there was a genuine crisis.

Osborne is entitled to his opinion and just possibly Jaunich might have been tempted to dismiss it as 'sour



Once you've shelled out your life savings on a computer, you'll find the list of people prepared to take another few quid off you is now lengthened by somebody producing 'VDU spectacles'.

These apparently exclude ultra-violet and infra-red, make a clearer image, and are available in a 'variety of colours'.

My suggestion, if you have a harmful VDU, is: get a better display. For full information on these trendy new fashion accessories ('I have to wear them, because of my powerful computer display') contact Bolle UK on (04254) 79055.

grapes' — were it not for one interesting factor, in the character of a co-author of the book.

The book was prepared with the help of John Dvorak, who was, at the time it was all going on last year, editor of the West Coast weekly, *Infoworld*.

Dvorak's reputation as a reporter is very high, and is bound to make many readers take the book more seriously than they would otherwise. He has no obvious axe to grind, and the fact that he has apparently taken Adam's theories seriously must inevitably lead others to think longer before dismissing them.

Nonetheless, there will be many who will not believe a word of it.

Mike Healy, the man who ran Osborne UK and who now acts as Osborne's UK distributor (the company has emerged successfully from bankruptcy as a going concern) was far too canny to make any statement about his own personal beliefs.

But, he did comment: 'There are many obvious reasons why Adam might want that version of events to be accepted, and why he might believe it himself.'

And one of Osborne's closest colleagues inside the company confided: 'It's just classic, the man cannot accept that he could make a mistake, and now admits that he did, but only the mistake of believing that he was mistaken. He thinks that if he had stayed on as president, all might have been well.

'And, historically, that wasn't an option open to him, even back in November '82: the weight of executive opinion inside Osborne Computer Corporation was already building up behind an "Adam Must Go" campaign,' added the inside man.

Nonetheless, no one who knows US stock market habits and big business practices will deny one thing.

That is: the sort of thing which Adam writes about has happened before, is happening somewhere today, and will happen next year. It isn't just wild fantasy, even if it didn't happen at Osborne Computer Corporation.

A camel for the Spectrum — nothing to do with Jeff Minter's hump-mania, either. It's a family of devices to load EPROM memory chips with your own program, run the program, and change the program. The unusual feature, according to Cambridge Micro Electronics (CaME1), is that you can use the Spectrum ROM program memory at the same time.

Full catalogue details on (0223) 314814.

The Pied Piper of Atari takes his revenge

Jack Tramiel, ex-boss of Commodore, has taken over quite a lot of Atari's computer business.

No one uses the word 'fired' about someone as important as Tramiel — not because they are in any doubt about it, but because even if it is blindingly obvious that he wanted to run a micro company, and wouldn't have left Commodore unless under pressure to do so, the word 'fired' is supposed to be rude.

I won't use it, either, because although it is *the* word most Commodore insiders use, there is still the possibility that this very ingenious man has bought Atari in order to bring it into the Commodore empire.

Tramiel is, of course, wealthy. He also has access to powerful backers, and the news that he was able to pay $240 million for a complicated package of shares and debt shouldn't be a shock.

But it was — especially to Philips, where talks were still under way preparing for a takeover on the day the Tramiel deal was announced.

The future (in terms of hardware) is still unpredictable. In human terms, however, it is becoming clear that many of Atari's top executives are leaving, and that friends of Tramiel are moving in.

Famous for the 'revolving door management style' of quick hire and fire, Tramiel has never been one to respect people who stood up to him and told him he was wrong.

But when it comes to the high technology designers, his record is very different — and many of the brightest chip technologists and systems designers from Commodore and MOS Technology are expected to follow him to Atari.

His UK acolytes, however, don't have this option. And one of Tramiel's firmest followers in Commodore UK was always marketing boss John Baxter.

Baxter has now left Commodore, but not to go to Tramiel Technology (TTL). He has joined the Vulcan part of Andromeda, where he has yet to reveal his long-term plans.

Share and share alike

Software to share IBM micros among several users together is starting to turn that machine into a multi-user system.

Multi-user micros continue to make money for companies like Altos and ICL, if only because the big-selling machines like IBM and Sirius and Apple don't have any way of letting a half-dozen people share the same system.

The real trick is not just to have people share the system, but share the workload — for example, with two clerks both entering orders into the same file. It's a trick beyond some systems which call themselves 'multi-user'.

The first newcomer, Alloy's PC Plus, appeared in prototype form in July, with a promise of full details in August.

This system involves plugging new processors into the IBM box, and using the PC Plus software to link them together, sharing disks and printers, with the extra users talking to the processors from remote terminals.

The fact that full details are still not forthcoming is not encouraging, especially when you read claims like 'a single IBM PC can be expanded into a multi-user system comprising up to 30 processors' and that 'the family comprises single board 16-bit and 8-bit processors.'

Data transfer is 'orders of magnitudes faster than local area networks' adds Alloy. This claim implies that it is at least 100 times faster.

And there is no word on how multi-access software would run on a system with both 16-bit and 8-bit processors, which makes it a good bet that it won't.

Digital Research, which has been plugging away at the concurrency idea for a couple of years now, has started talking about a very similar sounding system to Alloy's — DR StarLink.

StarLink uses Concurrent-DOS as the basis of its operating software.

It is already available to US users, but won't be freely available in the UK until September — but the claims already imply that multi-access will be possible. 'Several people can gain access to the same programs or files at the same time,' is the way the official announcement put it — but there is a not very subtle difference between 'gaining access to' and 'updating'.

Like Alloy's system StarLink is based on add-on processors, letting up to five people use the same IBM PC box (four of them on remote terminals) together.

From a new American name, Bluebird, a third multi-user solution is called SuperDos.

This is a very ambitious multi-access system. It genuinely does allow two users to update the same file, with precautions built-in to make sure that they don't actually update the same record.

'SuperDos applies locks at the logical record level, not merely at the sector of file level,' the company claims — and that is both safer, and quicker.

There is just one small

One way or another, you can have a computer in your pocket.

No, we're not exaggerating.

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An extremely efficient filing system in your pocket.

The Psion Organiser comes complete with a plug-in datapak which can permanently store over 10,000 characters. Allowing you to enter such day-to-day information as diary engagements, telephone numbers, addresses, train times and exchange rates. To name but a few applications.

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problem: SuperDos is not compatible with any other IBM standard operating system. It may offer indexed sequential access method, with multi-keyed files — but wonderful though that is, it doesn't help much when you wants to run Lotus or WordStar or whatever.

Bluebird is in Atlanta on (404) 451 4470. Alloy is in the UK on (0272) 290651.

Executive answer is 'think big'

Ashton-Tate products in the dBaseII family can now download mainframe database information in a format that they understand, with a product developed jointly with Informatics, a mainframe software company.

The new product is called dBase/Answer. The move should give a lot more executives access to mainframe information.

It always sounds a lot cleverer than it is, to offer 'full IBM-compatible mainframe communications' on a micro.

What it does is to let you access the mainframe as if you had a terminal, and get information out of it as if you were an authorised user. Fair enough, except that the cost of the terminal isn't usually the problem — it's the cost of having yet another user (inexpert, occasional, and likely to cause problems) on the mainframe, and the cost of keeping data there, that makes the DP manager postpone the decision.

dBase Answer deals with the complex task of taking a mainframe file, and turning it into a dBase file. Once that's been done, the micro user can switch to dBaseII or dBaseIII, or Friday! or the latest product, Framework, and create reports, print sorted lists, or whatever.

Double size, double trouble!

Some of the excitement has drained out of my discovery of DoubleMode, the company which sells computer colour monitors made out of ex-rental TVs, for £85.

I ordered one to test, and was assured that it would be with me quickly. 'But we don't have the 14-inch screens — the smallest is a 20-inch. Is that OK?' the salesman asked.

I said it was.

The trouble is that your mind doesn't translate 20 inches into reality. Think about the sort of coffin which comprises an out-of-date, ex-rental colour TV set with a 20-inch screen, and you will start to construct the scene that ensued when the thing was delivered.

First, I thought it must be all packing. It wasn't. It was huge, and it took two people to carry it upstairs.

Next, when placed on the table, it turned out to leave no space for the microcomputer. A platform under it, made space for the micro, but then it turned out to be simply too big to sit that close to, You get a stiff neck, swivelling your head around to look from the left to the right of each line.

Probably the ideal solution would be a baronial table, with the display at one end, and the computer at the other. Perhaps this would have been tried, if the display hadn't switched itself off after the first day's use.

I rang Double Mode to tell the company that its onsite maintenance was about to be tested — and the phone wasn't working.

An official at the Irvine Development Corporation assured me sadly that the phone was indeed out of order, but that it hardly mattered. 'The factory is on holiday for two weeks,' said the unhappy voice.

I may stand it on end and use it as a coffee table . . .

Software consultancy which aims to 'clean up'

Sticking his neck a long way out, ex-IBM salesman David Everard is taking his software house (RSB Systems) into the hardware market.

He is doing it, he says, to save users from people who sell inappropriate hardware.

This is a touchy little subject at the moment, following the star treatment given to Keith Park of ParWest (a software consultancy) on the radio *Watchdog* show.

Roger Cook interviewed Park and also spoke to several of his angry clients. They told of systems (for which advance payment was requested) which never worked, and didn't meet their needs, and which were delivered late anyway.

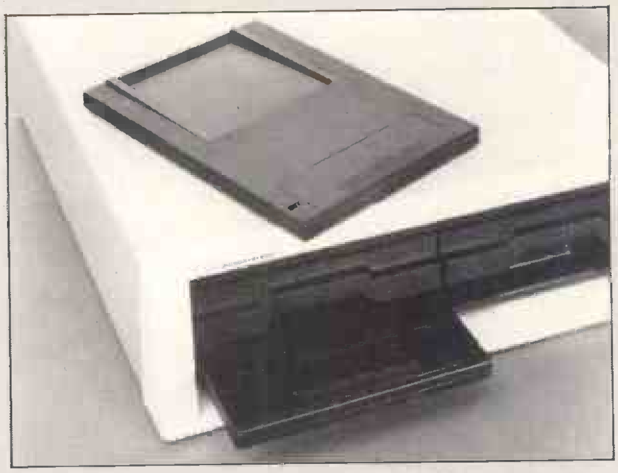
The incident has left scars in the minds of many in the business micro trade since Park announced he was going out of business (a press release which, he told Cook on the radio, should have said 'temporarily, for a month' but didn't).

Everard of RSB is not specifically referring to the sort of problem that faces ParWest's unhappy clients — he is concentrating more on the phenomenon of being called in by businesses which have actually gone to a shop, and bought a micro which he, Everard, then has to tell them is just not suited for the job of running the application they need.

'We were originally set up in 1979 as a software house, specialising in accountancy programs for IBM mini and micro systems,' Everard told me, 'and in all too many cases, people buy the hardware before thinking of the software.'

His new Business Systems Centre has agreed to deal in IBM, Apple and NCR micros, but, he insists 'the work will be more along the lines of consultancy than pure hardware sales.'

If the plan works, he could find himself putting out fires caused by software being bought from unqualified consultancies, too.



It may look like a square floppy disk. It is in fact a 'hard' floppy disk, holding 20 megabytes — the secret of making a floppy disk hard is the speed you spin it. Apstor's Alpha 10 has now been sold to a Dutch buyer — first export order — as a result of a Netherlands magazine review which found it to be 'the first removable cartridge storage device to pass every one of their tests'. And that is the key — it is a cartridge, and cheap. Most hard disk systems are permanent, unremovable, and take hours to copy onto floppies. This one can be copied onto another cartridge in less than five minutes.

Details on (0273) 422512.

Details on (02357) 66330.

Lisp implemented on MS-DOS

A new product for those following Dick Pountain's Teach Yourself Lisp series: Microsoft has released a version of the language for MS-DOS computers.

The package, called the muLisp-82 Artificial Intelligence Development System (sounds like a set of mental exercises), will work mainly on IBM family machines, where it requires a minimum of a single floppy

It can cope, says Microsoft, with the bigger (segmented) memory systems of the 8088 or 8086 family of microchips — something a bit beneath one or two Lisp compilers which can restrict memory artificially.

As well as two educational games, the package also includes an implementation of the original Eliza or Doctor program, written by Joseph Weizenbaum of the Massachusetts Institute of Technology — the program which always ducked any attempt to ask it a question, by turning the question into another. ('Who are YOU?' — 'Why do you want to know?')

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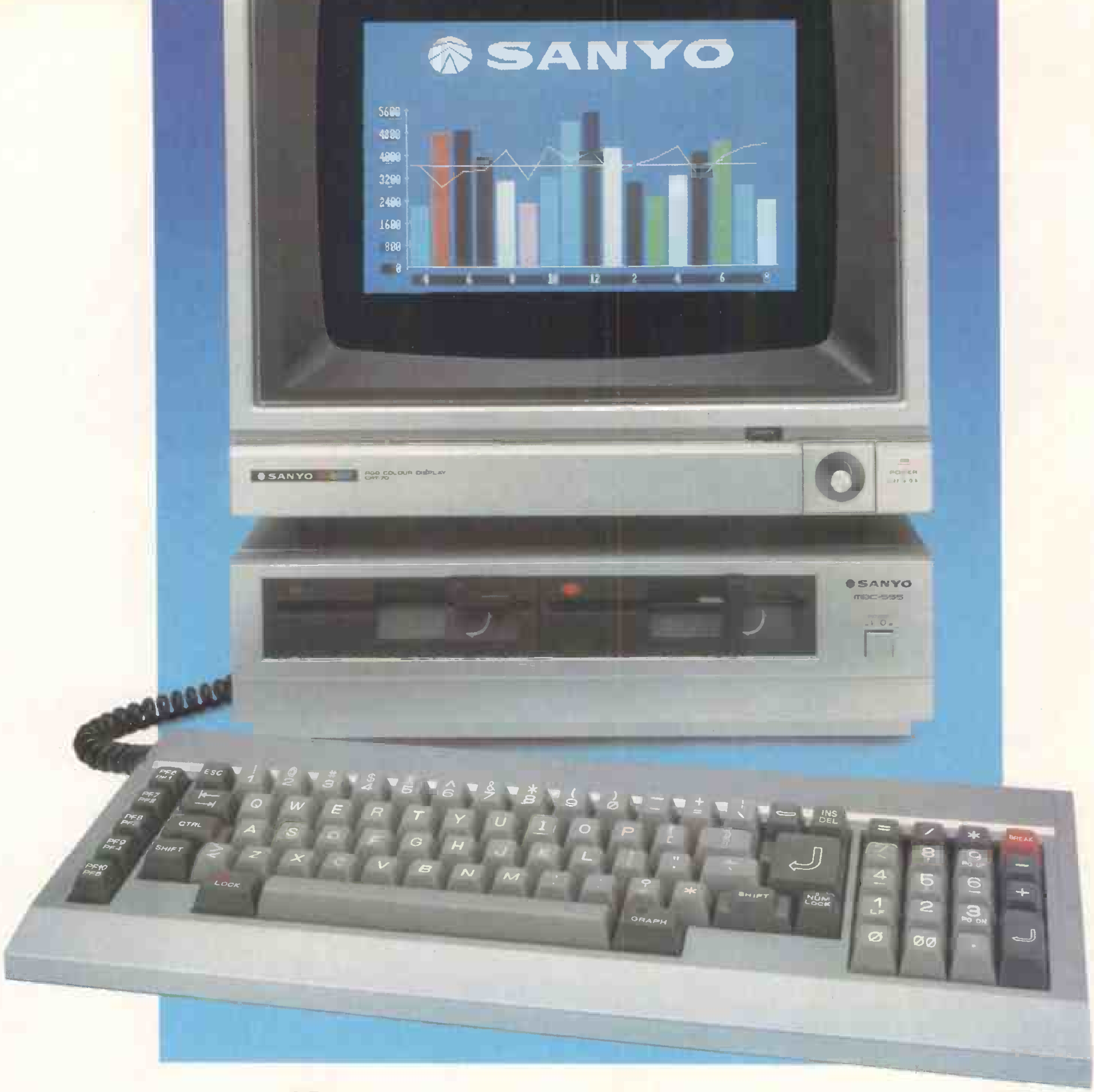

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Broadly speaking . . .

One of the very first computer shops to be set up in Britain was Comart, which expanded two years later by buying the Byte Shop chain.

The man who started it all off was David Broad, who has now made himself personally wealthier by selling out to Kode.

What the move will mean to people who buy micros from Comart or its subsidiary companies is just guesswork. But what it will mean to people who read this column, I'm afraid, is that David Broad is likely to be quoted more often.

Broad is out to become a force behind the scenes in government circles.

He has done his bit in the past, setting up things like the British Microcomputer Manufacturing Group, and lobbying for changes in import duties, and so on.

'I don't expect to be going in for politics, at least, not for a few years,' Broad told me when the news broke, 'but that does remain a possibility. What I'm really out to do, though, is to get involved in a few more government committees, and advise a few more City people on the micro business.'

Just because he's a comfortably off ex-chairman of an enterprising start-up company with contacts in Parliament, doesn't mean you can expect him to wear a blue tie.

'I am not a Tory,' he said candidly, 'nor yet Labour. I tend towards the centre in British politics.' And he confessed to being a member of 'one of the Alliance parties'.

Good news, perhaps, for whichever Alliance party that is.

The Kode deal valued Broad's 82 per cent of Comart at £2,500,000. Quite a substantial part of that money was paid in cash (less than half, though).

In return, Broad will be 're-investing some of the money to secure a 5 per cent holding in the enlarged group'.

Somewhere over the rainbow

The price cut of a DEC Rainbow by 20 per cent to £2295 doesn't sound as good as it is.

Two important points by comparison with the IBM micro need to be made: first, this price does include two 400k disk drives, and second, it includes the Z80 processor with ordinary CP/M as well as the MS-DOS machine, in the same box.

DEC also makes much of a unique free maintenance scheme, backed up by a personal hotline service, which is not something you'll get from other suppliers, and is worth a mention in passing.

It may sound a lot for a single circuit card, £500, but what makes it sound better is the list of things the Ultrapak does for an IBM PC.

Its main task is to give graphics to a monochrome IBM system, including Lotus 1-2-3- graphics.

It also provides other essential add-ons, such as a Centronics compatible parallel port, a serial RS232 port, and a clock/calendar with its own battery, so that the computer always knows what time and day it is when you turn on.

Finally, it lets you pretend you have a VT100 terminal so that you can connect your IBM to Digital Equipment minis.

Details from MBS Plus on Colnbrook 3292.

Chip talk

Just a small aside to Sir Clive and his QL: Motorola, the company which makes the 68008 chip inside the QL, has announced a 32-bit version.

In the announcement, Motorola refers to the 68000 (the existing chip of which the 68008 is the little sister) as 'a sixteen-bit processor'.

If Motorola thinks that the 68000 is a 16-bit chip, why does Sinclair think that the eight-bit version of it is a 32-bit processor? His own explanation (at the time of the launch, you may remember) was 'We decided to skip the 16-bit chips because we wanted to wait for the 32-bit chips, which have more memory'.

The 68008 can address a megabyte of memory. That is more or less exactly what the IBM's 8088 chip can address.

Don't rush off, by the way, looking to buy the new 32-bit Motorola chip, because even when samples are available a few months from now, the chip will probably fetch £400 . . . and until then, can we please save the term '32-bit' for when we really need it?

A wise move?

It is very impressive to see software appearing, at last, for the QL. But it is a little alarming, to say the least, to see how many people are preparing to run businesses with the beast.

Sagesoft, of Newcastle upon Tyne, has agreed to put the Sage accounts program on the QL.

I'm very happy to pass on this announcement, but after years of disasters with floppy disks, I really don't feel up to recommending that you actually try running accounts on a QL until you've used the machine for six months, and have a very good idea of how long a microdrive cartridge lasts.

On the other hand, there isn't any cause for panic. Sagesoft endearingly predicts that the QL version 'will be launched in Spring 1984,' by which the company means in nine months' time.

Other software, according to Sinclair boss Nigel Searle, is just around the corner.

Responding to recent scepticism about 'where is the software', Searle retorted with the rhetorical question: 'Tell me one software house which isn't preparing a package for the QL.'

It's not the sort of question I can answer, but it did sound convincing.

Sagesoft is on (091) 284 7077.

Before you upgrade to dBaseIII . . .

The main difference between the old dBaseII database, which sold so well, and the new dBaseIII, which Ashton Tate has just launched, is that the new one assumes you are using a 16-bit processor — or larger.

The main difference between eight-bit systems (generally) and sixteen-bit systems, is the amount of memory available, and the size of the file descriptors.

So dBaseIII can store up to two billion records per file, and 128 fields per database.

From the database user's point of view, the biggest change will be the ability to use 10 database files simultaneously — where dBaseII could only manage two.

And it also uses colour.

The only doubts about the new product concern its newness. According to one consultant, the new version is nowhere near as stable as dBaseII (which is no surprise, of course) — but also, not as stable as it might be at launch.

That's the sort of information which isn't very useful except as a vague warning, since the only way to test a database for stability is to use it heavily for six months. Typically, databases seldom break down when trying to manipulate one or two small files, even if they are known to be flaky.

On the other hand, it's worth passing on somebody's doubts, just in case you were

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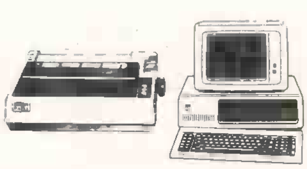

IBM PC PACKAGES

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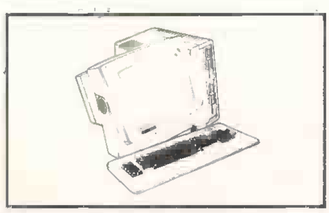
IBM PACKS 3 & 4. PC XT, software. Daisy printer at no cost.



IBM PORTABLE PC

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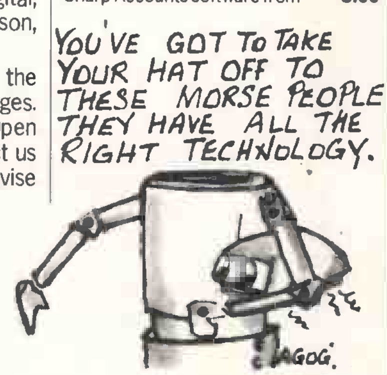

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MORSE COMPUTERS 78 HIGH HOLBORN, LONDON WC1V 6LS. 01-831 0644. TELEX 916509.

Mouse, pen, digitising tablet and graphics — when I saw this in America, it was a Pencept tablet. Here in Britain, it turns out to be called the Kode Penpad 320.

Just as a mouse for the IBM, it would be worth considering. But the ability to write on the pad, and see the words appear on the screen, makes it worth serious consideration, especially for non-typists. And it will, says Kode, work with Lotus 1-2-3.

Details on (0249) 813771.

planning to use it for something critical — so that you can take the precaution of keeping your old system going at the same time, until the new one is proved stable. And I suppose you could describe the company, Ashton Tate, as having proved that it will stay around and support the product.

Acorn first past the post

The BBC's decision to stick with Acorn and the BBC Micro put an end to months of rumour — but not to discussion on the subject.

Acorn won a new four year contract to manufacture and distribute the BBC Micro. Competition from Sinclair Research's QL and late starter ACT with its Apricot F1 made no impression on BBC Enterprises.

Tenders from at least four other micro manufacturers, including one which has now called in the receiver and another which doesn't actually have a machine yet fared no better. Sir Clive just hasn't had any luck — the NewBrain, originally intended to be the first BBC Micro, also started out life on the Sinclair drawing board.

There's no mention in the new contract of a new BBC machine: it speaks of Acorn's commitment to 'support and enhance' the BBC B for the term of the agreement. However, a spokesman for Acorn admitted that the BBC B would not be competitive throughout the four years of the contract, and stated that a new BBC Micro *would* be coming from Acorn.

Comment from Sinclair was spartan but Commodore was more outspoken, while denying it wanted the contract. John Baxter, Commodore's marketing manager for the present, but due to leave soon, was not impressed. 'I'm surprised BBC renewed for the same damn product. Sales are already declining, and internal pressure is building in the BBC to unhitch from commercial involvement with any company. Nowhere does anyone from the BBC say anything about a new micro — that's the most significant part of the announcement.'

If Acorn does have a new BBC machine it won't appear before the launch of its range of business micros in September. There are likely to be two machines, both 16-bit, one a portable. Informed sources quote 3½in drives and built-in compatibility with current BBC B business software. One question which has yet to be resolved is whether you'll be allowed (because you'll undoubtedly be able) to pipe your software from 5¼in to 3½in disks. No prizes for guessing which way Acorn will go.

Jerry Sanders

BBC recording deal for bit-part 'stars'

Three new computer series from the BBC are being recorded. October this year sees the start of a monthly magazine on BBC 2 for experienced enthusiasts, provisionally called *Micro Magazine*, and starting in March 1985 two new series will be broadcast on BBC 1. *The Learning Machine* will concentrate on educational software and how to write, choose and use it. A second series, as yet untitled, will explore the use of computers by the handicapped.

Jerry Sanders

Expert from Monaco

Monaco is the unlikely source of a new expert system for the IBM PC.

The company concerned is Framenlec and the program it's offering is a cut-down version of its Lisp machine S.1 expert system.

Known as M.1, the package runs on the IBM PC under PC DOS 2.0 with a minimum memory requirement of 128k RAM. Written originally in G-Lisp, M.1 comes pre-compiled and offers automatic question generation, fuzzy logic factors and presupposition checking — features normally associated with systems running on dedicated Lisp machines.

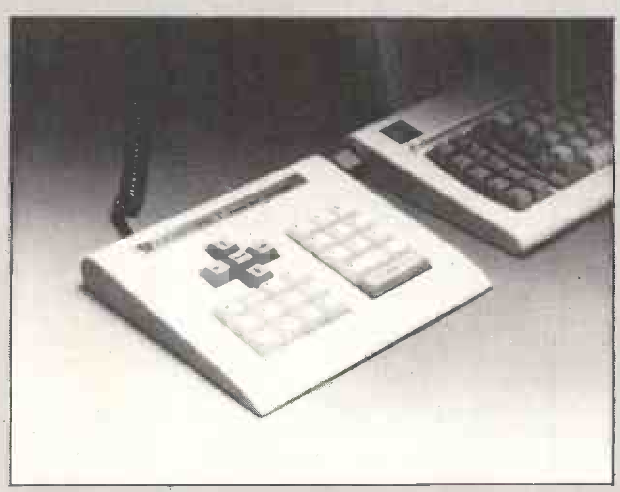
No UK price has been set, but don't expect it to be cheap. The Xerox 1100 mainframe version of S.1 is on 'introductory offer' at $50,000 for the first CPU!

Jerry Sanders

Job spot

***If you've ever wanted to work for PCW* as well as read it, now's your chance. We're looking for a staff writer to coordinate our program pages. Once that's under control, there'll be plenty of opportunity to contribute to the other sections of the magazine.**

We're also looking for somebody to take over Computer Answers on a freelance basis. So if you've got the ability to answer technical queries on a range of micros, write and let us know. We're waiting to hear from you.



'But the IBM keyboard already has a numeric keypad,' you cry. 'Why would anybody want to spend around £150 on an add-on?'

The answer, according to Touchstone Technology Inc, is that: 'We know from discussions with PC owners that no one uses the numeric keypad on the standard pc keyboard.' That's because the keypad is actually a cursor controller, and you have to press the Num Lock key to get the numbers.

Details of the 29-key pad on (716) 235 8358 in Rochester, New York.

YANKEE DOODLES

David Ahl reports from over the water on a phone that keeps your diary, a multi-lingual voice command module and computers with ears.

Random bits

Xerox has introduced a hardware/software package that allows IBM PCs to tie into Xerox's Ethernet local area office systems network. It is hoped that PC users will be attracted to other high-technology Xerox office products such as copiers, storage devices and work stations . . . Coleco has introduced a disk drive for the Adam computer at a price of about $250, bringing the total system cost to over $1000 . . . Six different Japanese MSX computers appeared at the Summer Consumer Electronics Show (CES). Manufacturers were not taking orders but admitted to 'testing the water' . . . Also at the Summer CES, Quicksilva and Virgin Games sponsored an English breakfast for dealers and the press. The hotel chef had never made kidneys, so Quicksilva provided a recipe. Unfortunately, the recipe didn't say how they should be served, so guests were confronted with a large bowl of whole kidneys. It just wasn't Quicksilva's day: its rented double-decker London bus had engine problems so was unable to provide transportation (or publicity) . . . Nor were CES' problems limited to Quicksilva. The *CES Daily News* reported that the Sinclair QL computer uses an 8-bit Z80 microprocessor rather than a 32-bit 68008 MPU . . . For the first time ever, more education and personal productivity software packages were introduced at CES than games . . . Can computers relieve the stress they cause? Three manufacturers have demonstrated devices for measuring physical tension through surface electrodes and provide users with a way to monitor tension, relieve stress and even play games. Watch for announcements from Atari, Synapse and Thought Technology . . . Researchers at the Submicron Research Facility at Cornell University have produced the first layered circuits, possibly the predecessors of truly 3D integrated circuits . . . The 3000-year-old cryptic wisdom of the I Ching has now been turned into a $69.95 computer program by Prof Kerson Huang of the Massachusetts Institute of Technology. He admits to selling 'only a few copies'.

Looking for a reason . . .?

Some years ago, popular lore had it that more Apple computers were sold because of VisiCalc than for any other reason. Since then, few peripherals or software packages have played such a key role in the industry.

However, Computerphone may be that unique product which provides a reason to buy a Macintosh.

In appearance, it looks like a sleekly-styled telephone handset with a built-in touchstone pad that hangs on the left side of the computer. The software disk stores 200 phone numbers, billing information, memo pad and calendar. You use the mouse to select a name and the number is dialled automatically.

The phone then becomes a standard voice instrument: as you are talking, the computer can record any notes you wish to make about the call. When you hang up, it makes a record of its duration and cost.

The calendar portion of the program reminds you of meetings, appointments and calls to be made, and keeps a permanent record which can be viewed or printed.

For $200, Computerphone is one of the most interesting products to come along in many a year. It's made by Intermatrix, 5547 Satsuma Ave, N Hollywood, CA 91601.

Apple-compatible evolution

For years, MicroSci has been producing add-on disk drives for Apple and Commodore 64 computers. In an effort to diversify about two years ago (at the peak of the game craze), the company considered making a low-cost system solely to play Apple games (MPU, memory, disk drive, joystick and video port). But as the bottom dropped out of the games market, the design grew and evolved into a full Apple-compatible computer.

The shoebox-size system unit contains the MPU, 64k, motherboard, I/O interfaces and single disk drive. Built-in are both serial and parallel printer ports, RS232 port and connectors for a second disk drive, monitor and joystick. The Havac is exceptionally easy to start up; one keypress causes it to automatically boot up nearly any type of Apple II disk (the only combination that doesn't work is Prodos plus Basic which needs more than 64k). It has full colour graphics, upper and lower case, but can display only 40 columns of text.

A short cable connects a detachable keyboard to the system unit. The keys have a good feel; layout is similar to the Apple IIe. Like the IIc, the Havac has no expansion slots and I/O is built in. At just $850, it should be a winner for schools and home users who want a simple but powerful machine with a huge software base.

The Havac is made by MicroSci, 2158 S Hathaway St, Santa Ana, CA 92705. And please don't spell it havoc.

Hearing aids

The IBM PC and Apple micros are to grow electronic ears to match the Apricot portable's.

The new electronic hearing device has been demonstrated by Dragon Systems of West Newton, Massachusetts (no relation to Dragon, UK). The Dragon ear is considerably more accurate than more expensive designs: for example, in a test of more than 50,000 words the Dragon system made only 34 errors.

Dragon is supplying the system on an OEM basis to Koala Technologies (maker of the Koala graphics pad) for incorporation into three new products. In addition, it will be sold by other companies as an add-on to the IBM PC and Apple computers. Price of the ear is around $300.

This is the same system that is used in the new ACT Apricot Portable. The unit has an active dictionary of 32 words which can be changed in a program to other sets of 32 words. But don't talk to it if you have a cold — it probably won't understand you.

Chirpee conversations

Chirpee is a voice command module that allows you to give spoken commands to an Apple or Commodore computer. It's capable of accepting commands spoken in any language from English to Swahili as it's based on phonetic syllables.

Moreover, Chirpee can be trained to respond to one person exclusively or to several people. It can be easily integrated with practically any software package and can augment or take the place of mouse, touch screen or keyboard entry.

This compact marvel costs just $179. It's made by ENG Manufacturing, 4304 W Saturn Way, Chandler, AZ 85224.

A long way from dinosaurs

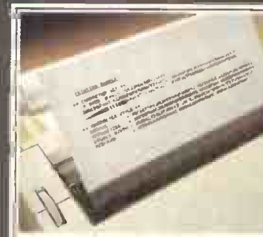
The integrated software system for the Epson QX-10, Valdocs (Valuable Documents), has been praised for its user-friendliness but criticised for its slow response. Chris Rutkowski, president of Rising Star Industries, developer of Valdocs, gave me a preview of Version 2 which makes the current version look like a dinosaur.

Integrated in the system are word processing, database management, calculation and graphics functions which are so natural that a printed manual is virtually unnecessary.

Although the QX-10 uses an 8-bit Z80A microprocessor, Valdocs automatically takes advantage of any amount of installed memory without the user having to worry about bank selection or memory management. File names can be 40 or more characters long and are retrieved by keywords or menu selection.

Look for an introduction in late fall at regular Epson dealers. END

Little Brothers should be seen but not heard.



REGULAR, CONDENSED, OR EXTENDED FACES.

CUT SHEET A4 OR ROLLER PAPER.

BATTERY OR MAINS OPERATED.

A maxim which eloquently describes the Brother HR-5.

Less than a foot across, it's nonetheless loaded with features.

The little printer that's low on decibels.

There's one thing the HR-5 won't give you. Earache.

For the annoying 'clickety clack' many printers produce is mercifully absent from the HR-5.

Quietly efficient, it delivers high definition dot matrix text over 80 columns at 30 characters per second (maximum).

Text or graphics with ease.

The HR-5 also has something of an artistic bent.

Being capable of producing uni-directional graphics and chart images together with bi-directional text. What's more it will hone down characters into a condensed face, or extend them for added emphasis.

At home with home computers.

Incorporating either a Centronics parallel or RS-232C interface, the HR-5 is compatible with BBC, Spectrum, Oric, Dragon, Atari and most other home computers and popular software.

Perfectly portable, the battery or mains operated HR-5 weighs less than 4 lbs, and has a starting price of only £159.95 (inc. VAT).

Which is really something to shout about.

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CPC 464 complete with monitor and datacorder

CPC464 green screen VDU (GT64)

The new CPC464 comes complete with its own colour monitor or green screen VDU for obvious reasons.
Connect as directly as possible to the electronics that control the screen display and you get the best possible performance.
The monitor drives each colour on the screen directly from the computer. So there's no unwanted circuitry in the way to distort the picture.
It's clear and steady. Much better than a micro/colour TV combination. And there are no tuning problems, either.

Complete, ready-to-go system.

The CPC464 is unique at the price. No other computer system offers you so much for so little.
64K of RAM (over 42K available to BASIC), 32K of ROM, colour monitor or VDU, built-in cassette data recorder, typewriter style keyboard, numeric keypad and a very fast extended BASIC.

Green screen VDU.

This purpose designed visual display system has an 80 column text display. Text and numerical data are bright, sharp and easily read at a glance. (Invaluable for word processing, accounting, budgeting and developing programs).
Green screen versions of the CPC464 can be used with a colour TV by connecting the optional power supply and modulator MP-1.

Amsoft. Wide range of software.

A rapidly expanding range of programs is already available. The high quality software takes full advantage of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.
Arcade games, educational programs and business applications are all designed to utilise the CPC464's impressive graphics, sound and processing abilities.

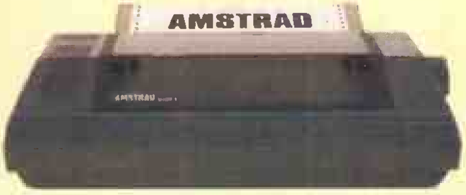
Amstrad. User Club.

Whether you're interested in serious commercial applications or you're a games fanatic, you'll want to join the Club.
Members enjoy immediate benefits like the privilege card, Club binder, regular magazine, competitions for valuable prizes and contact with other Amstrad users.

CPC464. Unlimited scope for expansion.

At Amstrad, we look to the future. That's why there's a built-in parallel printer interface.
A low cost optional disk drive system including CP/M* and LOGO. A joystick port. And the virtually unlimited potential of the Z80 data bus with sideways ROM support.

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



Optional 80 column dot matrix printer DMP-1. Offers high performance computerised text processing for only £199.95.

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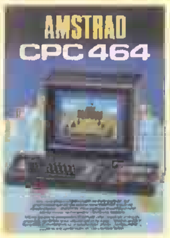

ACT Pulsar 'File Transfer'

It's easy to get the impression that the differences between micros are there to tie you down. How do you upgrade from 8-bit Apple to today's 16-bit micros, or copy files between different 16-bit machines, without hours or even days of laborious data re-entry – and all the dangers that entails?

The answer is Pulsar File Transfer. It puts Apple, Sirius, Apricot and IBM straight onto the same wavelength, transferring file type, text, binary or graphic information directly at up to 9,600 bits per second.

With the correct combination of Pulsar File Transfer packages you have access to complete software freedom between IBM-PC, Sirius and Apricot and instant transfer of data from Apple. Multiple files can be sent or received with a single command, while an in-built error-checking facility guarantees absolute accuracy.

For more information on the Pulsar connection just return the coupon. Vive la difference!

ACT (Pulsar) Ltd.

FREEPOST, Birmingham B16 1BR or call 021-455 7000.

PULSAR SOFTWARE

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POSITION

COMPANY

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TEL:

PCW 9/84

Shinichiro Kakizawa boasts about Japan's innovative answer to Sinclair's microdrive, Epson's lap-held explosion and a VDU the size of a watch face. Watch this space!

Inexpensive and reliable storage

Storage standards are becoming even more confused. The latest Japanese offering, the Quick Disk, follows the principle of Sinclair's microdrive (fast sequential access) but is based on disk rather than tape—and the disk size is 2.8ins.

Quick Disk can store up to 64k or 128k per disk depending on the model. It rotates the disk by a spiral method—consisting of only one track—at 423rpm, with a recording density of 4410bpi. The data transfer rate is 101k.

Quick Disk's major advantage is that it only takes eight seconds to load and save an entire 64k program, while a conventional cassette tape takes more than 10 minutes.

One machine already featuring Quick Disk is the recently launched Sharp MZ-1500 low-cost home computer but some of the MSX machines will also be using it. The MZ-1500 uses a Z80A CPU of 3.58 MHz, with 64k RAM as standard, 24k graphic RAM, 4k VRAM and 12k monitor ROM. The MZ-1500's Basic is compatible with Sharp's earlier home computer model, the MZ-700. All MZ-700 software will run on the MZ-1500 as the latter employs the ordinary cassette drive interface on which tapes are interchangeable.

Quick Disk is now available from several manufacturers including Mitsubishi—OEM supplier of Univac PC. The very first Quick Disk to come onto the market was from Mitsumi Electronics, Tokyo. (Sharp MZ-1500 uses the Mitsumi drive.) The Mitsumi Quick Disk is about the same size as a cigarette pack and costs £1.50

Suitable for low-cost home computers, it is more reliable than cassette tape. (*PCW* readers will probably see one of the MSX machines using the Quick Drive by Christmas.)

Epson out front with lap-helds

Epson has launched two more lap-held machines only two months after introducing the PX-8.

The new computers, the HC-40 and HC-41, look very similar to the NEC and Tandy Kyocera portables. The screen size is the same, too: 40 characters × 8 lines. The CPU consists of the CMOS Z80 chip, 3.6564MHz. 64k RAM and 96k ROM are standard and the LCD screen is 240 × 64 dots. Standard interfaces include RS232C, serial, bar code reader and Centronics. A microcassette drive is available as an optional feature.

The micros have two major attractions. Firstly, the keyboards are detachable. The HC-40 has a standard typewriter keyboard, the HC-41 has an item keyboard on which each key can have user-defined functions to facilitate easy key entry for a specific application; and you can have a multiple key assignment for a number of different applications. Secondly, another improvement on the model HX-20, is that the new machines run CP/M. With an optional disk drive attached, a variety of CP/M software is available.

Prices of the HC-40 and the HC-41 are approximately £400 each.

Small is beautiful

Seiko has launched a wrist-watch VDU—the RC-1000. The VDU can hold a maximum 2k of data in its RAM, and its LCD screen can display up to two lines of 12 characters at any one time.

Here's how you use it.

You wake up in the morning, pick up your wrist-watch VDU and connect it via the RS232C attachment to your desktop microcomputer where you keep your necessary information for the day. It takes only 10 seconds to transfer the entire 2k of data, and then off you go!

An alarm sounds for each appointment on the time-table (stored in the VDU's memory).

The RC-1000 is not the first wrist-watch computer launched by Seiko. In 1982 the company brought out a wrist-watch TV; and in 1983 its first wrist-watch computer: the UC2000. Although similar to the RC-1000, it did not have an automatic alarm.

Seiko's determination to stick with wrist-watch technology is remarkable. If anyone is going to make the dream of the space age science-fiction wrist unit come true, I expect it'll be Seiko.

Retrogressive step for Hitachi?

Eight-bit micros are not dead (or at least not yet) in the Japanese market.

Hitachi, manufacturer of large IBM-compatible mainframes and OEM supplier of these machines to NAS, BASF, and Olivetti, has applied mainframe design technology to its first-class 8-bit micro. It has 1 Mbyte memory space, and its graphics display response time is 55 times faster than other Hitachi 8-bit machines. For home users, a 'Superimpose' feature is provided.

Hitachi believes there is a good market for such a machine. The trend is to move away from 8-bit, but there are an awful lot of the company's applications for which you really don't need 16-bit technology.

The new models are the MB S1/10 at £350 and the MB S1/20 at £500; the latter being directed at businesses.

Pick a graph, any graph

Matsushita has just unveiled its portable, electronic (battery-operated) plotter/typewriter which is capable of printing graphs and characters in up to four different colours. The 'Panagraph' can print in black, red, blue and green using specially developed ball-point pens at a printing step of 0.1mm. It has a small LCD screen and 256k buffer storage so that editing can be carried out in memory before the text and/or graphs are printed. It has 3k RAM to store the text or the graphs and looks similar to the Brother's portable typewriter, the EP-44. The Panagraph weighs 2.6kg, and costs £171 in Japan.

Almost simultaneously Brother came up with its own very similar graphic machine called 'Picograph'. This uses four-coloured ball-point pens and most of the functions are designed for the convenience of drawing graphs. Picograph runs on batteries, weighs 2.7kg and costs £168.

Music while you work

Ricoh has developed a system which can record voice and music as well as data, all on the same floppy disk. It can be attached to the Ricoh range of microcomputers through a special interface box.

Reproduction of voice and music is program-controlled. This means you can carry out a *Name that Tune* type of music quiz on your computer.

Reproduction quality on the floppy disk is as good as on an ordinary musical cassette.

Through the grapevine

Japanese MSX micros are not going to be solely home machines. The operating system, developed by Microsoft to the horror of some other American companies, will be compatible with CP/M at the system code level so that you can run any CP/M program on any MSX machine. MSX will also be compatible with MS-DOS at the file level to enable interchange of data between the two systems . . . ASCII, a system house/publishing company in Tokyo, carried a special Benchmark test/evaluation report on the BBC B in its influential monthly microcomputer journal. Acorn, we hear, is now talking to several Japanese firms about the possibility of a marketing/collaboration deal . . . IBM's rumoured new lap-size computer, it seems, will probably not be made this time by Matsushita, because IBM is unhappy about Matsushita's secret sales of IBM5550 lookalikes. Speculation is that the deal will go to Hitachi. END

NETWORKS

Ever wanted to know what a bibliographic database is? Peter Tootill knows the answer; and a whole lot more about bulletin boards.

You're bound to come across the term 'bibliographic database' at some stage, so here's a brief idea of what it is. A bibliographic database is a bit like an electronic library, except that where a library contains books, the bibliographic database contains information relating to the books it covers. It will have references to, and abstracts from, books and journals and other publications and it is the ideal location for researching information on a particular topic. One of the largest, if not the largest, is Lockheed's 'Dialog' which holds more than 40 million records of information from 60,000 journals in over forty languages!

Some bibliographic databases operate in specialised areas such as EPO (European Patents Office) which only carries details of European published patent applications and patents. Others such as Dialog, ESA-IRS, (the European Space Agency Information Retrieval Service), and 'Datastar' try to give as wide a coverage as possible. The providers of the services are usually referred to as 'hosts'; each host providing a number of individual databases. Dialog has over one hundred, ESA-IRS has over 30, Datastar has around 40. Costs of using the systems vary. Most hosts have a subscription fee, or at least some form of registration before you can gain access to the system; you are then charged on a time basis at a rate that depends on the database to be used. Some cost a few dollars an hour; other more specialised ones will set you back $2-300. However, most searches only take a few minutes, so total costs will not necessarily be that great.

All the hosts are linked to the packet-switching data networks and in this way can be used from many parts of the country by means of a local call plus data charges. Even overseas systems can be used at a cost below that of an international phone call.

Plug-in modem

A plug-in modem board for the Sirius (approved by BABT) has been introduced by ACT. It comes complete with software to use ACT's own 'Micromail' electronic mail service, which is based on Telecom Gold. The cost is £295 plus VAT. More details from ACT on (021) 455 7000.

Bulletin board news

Hull, the birthplace of the British BBS with Fred Brown's pioneering Forum 80 system, has scored another first. It's the first UK city outside London to have *two* bulletin boards. Called 'Hamnet' the second bulletin board is designed for radio hams. Tel: (0482) 497150. Hours: Mon-Thurs: 6pm-8am; weekends: 6pm Fri to 8am Mon.

Please note that Forum 80 has revised its system times as follows: weekdays: 5pm-11.30pm (Tues and Thurs registered users only); weekends: noon-11.30pm.

Although CBBS Cumbria on (06992) 314 has been running for some time, it has inadvertently been overlooked in 'Networks'. The system has a lot of CP/M user group software available for downloading. Hardware includes a two megabyte RAM disk (speeding up response times noticeably).

Another interesting point is that it will accept calls from normal V21 (300 bps) and V23 (Prestel) and US (Bell 103) standard modems. When you call it, it sends out a message inviting you to press 'return' at the various speeds. When it recognises the correct code for 'return' it knows it's got your standard. This means you may get a bit of garbage as it sends out messages at speeds not recognised by your system. CBBS Cumbria is a ring-back system and runs from 6-10pm daily.

Comms shopping

Davidson-Richards offers a range of products based on the IBM, Apple and Commodore micros, plus some CP/M systems. It can supply everything (including the micro) for a range of applications including micro to micro and micro to IBM or ICL mainframe links. More details from: Davidson-Richards, 29 Charnwood Street, Derby DE1 2GU. Tel: (0332) 683 231.

BULLETIN BOARDS

UK free networks

CBBS South West . . . Tel: (0626) 890014. Hours: 24 hours daily.

Mailbox-80, W Midlands Tel: (0384) 635336*. Hours: 6pm-8am daily (ring-back system).

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. International electronic mail, library for up/down loading. Hours: 3-11.30pm, Mon-Fri; noon-11.30pm, Sat & Sun (CCITT); midnight-8am, daily (Bell 103).

Forum-80 Users Group, PET Users section shopping list system. Hours: Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. Electronic mail, library for down-loading. Hours: 7-10pm weekdays; midday-10pm weekends. Ring and ask for Forum-80.

MG-Net CBBS London . . . Tel: (01) 399 2136. Facilities: electronic mail, program downloading. Hours: Sun 5-10pm.

Liverpool Mailbox . . . Tel: (051) 428 8924. Electronic mail, down-loading, TRS-80 information. Hours: 24 hours daily.

TBBS, London . . . Tel: (01) 348 9400. Hours: daily 9am-7am.

BASUG . . . Tel: (0742) 667983. Hours: 24 hours daily.

Computer Answers . . . Tel: (01) 631 3076. Hours: 24 hours daily.

CBBS Surrey . . . Tel: (04862) 25174. Hours: 24 hours daily.

Blandford Board . . . Tel: (0258) 54494. Hours: 24 hours daily.

Southern BBS. Tel: (0243) 511077. Messages, down-loading. Hours: 8pm-2am daily (ring-back system).

NBBBS-North Birmingham . . . Tel: (0827) 288810

TBBS Southampton . . . Tel: (0703) 437 200 (ring-back)

Stoke ITeC (Information Technology Centre) (Remote CP/M) . . . Tel: (0782) 265 078. Hours: 24 hours daily.

UK commercial systems which are free in part

DISTEL. Tel: (01) 679 1888. Run by Display Electronics (new and surplus electronic and computer equipment, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free. 24 hours.

REWTEL. Tel: (0272) 236628. Run by *Radio and Electronics World*, the publishing side of Ambit (electronics components suppliers). Information on stock lines, some message facilities, Business users: £15 per quarter and 5p/minute up to credit card sales; the latter only for subscribers. 300 baud only at present. Cost: limited areas free, remainder £10 pa. 24 hours.

MAPTEL. Tel: (0702) 552941. Run by Maplin (electronic components and micro-computers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free. 24 hours.

ESTELLE. Tel: (0279) 443511 V21 (Datel 200); (0279) 441188 (Datel 600); (0279) 441222 (Datel 1200). For customers of STC Electronic Services. Office hours only.

Subscriber commercial systems in the UK

PRESTEL. Subscribers only: Prestel consists of a database made up of individual pages provided by many different organisations (not by Prestel itself). 1200/75 baud service at local call rates for a large percentage of potential users. 300 baud service on London telephone number only, at present. Cost: domestic subscribers £5 per quarter and no time charges outside peak periods, 80 per cent of pages are free. 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: Dial 100 and ask for Freefone Prestel sales.

MICRONET 800. An organisation providing information within the Prestel database specifically aimed at microcomputer users. Service details as Prestel. Cost: £50-£75 joining fee (covers acoustic coupler and software—for a limited range of machines at present) and £8 per quarter on top of normal Prestel charges. Information: Micronet 800, 8 Herbal Hill, London EC1R 5JB. Tel: (01) 837 3699.

Subscriber business systems in the UK

TELECOM GOLD. Info from: Julie Ireland, 42 Weston Street, London SE1 3QD. Tel: (01) 403 6777.

COMET. Message handling system giving user facilities for leaving and retrieving messages: costs £30 per month. Info from: John Douglas, BL Systems Limited, Grosvenor House, Prospect Hill, Redditch, Worcs. Tel: (0527) 28515.

*RING-BACK SYSTEM—dial the number, let phone ring once and then ring back.

US Bulletin Boards

TYPE		SYSTEM NAME	TEL NUMBER
TBBS		Akron, OH	216-724-2125
TBBS		Amarillo, TX (Berg Board)	806-374-9711
TBBS		Amherst, NY	716-631-8845
TBBS		Ann Arbor, MI	313-662-8303
TBBS		Austin, TX	512-385-1102
TBBS		Baton Rouge, LA	+ 504-926-0181
TBBS		Baton Rouge, LA (LNW/SE)	+ 504-291-4331
TBBS		Boston, MA (Hub Graphics)	617-569-9140
TBBS		Bremerton, WA	206-692-8408
TBBS		Camp Hill, PA (CAPTUG BB)	717-774-6543
TBBS		Cary, NC (Orch-80/85/90)	919-467-7919
TBBS		Chicago, IL (Aurora Computer)	312-897-9037
TBBS		Chicopee, MA (Apollo Sys)	413-594-2524
TBBS		Colorado Springs, CO	303-632-3391
TBBS		Colorado Springs, CO (WP)	+ 303-574-1615
TBBS		Colorado Springs, CO	303-598-4500
TBBS	(HQ)	Denver, CO (TBBS HQ)	+ 303-690-4566
TBBS		Denver, CO (Apparat Inc)	303-741-4071
TBBS		Denver, CO (Software Tech)	+ 303-695-4518
TBBS		Denver, CO (AmERICan BBS)	303-333-1132
TBBS		Denver, CO	+ 303-751-8653
TBBS		Fremont, CA (Aardwolf-80)	+ 415-651-4147
TBBS		Fremont, CA	415-797-4544
TBBS		Gadsden, AL (Infinity Info)	+ 205-543-1064
TBBS		Golden, CO (UFONET)	+ 303-278-4244
TBBS		Greenfield, WI (CANOPUS)	414-281-0545
TBBS		Hattiesburg, MS	601-264-2361
TBBS		Hawkins, TX (MicroServe)	+ 214-769-3036
TBBS		Houston, TX	713-331-2599
TBBS		Houston, TX (Exidy-2000)	713-442-7644
TBBS		Houston, TX (FREELANCIN)	713-488-2003
TBBS		Islip, NY (The Datapoint)	516-581-0898
TBBS		Janesville, WI (J.A.D.E.)	608-752-7840
TBBS		Jacksonville, NC	919-353-0610
TBBS		Kileen, TX (Tele-Med-Comm)	817-526-5915
TBBS		Lexington, KY	** Down **
TBBS		Lincoln, MA (The Outpost)	+ 617-259-0181
TBBS		Linden, NJ	+ 201-486-2956
TBBS		Liverpool, England	+ 051-428-8924
TBBS		Long Island, NY	+ 516-467-6545
TBBS		Memphis, TN	901-358-8227
TBBS		Metuchen, NJ	201-494-3649
TBBS		Milwaukee, WI (Beer City)	414-355-8839
TBBS		Montgomery, AL	+ 205-288-1100
TBBS		Montreal, Quebec, Canada	514-252-8645
TBBS		New York, NY (People-Links)	212-877-7703
TBBS		Orlando, FL	305-644-8327
TBBS		Plattsburg, NY	518-563-0494
TBBS		Ravenswood, W VA	304-273-4136
TBBS		Riverside, CA	714-359-1586
TBBS		San Angelo, TX	915-942-8035
TBBS		Shreveport, La	318-635-8660
TBBS		Springfield, MA	413-733-1749
TBBS		Staten Island, NY (SISTER)	212-442-3874
TBBS		Summerville, SC	803-871-3468
TBBS		Tacoma, WA (Corvus Support)	206-756-0448
TBBS		Tacoma, WA (CORK BOARD)	206-472-9884
TBBS		Tacoma, WA	206-535-2837
TBBS		Tulsa, OK (TBBS TULSA)	918-749-0059
TBBS		Tulsa, OK (Tulsa Info Exch)	918-438-3363
TBBS		Tyler, TX	214-566-1374
TBBS		Waltham, MA	617-899-6524
TBBS		Washington, DC	301-681-5065
TBBS		Wausau, WI #1	715-352-2093
TBBS		Wausau, WI #2	715-848-3415
TBBS		Wenatchee, WA	509-663-0792
TBBS		Winter Park, FL (OMNI-BOARD)	305-645-5543
TBBS		Woodhaven, NY (Rainbow Conn)	212-441-3755
TBBS		Yaphank, NY (LNW BBS)	516-824-8115

+ = 24 hour system

Could this be the biggest selling disc since White Christmas?

A few months after its release, the latest disc from Lotus™ is now romping up the charts.

Symphony™ is the follow-up to that other catchy number, the Lotus 1-2-3,™ itself the biggest selling integrated software disc of all time.

But Symphony's success isn't altogether surprising. It takes the proven benefits of 1-2-3 then adds a few ideas of its own.

The spreadsheet, for instance, is even bigger (8192 rows by 256 columns, to be precise).

The database is even better. Its graphics verge on the artistic (bar charts, line charts, not to mention exploded pie charts). All in colour.

Next, Symphony throws in word processing that matches the speed and the power of any popular WP program.

It adds communications that let you chat with computers anywhere.

And to cap it all you can put everything on the screen at the same time.

So that when you change the numbers in one window the graphics change in another.

But for all this, Symphony is easier to learn and simpler to operate than programs that do half as much.

To find out more about Lotus Symphony and the name of an authorised dealer call Teledata on 01-200 0200.

It may not capture hearts in quite the same way as Bing's disc, but for millions of executives it'll be music to their ears.

Lotus™

The hardest working PC software in the world.

SYMPHONY NOW AVAILABLE FOR THE IBM® PC AND XT,™ COMPAQ™ AND 100% IBM COMPATIBLES 1-2-3 NOW AVAILABLE FOR THE IBM PC AND XT, COMPAQ OLIVETTI™ M24, 100% IBM COMPATIBLES, DEC RAINBOW™ WANG PROFESSIONAL™ AND TI PROFESSIONAL COMPUTER™

AID YOU
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PUTER?

D BE.

Both advance the state of the art in their own way.

We know that many people hold back from buying a computer now because something better may come along the moment after they've put their money down.

Don't make this mistake.

If a computer will save your business money, buy it now.

You will amortise the cost very rapidly. Our prices start at around £1,000. If a computer only saves you £40 or so a week, it won't take many months to pay for itself.

are easier to use and better value than competing computers.

We will be happy to compare them with any other make to prove our point.

Evidence that we aren't alone in our opinion lies in the fact that ACT sell more 16 bit computers than anyone else in the UK.

We also sell the ACT range of Pulsar and Apricot software which constitutes a library of published, business software as large as you'll find anywhere in Britain.

WILL THEY BRING OUT A BETTER ONE NEXT WEEK?

ACT is a forward looking company with a vigorous research and development programme who aim to be at least a year ahead of their competitors.

They've just announced the amazingly user friendly Apricot F1 computer and the new Apricot Super Portable.

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ACT ComputerWorld Limited, ComputerWorld House, 43 Calthorpe Road, Edgbaston, Birmingham B15 1TS. Tel: 021-455 8484.

☐ Please send me further details on the Apricot range of products.
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MPTON Security House, Cleveland Street, Wolverhampton. Tel: 712121.

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

'Pack of lies'

There has been so much correspondence recently regarding the problems with the Sinclair QL that the continuing problems of Spectrum owners are in danger of being overlooked.

I am a Spectrum owner and over the sixteen months I have had my Spectrum I have been very pleased with it. I have, however, found loading my software from tape a time-consuming and frustrating business. Like many other Spectrum owners one of the reasons why I chose to buy a Spectrum was that Sinclair Research stated that microdrives would shortly be available and would enable quick reliable loading and saving of programs and data. I waited, patiently at first, impatiently as time passed with no sign of the microdrives.

In September last year I finally received a letter from Sinclair Research, signed by Nigel Searle. It was a standard letter presumably sent to thousands of Spectrum owners. It stated that the microdrives were available and it included the following paragraph:

'The fact that you are receiving this announcement means that we have your name as a registered Spectrum owner, and is your guarantee that as soon as your turn comes you will be sent a microdrive order form. Please don't try to order before you receive an order form.'

The letter concluded by saying:

'As soon as we have enough microdrives, we'll be in touch with you.'

I resigned myself to a further wait. Hearing that the waiting list was down to a *mere* fourteen months by December, I expected to receive my promised order form in March. You can imagine my surprise when I learnt in April that the microdrives were in the shops and I had heard nothing from Sinclair Research. I was even more surprised to learn that the Interface 1 (without which any microdrive is, of course, useless) had increased in price from £29.95 to £49.95 — an increase somewhat greater than would be expected from the rate of inflation!

I wrote to Sinclair Research asking for an explanation and was informed that the microdrive and Interface 1 became freely available upon request in February and that the price increase took effect on 1 April.

I wrote again pointing out that I had been guaranteed that I would be sent an order form when my turn came and that I had been specifically told not to try to order before I received an order form and that it was therefore ridiculous to say that they had been freely available since February. Not only had Nigel Searle's 'guarantee' unnecessarily delayed my acquisition of a microdrive and Interface 1 but now I was expected to pay an additional £20 as well. Needless to say this and further correspondence have failed to produce any satisfactory response.

The conclusions to be drawn from this would appear to be:

1) Any written guarantee from Sinclair Research is totally worthless.
2) Any concern expressed by Sinclair Research for customers who have been patiently waiting for their products is a pack of lies merely issued to reduce customer complaints.
3) Any price quoted by Sinclair Research for its products will, without warning, be increased to the maximum that it is believed the market will bear without warning.

Alan Harwood, Birkenhead, Merseyside

Soggy jargon

With reference to Banks' Statement, *PCW*, July: 'The number of jargon words . . . is inversely proportional to the square of the misunderstanding . . .' So, the more jargon, the less misunderstanding? '. . . more tightly defined . . .'? Banks hoist with his own verbiage, more like!

Let us be clear: technical terms, used sparingly and directly, are not jargon.

The 'interface between CPU and disk drive' (for disk controller) is good, precise, technical English.

The 'interface between education and industry' (for where they meet) is soggy jargon.

Terms start sharply defined, like new-minted coins. They are debased into jargon when used, first loosely, then in vague imagery, finally to look clever.

JS Paine, Rhyduchaf, Gwynedd

Array passing . . .

With reference to the article in *PCW*, July, on array passing procedures, I was surprised by your concluding comment that other versions of Basic do not include this facility.

In fact, array passing is a feature of Basic sub-programs in Extended Basic for the TI 99/4A.

Surely this can't be the only Basic to include this facility?

Roger Hadfield, Macclesfield, Cheshire

. . . exception

I was interested to read the article by Andrew Bangham in the July issue of *PCW* concerning array passing to procedures in BBC Basic.

I would take issue with the point that the program will not work on a 6502 second processor. I have tried it and it does! In general the author is right to assume that direct memory 'POKEing' and 'PEEKing' will invalidate a program for use in a second processor. However, in this case, the program POKEs and PEEKs locations which are set up by Basic itself — namely the variable pointers in page &400. As Basic is copied across into the second processor, it expects its variable pointers to be in page &400 *in the second processor*, and therefore, paradoxically, direct memory access is the correct way to access the locations. If you try to use the legal OSWORD call with A=5 (call to read the I/O processor memory) *then* the program will not work, as page &400 in the I/O processor contains TUBE handling software when the second processor is active. I suppose this is the exception which proves the rule!

Robin Newman, Director of Software, Oundle School, Peterborough

The eternal triangle

I am in the initial stages of my research into the effects of excessive computer usage: the problems of the computer 'junkie'.

We are all well aware of the positive benefits flowing from the new technology but there are many fears that, if misused, it can inhibit social development in some young people so that they become social outcasts. There are also instances where marriages have failed because the husband has become obsessed by the computer. It appears that the 'other woman' in the eternal triangle is being replaced by a microcomputer. As yet I have not heard of a single female so affected, an issue which also needs careful investigation.

This contemporary problem is causing great concern in many quarters; and research has been set up to investigate the extent of the problem, the types of people likely to be affected and its influence within the family.

I would like to get into contact with individuals or families who have direct experience of this problem to see how they have been affected.

Margaret A Shotton, Loughborough University of Technology LE11 3TU

(I think this one's for real—Ed.)

'Unfair and inaccurate'

When you publish a review of a new micro it is your responsibility to ensure that such articles are fair and above all factually accurate. I believe that your review of the Advance 86B in the July issue of *PCW* failed on both counts. Although it will not be possible to undo the commercial damage the article will already have done, I hope you will give equal prominence to correspondence which balances the distortions with facts.

The author was disappointed with the keyboard. That is fair, if subjective, comment. But to describe the keyboard as 'appalling' is unfair. Was he disappointed at first then appalled after he had gashed his thumb? In a June review a rival magazine described the keyboard as 'well-made' and the keys 'silent and with a positive feel'. My view is that the IBM keyboard is marginally better.

The Advance disk system is described as a 'great hulking brute of a machine which is not portable by any stretch of imagination'. I have never seen the Advance 86B (or the IBM PC for that matter) advertised as a portable. Also I measured the office IBM disk system at 16in x 19½in overall, which equates to a desk area of 312ins^2 compared with 314ins^2 for the Advance 86B. The height of the Advance disk system means that the monitor is ideally located at eye level and the bottom section, which the IBM lacks, is a perfect dust-free housing for the keyboard. It is not as sleek as the IBM disk system but personally I do not think that wind resistance is too important.

I could not understand the 'bug' allegedly associated with DOS 2.11. All I know is that my DOS 2.11 does not have the bug described.

The omissions in the price comparison between an IBM PC and the Advance 86B were so conspicuous that they must have been deliberate. To be objective the author should at least have compared like with like. For example, he should have explained:

i) that at the price he quoted the IBM has only 64k RAM and is therefore useless for many business software packages;

ii) that an extra colour card is required to bring the IBM PC to the same spec as the Advance; and

iii) that if a 16-bit processor is installed in the IBM an add-on box is required (and what of desk space then?).

The software package supplied with the Advance is dismissed because it's 'free'. Well, most people who buy a business machine will require some if not all the packages provided. Therefore, if you buy an IBM PC you will be faced with an additional outlay of between £175 or more (for a decent word processing package alone) to £750 (for a suite of software packages similar to that included in the Advance deal). Actually, the Perfect software, although perhaps not the best available, is an extremely powerful and professional software package. Choosing a business system based on the Advance 86B compared with the IBM PC route has saved me at least £1200.

Finally, the author was dubious about the support that WH Smith is likely to be able to give. Well, so far the support I have had from WH Smith in Croydon has been excellent and very knowledgeable. It seems to be making sure that the serious business computer side of their business is appropriately staffed.

Anthony Bretherton, Epsom, Surrey

(From the number of letters and phone calls we've received from contented Advance users, it's clear that Surya is in the minority in his opinion of the machine. Any other views? — Ed)

Patience and promises

I write concerning my request for Oric Products International to upgrade the ROM in my 48k Oric-1 computer. The order for the computer was made in February 1983 on an order form supplied by *PCW*, to which I subscribe.

The computer was received in April 1983 and apart from other errors it simply would not load. By late August a replacement machine had been received; the recommended price had started to fall and settled at £130, a fall of £40. I continued with my faith in the Oric-1 and registered the guarantee from 29/8/83, the date of receipt. The machine still suffered some load problems but none with my hi-fi cassette deck which I now use (a new recommended Ferguson is still awaiting its chance). Also, as you will be aware, the ROM still held bugs so now, not trusting Oric to reply to my letters, I telephoned a number of times from September to November. The outcome was the assurance that Oric accepted that the faults made the Oric-1 fall below the early advertised claims, and that it planned to replace the ROMs when the new ROM was perfected and would I please be patient.

I wrote to Oric when news of the ROM was released. The response received three months later, as I was preparing this letter, is a standard offer to upgrade to Atmos standard for £60. Considering the delays, inconvenience and promises made, plus the fact that the price was reduced by the time a working computer was received, I consider that for me, a full upgrade should only cost £20. Indeed, I would not want to pay more.

I feel that all original mail order customers should be offered a simple ROM and manual only upgrade for a basic cost (for example, £10 including postage and packing). This would certainly satisfy my complaint and produce the computer which I paid for.

Robert MacLaren, Wilmslow, Cheshire

Mistaken identity

I read with interest your review of the new HP110 portable computer (*PCW*, July). Harris Semiconductor worked closely with Hewlett-Packard for two years on the development of this product which uses several of our 'state of the art' CMOS integrated circuits. I was rather disappointed, however, that the three references made to the HP110's microprocessor gave the impression that this device was manufactured by Intel.

Harris Semiconductor has pioneered the development of advanced 16-bit CMOS processors, and while it's true that Intel has agreed to be a second source it is still some time away from shipping anything.

Users of the HP110 may have little interest in knowing the manufacturer of the chips used. However, your magazine is probably unique in its class in that it is read by many electronic and system design engineers in the electronics industry who would be very interested to know that Harris products are used by Hewlett-Packard.

The next few years will see a large number of portable micros come onto the market, many of which may use the Harris 80C86 or 80C88 processors, so hopefully Harris will eventually be recognised as the supplier and not Intel.

Steven Bennett, European Applications Manager, Harris Semiconductor, Slough

Multi-lingual terminals

Good news for Mr Reekie of Brussels and others seeking European keyboards from British suppliers (*PCW*, July)!

The ICL 6402 (monochrome) and 6404 (colour) terminals can support

'No, you can't go out until the computer's done your homework . . .'

English, American, German, French, Swedish, Finnish, Danish, Norwegian, Dutch, Italian, Spanish, Portuguese or Canadian French. They use an azerty layout for the two French versions and an awerty layout for Italian. Accented characters are produced by a single keystroke.

These terminals are normally used in association with our multi-user PC but could be used in association with other suitable systems having an RS232C interface.
Chris Haynes, Product Strategy Manager, ICL Small Systems Business Centre, Bracknell, Berks

On the contrary . . .

Your contributor Guy Kewney seems to have some unfortunate misconceptions regarding telesoftware sales on Micronet 800.

His news item 'Software by post' in the July issue contains a couple of the most apocryphal statements on the subject to date.

Contrary to his beliefs — or those of the unidentified software companies that he quotes — we can and do guarantee to monitor the number of sales accurately. Indeed, within the Prestel context it is impossible not to.

The second statement is no more than fallacious. Our telesoftware is no less protected than the majority of cassette and disk-based commercial software.

As Mr Kewney himself has commented, nothing stops the most determined pirates.
Adam Denning, Software & Technical Editor, Micronet 800

(How about releasing some downloading sales figures? — Ed)

Permanent solution

The proposed sideways ROM standard from BEEBUG for the BBC Micro seems to have overlooked the following important points:
1 It assumes only 26 companies will develop ROMs. This is highly unlikely, especially with the new American market encouraging even more firms on both sides of the Atlantic to develop ROMs.
2 Different ROMs from the same company featuring identical commands will have the same problems. For example, the 'MOVE' command in Disk Doctor and Caretaker, both from Computer Concepts.
3 It does not help any user with ROMs issued before the proposed arrangement. As there are over 300,000 BBCs in use, this could lead to hundreds of thousands of ROMs and possibly their manuals needing replacement (no doubt at an extra cost).

I have found a far more flexible solution at a reasonable 'one-off' cost suffering from none of the above disadvantages. The 'ROM Manager' ROM package, recently released by Watford Electronics enables any command on any ROM to be accessed directly, and also offers many other useful features.

This permanent system would seem a better solution to a constant problem than the proposal by BEEBUG, which apart from creating its own inherent problems totally fails to take into account the ROMs already in circulation.
D Squire, Barnsley, S Yorks

Computers in social work

In the autumn I am proposing to publish a quarterly newsletter on the use of computers in social work entitled *Computer Applications in Social Work*.

The publication will encompass as wide a variety of issues as possible including computers used: as management tools; for direct work with clients; for research and education; and to cover ethical issues such as confidentiality.

Please write to me, for further information:
Stuart Toole, Dept of Sociology, City of Birmingham Polytechnic, Perry Barr B42 2SU

Software in the driving seat

With reference to the article 'Dial-up comms software', Newsprint, *PCW*, June, I would like to point out that the ACT Internal Modem is supplied with a software driver. Both conform to CCITT V25 auto-answer recommendations and approval for such has been granted. This allows the application writer to use the modem in auto-answer mode. ACT's own Apricot Asynchronous Communications Package aims to provide an auto-answer capability.

ACT's modem is not restricted to use with MicroMail, a software package enabling the user to send electronic mail via Telecom Gold. This network is neither designed for nor capable of dialling a user computer as it's based upon dial-up of a mainframe.
Jon Upton, Group Marketing Technical Manager, ACT, Birmingham

BLUDNERS

Lorcan Mongey has written in to say that he found the article on BBC array passing procedures (*PCW*, July) most convenient, as it solved a problem he was having at the time defining complex numbers on the BEEB.

He acknowledges that although arrays and variables are passed correctly to and from procedures, the original dummy variable vector is not restored on leaving the procedure. He says this can be demonstrated in the sample program below by adding, for example, the line

```
0    wexample = 42
```

to the listing and running the program. Although it appears to work properly, typing "PRINT wexample" gives the "No such variable" message, proving that the vector for variables beginning with lower case w has not been restored by PROC endproc.

Lorcan says this can be corrected by typing in:

```
210   LOCAL I, sum, B%, C%
310   PROC endproc
      ("xaddmean", C%)
1030  LOCAL B$, C$, L%, N%,
      I%
1290  I%=&400+2*ASC(A$)
1300  J%=!I% AND &FFFF
1390  I%=&400+2*ASC(A$)
```

Thank you, Lorcan.

A typesetting error crept into the July issue in the explanation of 'Parity' in Networks.

ASCII 'K' is 1001011, not 0101010. The MSB (bit 8) will be 1 or 0 depending on whether odd or even parity is selected.

And for those of you following the Teach Yourself Lisp series, the last line on Fig 1 should read:

(Eggs Milk Coffee) → (Milk Coffee)
'rest'

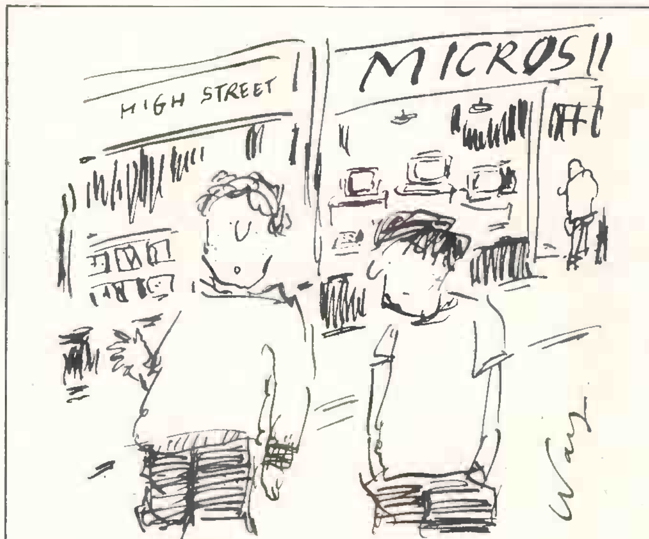
Finally, Spectrum Wide Screen Editor in the May issue can be enhanced as follows:

Omit lines 1033 and 2041: change 1032 and 2040 as follows:

```
1032 LET V=INT(PEEK a/k): IF
       V=2*INT(V/2) THEN LET
       k=PEEK a+k
2040 LET V=INT(PEEK a/k): IF
       V<>2*INT(V/2) THEN
       LET k=PEEK a−k
```

These modifications avoid logic errors which could arise in block handling.

Many thanks to our readers for sending in the above corrections. END



'Apparently Big Brother isn't some new hardware but some character in a book.'

Sampling the ware

Once again PCW Show time is almost upon us. Bigger and better than ever before, here's a foretaste of what we've got in store for you . . .

If you didn't die of suffocation at the Barbican last year, now's the time to start planning for September's *PCW* Show. It's being held at Olympia so you're guaranteed room to move — and you're also guaranteed an interesting time, whether you're keen on home or business computing.

If you want to take a look at the most advanced products available, try the Leading Edge stand where our selection of the best software and hardware will be on display.

If your interests are centred more on business, take your pick from industry giants like ICL down to independent software suppliers like Anagram Systems. Lotus Development Corporation will also be there, flying over from the US to show its business software.

Likely to steal much of the attention at the Show is ACT, exhibiting its range of machines aimed at bridging the gap between the home, educational and business markets. Less than three years ago the company only had the Sirius; now it's offering more Apricots than we can keep track of.

The two latest models will be on show: the portable, boasting speech recognition and Hitachi's 80-column by 25-line liquid crystal display; and the entry level F1. If you can't wait for the Show, read next month's *PCW* for the first full Benchtest of ACT's first micro for under £1000.

Also scheduled for a Benchtest in our October issue is the latest machine from another of the exhibitors, the Plus 4 from Commodore. As ACT moves down and Commodore moves up, which one will be the winner? We'll give you a chance to decide.

A stripped-down version of the F1, under the nondescript title of the F1E and retailing at the less nondescript price of £795, is aimed at loosening the BBC's grip on the education market. But Acorn will also be there, exhibiting the products with which it intends to fight back. Predictably it won't be possible to ignore Sinclair, nor Psion — the software house which developed the QL's applications software and now intends to offer it on bigger micros. Psion also fancies a share of the hardware market and has released the pocket-fitting Organiser to prove it.

If you'd prefer something a bit bigger, Kaypro will be there with its portable. Bigger still? Then try the aforementioned ICL stand — or look out for Digital Equipment and Apple, whose machines are rivalling the Apricots for abundance.

The UK line of resistance to the Americans is beginning to look a little ragged in places. Enterprise will be there showing its much-renamed micro. And GEC has enough confidence in the Dragon's future to have booked two stands for GEC-Dragon. Tandy will be there too, but with no further interest in the Dragon.

Also representing the US will be Atari — doubtless wondering what the future holds now that former Commodore boss Jack Tramiel is in charge. Perhaps the price of Atari software will finally fall to the levels of other suppliers.

For more arcade games, try Llamasoft's stand where the screens will be displaying more llamas than resident author Jeff Minter can get onto even the baggiest jumper. And to see what Japan has developed in terms of home software, pay a visit to the stand booked by the inappropriately named Tokyo company Hudson Soft.

If your preference is for adventure or strategy games, the choice includes M C Lothlorien, Molimerx and, of course, Melbourne House.

Rivals to Melbourne House's books include titles from Addison Wesley, Duckworth, Shiva, Sunshine Publications and Prentice-Hall. The Book Marketing Council will also be there, promoting its selection of titles covering a range of home computers.

The Book Council aims to help you find the best book. If it's advice on the best business machine or software you need, then head for the Businessman's Advisory Centre. To find out more about micros in general, try the Amateur Computer Club. Or if you just want to play games, the Top 20 Games Centre is designed especially for you. Nor are hobbyists being neglected: Bicc-Vero Electronics will be there with its range of items such as circuit boards and connector tools.

Remember, this is just a taste of what's in store. Our October issue, which will arrive in the shops about two weeks before the Show, will preview exhibitors in more detail. Tickets are available in advance from the organisers, Montbuild on (01) 486 1951, and admission costs £3.50 with a reduction for groups. The dates to mark in your diary are 29 September — 2 October. See you there. END

BANKS' STATEMENT

Talking toys

If mastery of the qwerty keyboard is an insurmountable problem, give up and try a computer with speech recognition/synthesis capability. Martin Banks advocates speech, the oldest form of communication, as a viable and impressive alternative to hours of frustration and knotted fingers.

Once upon a long, dim, distant time there were two hairy sort of persons who stood facing each other, scowling. They stood like this for some time until one, enraged beyond containment, let forth a strange growling sound which scared the other so much that it ran off.

The essence of communication had been discovered, as had its value. From that point the human race has developed to the stage where it has produced a number of different ways of communicating to complement that first form, vocalisation. One of the most important of these has been the development of the written word and, from that, the development of the machines that help humans create the words more easily: stone tablets, pens, paper, pencils and the typewriter.

This last one brought with it one of those inventions that is, at one and the same time, both incredibly clever and a pain in the . . . That invention is the keyboard. The qwerty keyboard is the bain of many people's lives, especially as it has been universally adopted as the standard form of input device for the computer. The technical reasons for doing this are quite sound and when the computer was a machine that was only used by trained personnel (either operators and programmers or typist-oriented key entry staff), the fact that the keyboard was being used didn't matter too much.

While the keyboard was being used exclusively by those explicitly trained in such arts, intimidation did not matter. Now it's different. Personal computers are everywhere. Workshop foremen use them, children use them, senior company executives use them. The intimidatory value of the keyboard has therefore become rather more significant.

A way around the keyboard was needed and over the last year or so technology has come up with some answers. The mouse is probably the most famous so far and, as far as it goes, is an excellent tool for moving the cursor around and entering simple commands by pressing. (Sorry, but it still has keys.)

Another device that has been employed of late is the touch-sensitive screen. This is actually a misnomer, for the thing is light-sensitive not touch-sensitive but, despite such split hairs, it allows the user to point to locations on the screen with a finger or similar apparatus and identify tasks, functions, windows or whatever is required. Again this is fine as a means of imparting simple instructions to the computer quickly and in a form that the user can readily comprehend.

Now, however, technology has come up with that which has long been predicted — the form of communications for which humans are rightly famous. Yes folks, the gabby computer has arrived. There are, to be fair, several add-on units that can be bought for the most popular personal computers which offer some degree of speech recognition and synthesis capability. But one of the first to come from a major manufacturer, to my knowledge at least, is the latest variant of the Texas Instruments Professional Computer.

TI has been in the speech technology business for some time, having produced such famous toys as the Speak'n'Spell educational unit. It also produced a speech synthesis add-on for its now defunct TI99/4a. These, it must be said, are just kids' stuff to what is now available. TI has produced a £1250 add-on board for its hard disk variant of the machine which really does have some interesting possibilities, and which could become the next generation of executive status symbol.

Early versions of the speech synthesis system tended to work only with small amounts of verbosity, and the digitised data for this was normally held in PROM on the same board as the speech processor. To limit the capacity further, the actual spoken sentences were constructed from individual words and phrases rather than long word strings. This meant that the recorded voice used in the first place had to be flat and uninteresting due to any intonation inevitably making a constructed sentence sound odd.

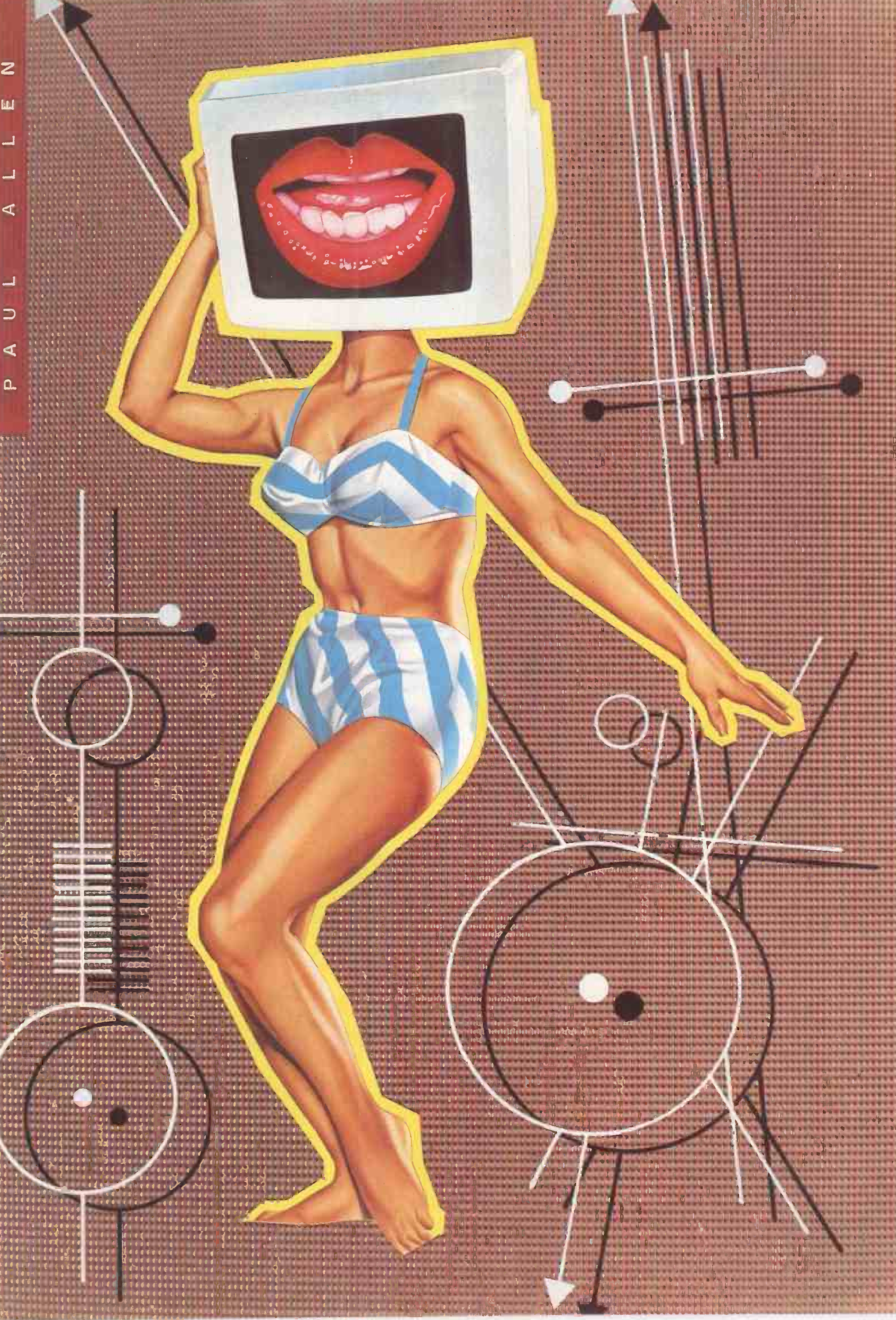
The TI system can now record a voice with any necessary intonation directly onto disk. It can then be read back for synthesis. On a 320k floppy, for example, TI claims it can record 20 minutes of continuous speech which can, as is the way with synthesis systems, be speeded up or slowed down without pitch changes as required. That may seem like a novelty but it has some uses.

The speech recognition system can identify some 50 different words in up to nine different vocabularies (that is, different individual voices). TI has produced a routine that allows the user to construct a file of commands which simulate the command keystrokes of any application program. Therefore it becomes possible to have the computer recognise you saying an application program command, 'scroll down' for example, and execute that command.

For a large number of applications this capability will allow quite a reasonable measure of 'hands-free' computing. With a spreadsheet, for example, it will be possible to have all the key commands and numeric data entry 'keystrokes' as spoken commands. Imagine it — the executive's status machine. You will sit at your desk and blithely say something like: 'Cell A4. 47321 point 68 return. Calculate.' The computer, with the right programming, will not only do the requested job but could also obsequiously mutter 'I hear and obey, oh Master.'

TI has introduced, at the same time as the speech system, a networking capability with all the usual bells and whistles including an electronic mail facility. The company confirms that there isn't such an official product yet, but it doesn't take too much thought to see that it should be possible to combine speech with electronic mail — after all, the digitised speech is just another disk file which can be squirted around the network.

Here is the ultimate executive's toy. Send someone a text document and append to it a speech file with myriad words of comfort, clarification, excuse, and so on. This could have some really interesting possibilities. END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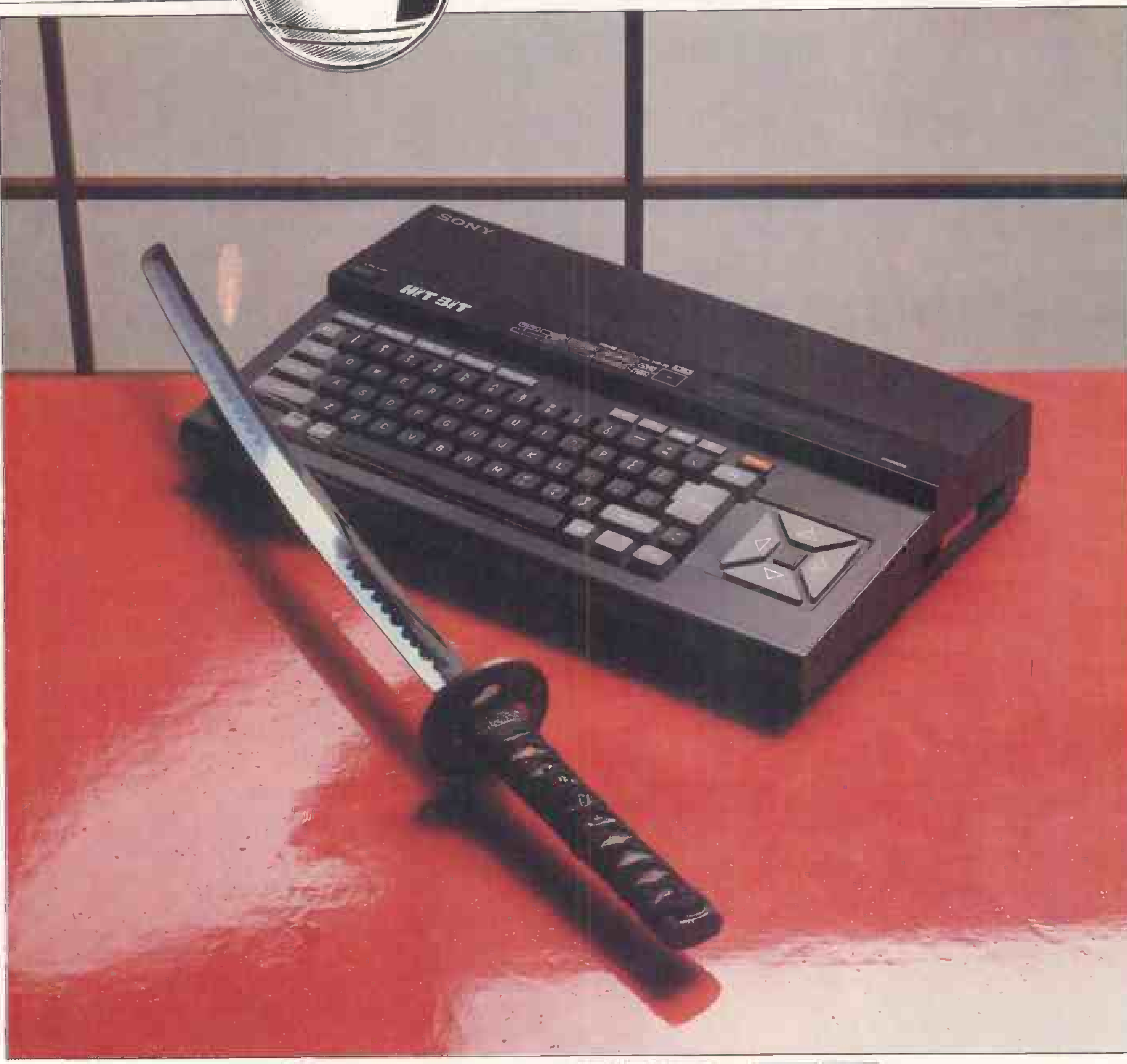


Sony HB-75

Sony has established an impeccable record for innovation and reliability. Tony Hetherington discovers that not only is its first home micro very competitively priced but an interesting extension of the basic MSX design.

MSX and the principle of software compatibility between machines have dominated the pages of computer magazines ever since the idea was first conceived a year ago.

Few people doubt the reputations or the financial resources of the companies involved — they read like an index of the major Japanese electrical manufacturers. Yet MSX has already had many critics. These critics, however, have based their arguments on the minimum specification of an MSX machine and have therefore missed the vital point: that MSX is only a central core around which computers may be built.

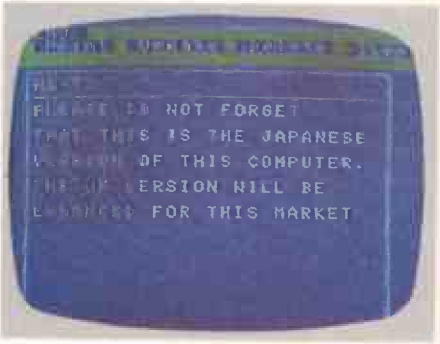
As the first wave of these computers begins to reach our shores, it is becoming clear that they go beyond that central core and contain some interesting built-in features.

The Sony HB-75 is not only one of the first MSX machines, it is also one of the better models. For under £300 it offers 64k RAM, MSX Basic, an impressive choice of video output, including RGB, and 16k of built-in software.

Hardware

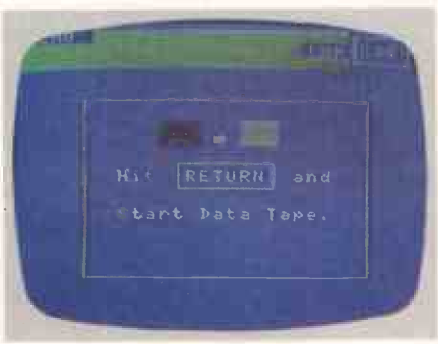
The Sony HB-75 computer conforms to the MSX requirements but goes further. It is supplied in functional packaging

The built-in programs are selected using the cursor and return keys



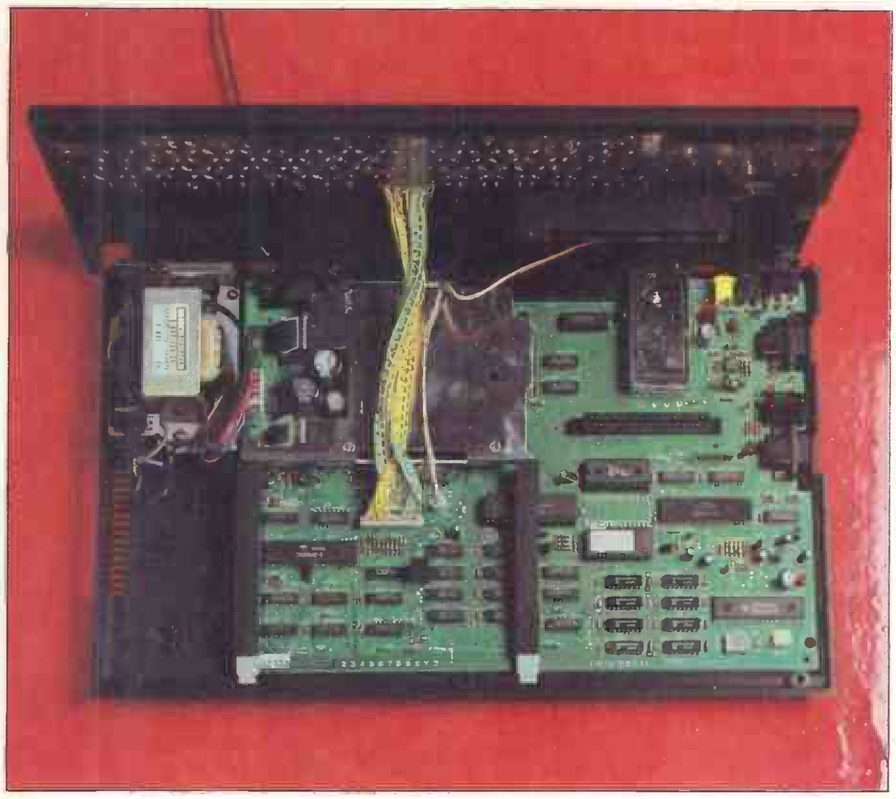
A page of the memo pad consists of nine lines of 15 characters

Pages of data can be searched for or sorted with this powerful utility



Information held on the Data Cartridge can be saved and loaded from tape

Executive image — the standard MSX keys are housed in a beautifully styled unit



Inside: the main circuit board is dominated by four chips

complete with a carrying handle. Opening the box reveals the micro itself, three manuals and the TV and cassette leads.

The review machine was in fact an English translation of the Japanese version and not the UK PAL version that will be available in the shops. However, we managed to get a non-working UK version for the photographs so that you would be able to see what you would be buying. Obviously there are some differences between the two versions but I'll try to rectify these in the appropriate sections.

The MSX standard states that the keyboard will contain 73 keys including the standard qwerty layout, five function keys and a cluster of cursor control keys. However, it is left to the individual manufacturer to decide what to make the keys from and how to organise them on the keyboard. Sony seems to have spared no expense on your behalf, and has gone for the executive image by housing the keys on a beautifully styled unit.

The keys themselves are set into the front part of the unit which slopes towards the user. They are typewriter style with a good positive feel. Surrounding them are the grey 'support keys' which include a CAPS SHIFT with a built-in LED (showing when it is engaged), a graphics key to obtain the graphics characters from the qwerty keys and a suitably large RETURN key.

The five function keys are found above the qwerty keys and are rectangular rather than the usual square shape. They also require a firmer press to register in order to avoid accidental pressing. Another set of such keys are to the right of the function keys and include an INSERT and DELETE key which are used with the full screen editor. Also in the group is a STOP key to pause or stop a program, and a HOME key to position the cursor to the top of the screen. Further cursor movement is performed by the four cursor keys arranged in a cluster to the right of the other keys. These are a bonus to anyone using the screen editor and can be used in games if you haven't got a joystick.

To complete the top of the keyboard there are keys for RESET and POWER. These are suitably guarded by plastic ridges to stop you from accidentally wiping out your programs.

Finally, the rear-raised section of the keyboard houses an MSX-compatible cartridge slot. A second cartridge slot can be found on the back of the unit in the UK version which replaces the Japanese version's I/O port. This is quite a sensible change since all peripherals can be connected to the Sony via a cartridge slot or the built-in Centronics interface. Also along the back is an impressive array of video outputs and a cassette interface which, via the lead supplied, allow programs and data to be stored on an ordinary cassette recorder. The video outputs include the MSX standard RF (UHF channel 36) and composite audio and video, as well as the RGB output. This isn't particularly surprising considering Sony's interests in this field but is a welcome addition to any machine.

The external features of the Sony are completed by two joystick ports on the right-hand side of the machine.

Undoing just three screws allows access to the inside of the Sony HB-75. This contains an internal power supply and the main circuit board which is dominated by four chips.

The Z80A processor is partly obstructed from view by a supporting strut that protects the circuitry from over-zealous keyboard pressing. It runs at just over 3.5 MHz and has access to 64k of RAM.

The processor is ably supported by a remarkable chip, the TMS9918A, which is made by Texas Instruments and is a sprite-based display chip. It is fully interfaced with the CPU and controls the screen resolution, sprites, colours and monitors, updates the additional 16k of video RAM and provides the various video outputs.

Another chip, the PSG AY 3-8910, complements the graphics chip and is responsible for the 3-channel, 8-octave sound that is a feature of the MSX machines.

Finally, there is a 32k ROM chip. This holds the MSX Basic and completes the recognised MSX standard. Although the original MSX specification only called for 8k of RAM, all the MSX machines that I know of have 64k, although there are reports of some 16k versions.

One further chip of interest, which is unique to the Sony micro, is the 16k ROM chip. This contains a collection of programs and utilities held in firmware that gives the Sony the luxury of built-in software.

An additional piece of hardware called the Data Cartridge should be mentioned here. This should be considered by Sony owners as a *compulsory* optional extra as it fits into the cartridge slot and provides instantaneous storage and retrieval of data: compulsory because its presence brings out the full potential of built-in software. The Data Cartridge doesn't involve any new technology but illustrates the Japanese flair for innovation. Quite simply the one I had consisted of 4k of low voltage CMOS RAM continually backed up by a small battery with a five-year life — all packed into a cartridge. The theoretical limit would be a 64k cartridge but the cost of CMOS RAM imposes a realistic limit of 16k.

Although this facility is available to the other MSX machines, so far only Sony has given it any prominence. This is a shame as I feel when the cost of CMOS RAM falls this will become an important storage medium.

At the rear an impressive array of video outputs together with cassette interface

System software

Unlike the other MSX micros which go directly into Basic, the HB-75 displays a menu of options when the machine is switched on. These options are selected using the cursor keys and the RETURN button and include an address book, memo pad and diary-like schedule reminder.

Such applications have always been mentioned as uses for a home computer but have never been realised, as the time to load from tape has been too long. However, Sony seems to have found the answer through the Data Cartridge.

Each of these programs is identical in structure and provides the user with screens of nine lines of 15 characters in which to store an address, memo or schedule. These screens of information are given a heading through which they can be located and sorted.

Selecting the address option takes you into another menu of options which stretch along the top of the screen. The first of these is 'files' which, when selected, displays a list of all the address headings that are stored in the machine (or on the cartridge). Moving the cursor down to the one required and pressing the RETURN key is all you have to do to select the screen for that address. A nice little trick with the address headings is to arrange them so that they contain the person's name and phone number. This creates an additional phone directory.

New entries can be made via the NEW option by simply typing in the entry. When you've finished, pressing ESC not only returns you to the previous menu but also saves it to the Data Cartridge if one's present in a cartridge slot.

Similarly, entries can be altered with the UPDATE option and, as with NEW, characters can be entered, altered or deleted anywhere on the screen. Again pressing ESC ends this process, but this time you are given the choice between keeping the updated version or losing it in favour of the original. While updating, you can clear the whole entry by selecting the delete option at the top of the screen.

The final option on the address menu takes you to the search/sort screen. Here you can search for a particular address by either typing in the whole title or a keyword. This keyword can be any number of characters and in either case only the appropriate files are listed. For example, if you had stored the addresses of all known computer magazines then the keyword 'Personal' would produce several entries whereas 'Computer' would result in a longer list.

As you create new entries these

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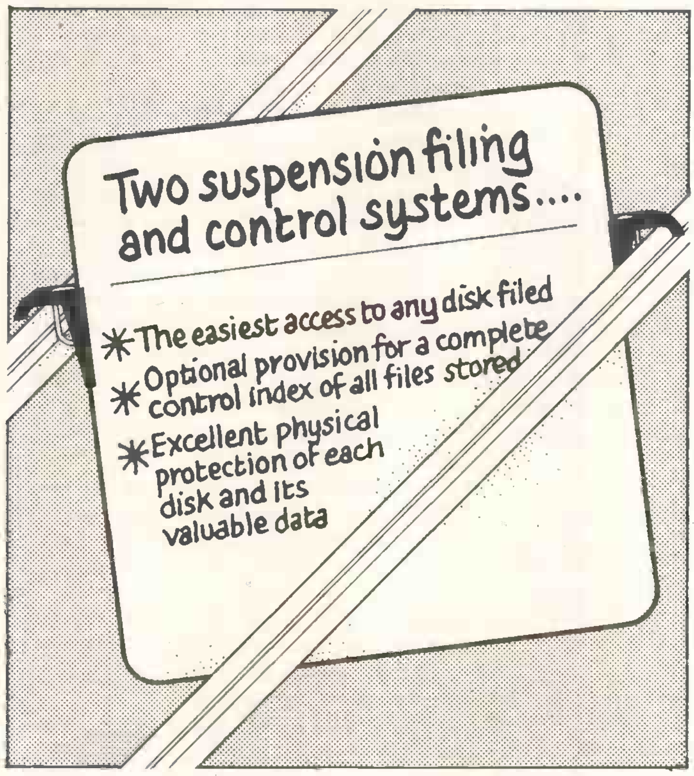

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appear on the top of the 'files' list but there is a sort facility which will instantaneously rearrange into descending order, giving preference to either numbers, capitals or small letters.

There doesn't seem to be a limit to the number of file entries that you can have unless you are using the Data Cartridge which would impose a 4k limit — about 22 full screens. The entries can be either kept on the Cartridge or saved to tape using the transfer utility. If the Cartridge is present then an additional tape to cartridge utility is also available. Any tape-saving process also includes an automatic verify, so you should ensure that you note the tape position from which the data is saved.

The whole process is very user-friendly and simple to use. So simple that I managed to discover all its facilities without having to delve into the accompanying Japanese manual. Thank goodness!

The software on the review machine still contained some Japanese characters which won't be present in the UK version. According to Sony the opportunity is also being taken to improve the machine. This will be a difficult task as the HB-75 already performs well. Yes, the screen size is limiting but 150 characters should be enough for anyone's address, memo or schedule reminder.

As mentioned above the memo and schedule reminder have identical structures but you should use the former as a notepad and the latter as a diary. Sony included various entries already saved onto the cartridge as examples for me to find, including a reminder of when to return the machine. Obviously the software is only at its best with the Data Cartridge which is why I referred to it as a compulsory extra.

You can also use the Cartridge to store a program using the SAVE "CAT:" command. This can then be recalled at any time by the opposite LOAD "CAT:". Unfortunately only one program can be stored at any one time. However, with careful planning you could have several routines as part of a single program. This ability to write to a Data Cartridge is just one of the Basic command sequences that sets MSX Basic above run of the mill dialects.

MSX Basic is the final option on the main menu and when selected takes the user into the standard programming screen found on all MSX micros. The screen colours are set to white letters on a dark blue background, although any of the 16 colours can be used.

The current setting of the function keys is displayed at the bottom of the screen. (F1-F5 are displayed, pressing shift reveals F5-F10.) The keys are pre-set to include commands which are useful to programmers and include AUTO to generate line numbers, LIST and of course RUN. These keys can be easily redefined and can be used effectively in programs via the ON KEY GOSUB command. This command is followed by a series of line numbers which the program jumps to depending on which function key is pressed. This matches the ON GOTO and ON GOSUB commands found on other machines for jumping to a line number depending on the value of a variable. However, MSX also includes the useful ON STRIG which is dependent on the direction of a joystick.

'The Sony HB-75 will be a very tempting buy to a first-time buyer. . . As an MSX machine it carries the benefits of an easy to use and powerful Basic along with a promised glut of software.'

These commands should not be confused with the more powerful interrupt-driven commands which have a similar syntax; for example, ON INTERVAL. These are driven independently of the Basic program by interrupts that are generated by the display chip sixty times a second.

The ON INTERVAL command is used to define time intervals at which subroutines will be called. The time interval is written in sixtieths of a second, so 10 seconds would be coded as ON INTERVAL=600 GOSUB 1000. This command would be at the beginning of the program and would be started by INTERVAL ON. Thereafter, every 10 seconds, the program would jump to the subroutine at line 1000. Later in the program it could be halted by INTERVAL OFF.

Other interrupt commands include ON SPRITE which is activated by a sprite collision, ON ERROR by a program error and ON STOP by an attempt to stop the program. The ON SPRITE command is particularly powerful since, without it, it would be almost impossible to check for collisions between the 32 sprites supported in MSX Basic.

These sprites are just one of the advanced graphics facilities which earn MSX the X for extended in its name. The others include the self-explanatory CIRCLE and PAINT and the powerful LINE command. This, in its simplest form, draws a line between two points but adding a 'b' in its syntax draws a box with two of the corners at the defined points. Finally, add an 'f' after the 'b' and the box is filled in.

More complex line drawings can be quickly created using the graphics macro language via the DRAW command. This is a logo-style language which follows simple drawing instructions. For example, U10 draws a line 10 pixels long up the screen. There are similar commands for left, right and down as well as the diagonals. The instructions are placed in a string which is then drawn. DRAW "U10L10D10R10" draws a box. A similar macro language controls the sound which is then PLAYed.

The pixels referred to above are part of the 256 × 192 graphics screen — just one of three screen modes which can be selected with the screen command. However, I would imagine that the 30 × 24 text mode would be dropped in the UK version, leaving the 40 × 24 mode, as British users will have little use for Japanese character sets.

These advanced Basic commands will be ample compensation to MSX users for the relative slowness of the Basic (see Benchmarks) and only having 28k of the original 64k for program use. They will allow even the beginner to produce remarkably sophisticated games and programs and the more advanced machine code programmers will relish the 60k of memory available.

Applications software

The amount of software available for a machine is of critical importance to its performance in the market. A number of technically sound machines have failed because of the comparative lack of software. MSX machines should have no problem in this area because the principal theory behind MSX is software compatibility.

This is the quite simple idea that software written for one machine should work on another. The video market is a good example of this in practice where any VHS machine can use all VHS cassettes (although even in video there's the rival Betamax standard).

The software houses obviously agree with the principle as at the time of

Benchmarks

BM1	2.1
BM2	6.0
BM3	16.8
BM4	18.3
BM5	19.3
BM6	31.2
BM7	44.8
BM8	216.3

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

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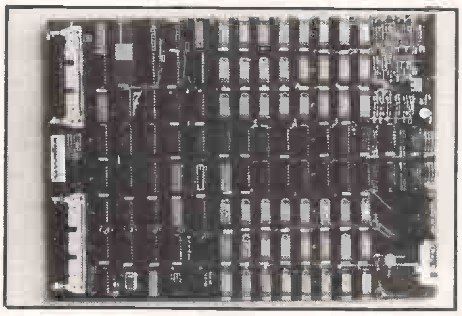

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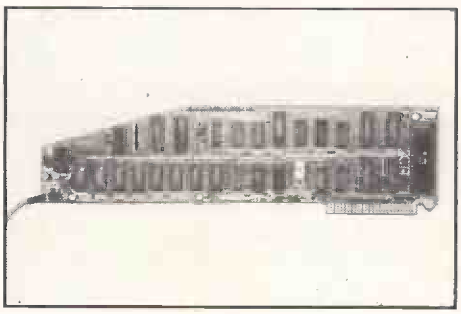

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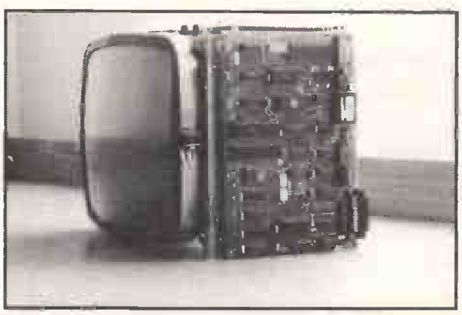

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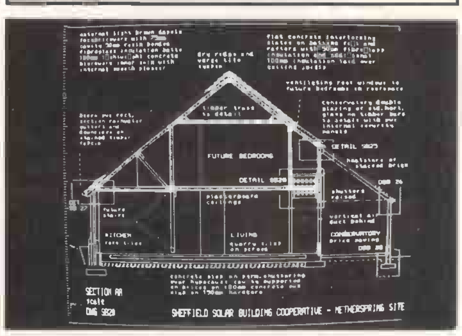

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MicroPro — WordStar Professional: WordStar, the no. 1 word processing program for micros, packaged complete with MailMerge, StarIndex and CorrectStar (MicroPro's new, phonetic spelling checker).

Lotus — Smyphony: All-in-one integrated package incorporating graphics, communications, spreadsheet (1-2-3 compatible), word processing and database system.

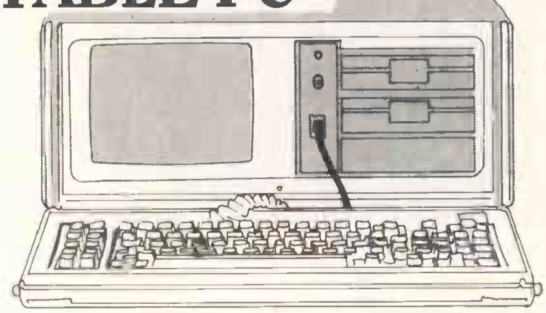
Peachtree — PBMS Ledgers: Interactive suite of Business Management Systems. Comprising Nominal, Purchase, Sales and Costing ledgers, inventory management and payroll.

Sorcim — SuperCalc 2: Probably the most popular spreadsheet package. Comprehensive, easy to use, and very well documented.

IUS — EasyWriter: Easywriter I is IBM's choice for quick efficient word processing, for more sophisticated text processing choose Easywriter II.

SPI — Open Access: A six-in-one package combining spreadsheet, 3-D graphics, word processor, scheduler, telecommunications and information manager.

THE NEW IBM PORTABLE PC



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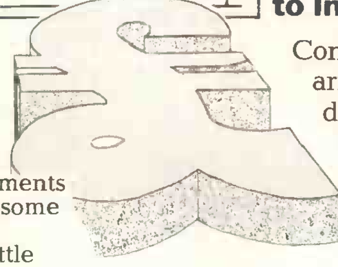
Contact us for further details or to arrange for a free product demonstration. We'll also send you a free catalogue and price list.



PRICE

You may know exactly what your requirements are and simply wish to take advantage of some of the lowest prices around, making that already over-stretched budget go just a little further.

INTERAM
COMPUTER STORE

INTERAM — Authorised IBM Dealer 46 Balham High Road, London SW12. Tel: 01-675 5325 Tlx: 8954072 writing 45 of them are preparing catalogues of up to 15 titles for release in the autumn. This list of 45 companies contains the majority of the market leaders, planning MSX versions of their chart-topping titles.

On top of those already committed there is probably an equal number waiting in the wings to see how well MSX-based micros sell. Should MSX take off, then I would imagine that the number of titles available will be immense, possibly even rivalling the Spectrum's range.

It is obvious that such a large range will include the inevitable fruit machine and space invaders programs which seem to plague most micros; but then I feel the machine's facilities will generate more advanced software. For example, machine code programmers have 60k to play with which is unrivalled in the home market. Similarly the Data Cartridge combined with a cartridge in the second slot provides the opportunity for immediate software.

Sony 3½in disks will be a third medium available to software houses and will no doubt be used to provide MSX owners with a range of home and small business packages including a comprehensive CP/M library.

Another reason for the availability of software is the help that the MSX group is giving to software houses — including a full list of useful ROM calls. This should be taken as a lesson to other companies who try to keep such information to themselves; which attitude is somewhat self-defeating as without such information programmers cannot best use a machine's capabilities. Consequently, the standard of software suffers and therefore so does the machine itself.

Documentation

Documentation is especially important in a machine aimed at the first-time user and therefore should contain a Basic language tutorial as well as machine instructions. The task of evaluating the Sony manuals was almost impossible as they were all in Japanese. However, by virtue of the fact that Basic keywords are recognisable, an educated guess can be made.

A side profile shows the ports for two joysticks

The three manuals supplied were: the introductory guide to the HB-75; an explanation of the built-in software; and a Basic tutorial guide.

The introductory guide takes you through setting up the computer and on to an explanation of the keyboard, particularly the function keys and CTRL key permutations. It closes with a full technical specification and even a vague memory map.

The second manual provides relatively clear instructions about the use of the firmware. This manual couldn't go wrong as the programs are well-structured and easy to follow. However, the manual presents it comprehensively and includes a diagram of the tree structure of the software marked with the key presses necessary to move around it.

The Basic tutorial manual will no doubt be renamed the 'Fido' manual as it likens the computer to a dog called Fido who is very good at following commands. This is quite a nice analogy which sets the tone for a manual blatantly aimed at children. (I was supplied with a direct English translation of this book which turned out to be a competent beginners' guide to MSX Basic.)

The main failing in the three manuals is the apparent lack of any explanation of the more advanced and useful facilities of MSX Basic. For example, there is no mention of the machine's 32 sprites, nor of the useful graphics commands or of the more involved interrupt-driven commands. This is a shame since it is these facilities that set MSX Basic ahead of other dialects.

However, according to Sony a fourth manual is being prepared which should answer these criticisms. This manual is said to include an explanation of each of the Basic keywords, with discussions and examples of the more advanced features.

Prices

At the time of writing exact details of the prices of the MSX machines are still somewhat vague. An early indication suggests that they will vary between £250 and £320. The Sony comes near the top of this range at £299, which is consistent with its additional features.

This price compares well with other £200+ micros; for example, the Commodore 64 and the BBC. The 4k Data Cartridge costs an additional £30.40.

Conclusion

The Sony HB-75 will be a very tempting buy to a first-time buyer, particularly if they already own a Sony product. As an MSX machine it carries the benefits of an easy to use and powerful Basic along with a promised glut of software.

It also expands on the MSX core with the inclusion of RGB and three useful firmware packages which illustrate the potential of the Data Cartridge. The 3½in disk drive will be only one of the many peripherals available as hardware manufacturers will no doubt jump on the MSX bandwagon.

However, it is unlikely that the computer industry will stop developing at its current rate. It may slow down a little, but development will continue. Consequently, there will always be room for the Sinclairs as they take home machines into the next generation.

It is debatable whether the MSX machines will be able to cope with these developments. Even if they don't, they will still form a much needed base line.

END

Technical specifications

CPU:	Z80A processor running at 3.58 MHz
ROM:	32k MSX Basic; 16k firmware
RAM:	64k RAM; 16k video RAM
Keyboard:	73-key MSX standard incorporating five function keys and a cluster of cursor keys.
Display:	Text mode 40 × 24, graphics 256 × 192. 32 definable sprites, 16 colours.
Sound:	Three channels, eight octaves.
Interfaces:	Centronics (printer), two MSX cartridge slots, standard cassette (1200/2400 baud).
Video output:	RF (UHF ch 36), composite audio and video and RGB.
Dimensions:	407 × 67 × 245mm (width, height and depth respectively)
Weight:	2.8kg

SOFTWARE

Time to get SMART?

With competition in the integrated software market hotting up, discerning micro users will not easily be fooled into buying the latest 'gimmick'. So, a system called SMART would seem to have a lot to live up to. Bill Holland puts it to the test.

Innovative Software's SMART system comes in three major sections which may be purchased individually but are intended to be operated as one large application. They cover the areas of word processing, spreadsheet with graphics, and data management. A fourth unit called 'Time Manager' is available but this was not included in the review package.

The SMART system is supplied on five diskettes. On loading the system a diagrammatic display of available options appears. You either move the cursor or press a letter-key to select Word processor, Data manager, Spreadsheet, or Time manager.

A 'macro' facility enables you to redefine any infrequently used key for the duration of a session to cover a frequently used series of key-depressions (for example, a set of reformatting commands, or a lengthy phrase like 'Associated Semi-Conductors Limited'). The macro can contain up to fifty keystrokes, and you can render a set of macros permanent by saving them for later reloading. There is even a function to restore temporarily the re-defined key to its normal function for one depression only!

Word processor

Having selected the word processing option (if you are using floppies rather than hard disk) you have to insert the word processing disk in order to continue; and similarly with the other applications. The program then presents the main area of window-1, bordered and with a 'ruler' at the bottom showing the left and right margins and tab stops. (Further 'windows' can be separated off, with different texts being loaded into each.) 'Word-wrap' is automatic, and as the cursor leaves a text line after any change, automatic re-formatting occurs.

As you input text a small diamond-shaped text-end indicator is pushed ahead of the typed text; a flashing cursor keeps pace with it as you continue, but if you go back into the body of the document for modification it leaves the diamond behind at the end. A number of function and letter-key options are displayed at the bottom of the screen which are available with the simultaneous use of the 'alternate' key (a sort of additional 'control' key) or the 'control' key itself. These options are, in fact, the most frequently used subset of all the generally available options available through the 'command' key.

The command key options are reached by using 'Esc' to get 'command list 1' to the bottom of the screen, after which the use of the '/' or command key (as with Supercalc) shifts you to the second to fifth command lists; another '/' depression takes you back to the first. A further nice touch is that the use of 'alt-x' re-presents the last instruction used, poised for further use.

Editing text is a delight. There are variations on the 'underscore' theme — you can underline, with respect to the present position of the cursor, a word, a line, a sentence, a paragraph, or a block.

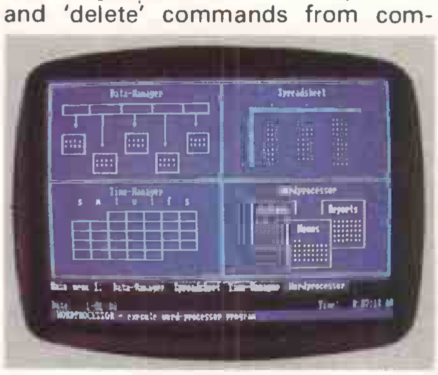
Apart from this, you can also select continual underlining of any new text input. Text 'find' and 'replace' works like WordStar (that is, in a convenient and logical way), with the ability to ignore the distinction between upper- and lower-case, to search the whole file onwards or backwards, ask before replacing, and so on. The 'copy', 'find' and 'delete' commands from command list 1 have similar parameter choices to those listed above for 'underscore'.

Another useful built-in extra is the 'compute' option; type in a formula with all-numeric terms and the program calculates the answer; or type in a list of, say, values, which will be totalled when you have indicated the top left and bottom right corners.

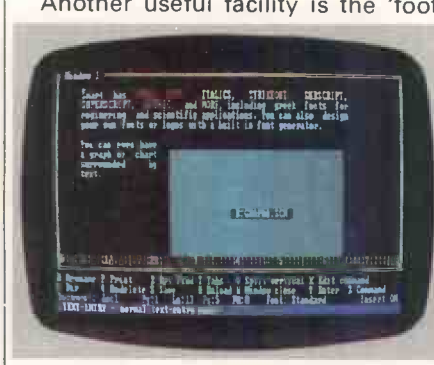
The file read and write commands are differently organised to WordStar's, even though they perform similar duties. Whereas WordStar offers D(ocument load), ^KD(one) to save, and ^KQ(uit) to abandon, the SMART system has 'Load', 'Unload', which removes a document from the document window (that is, the screen) without saving it, and 'Save'. which puts the file on disk without removing it from the screen. If you opt for 'Unload' you will be asked whether or not you want to save it first.

Be warned: there is an interesting trap in Save: if you save, you will be asked the document name. If you try to enter a new name, the program does not rename the existing document, but attempts to save a document of that name which it assumes you have been using in one of the alternative windows; it therefore tells you it doesn't exist. The trick is to press 'return' on the query without inserting a name, and the document is then saved under its existing name.

Another useful facility is the 'foot-



The start-up menu displays the available options



Editing text is sheer delight; with variations on the underscore theme note' function. This enables the user to insert a footnote marker at a particular point in the main text and link it to a textual footnote of up to three lines' length which 'follows' the marker around wherever it is shifted and prints at the bottom of the page of the printed document.

When the footnote text has been entered, it will not be visible when editing the main document, so a subsidiary of the main 'window' command allows you to display footnotes.

The 'print' option from command list 1 gives five options: Normal, Enhanced, Options, Default and Template. The 'Template' system requires some explanation. For each document created on the SMART system, a template for printing is also created holding the specific print features to be used for printing that document.

If you want to specify an individual template for a document, select 'Options' from the list, and a long list of possibilities will be presented: a three-line header, either left- or centre-justified, and a three-line footer, with up to three further (blank) lines respectively before or after; specification of the date for the heading, formatted in either alpha or numeric; lines to enclose the document; form length and width; top and bottom margins, and left and right indents; and single or continuous stationery. 'Normal' print is for users who do not have a graphics (dot matrix) printer, since the alternative 'Enhanced' printing produces italic and other fancy styles produced in the document with the 'font' function described above.

The 'merge' commands emulate the 'mailmerge' extra available on WordStar. Using it you can print, either by taking data from a file or by direct entry from the keyboard, personalised circular letters or other correspondence.

The 'graphics' option available from command list 4 allows the transferability of data between various segments of the sytem. This option will pick up a graph produced with the spreadsheet and incorporate it into a word processing document. A further step in this direction is the 'send' command — this takes raw data from one member program of the SMART suite to another. Thus you could enter despatch details into the data management program, update stocks and trigger re-order enquiries, then send the details to the spreadsheet to have extensions performed, VAT calculated, conditional commands carried out, take the result over to the word processor to have the result tidied up and printed out as an invoice.

Within each of the main SMART sections (word processing, spreadsheet and data management) you can run a 'project' file. This seems to be a derivative of the 'batch file' idea in CP/M; that is, you take a list of commands that you frequently run in a given sequence, and, by using the 'remember' facility, record them into a project file. At any time thereafter you can run the project with 'execute' and the project name.

The only problem worth pointing out is that the 'change-type' on command list 4 results in a 'beep' and 'Unknown command'. Apart from this and a few incorrect command list references in the manual, the word processor is very impressive.

Spreadsheet & graphics

When the user moves from the main menu to the spreadsheet, the screen takes on the familiar spreadsheet format; both rows *and* columns are numbered. Less conventional is the use of the extent of the spreadsheet; an economising method called 'sparse matrix storage' reserves space only for cells containing data, so that a thinly filled spreadsheet is much less likely to overflow memory. Help is at hand in the form of a 'parachute': if memory does fill up, the disk space available is also used. Due to this dedication of RAM space to data storage, a penalty is noticeable in that any little activity like cursor movement to outline an item on a menu, or matrix recalculation, causes disk activity as program sectors are fetched and discarded — no great time loss, however.

Formulae can be up to 1900 characters long, and are initiated with a '='. The worksheet has 9999 rows and 999 columns. In the spreadsheet it quickly becomes evident that the same general design principles used in the word processor have been applied to the spreadsheet — providing the same advantages and drawbacks. For instance, to move around in the spreadsheet you can use, apart from the obvious arrow keys, the home, end, tab, shift + tab, Pgup, Pgdn, ^ + arrows.

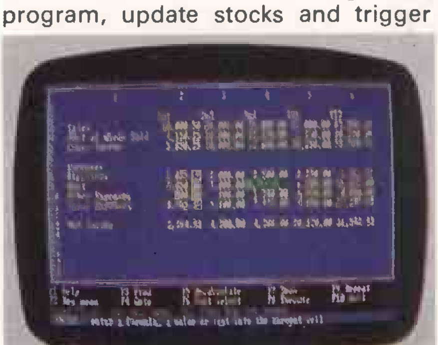
The method of command entry is normal for this type of application: that is, the initial choice of one of the commands from, say, command list 3 (done by moving the cursor and pressing 'CR', or by typing the initial letter of the command), causes the option list to be displayed and the command to be shown a line lower in 'pale' mode. When you choose an option, it is added after the 'pale' command, and any further choices displayed until the action takes place.

Cell referencing is more complex than in standard spreadsheeting: entry of absolute references (that is, those you don't want to change automatically if you shift the cell or replicate it elsewhere) are entered in the form r[n]c[n], whereas the normal relative references are entered as rncn. To add the last ounce of complication you can enter a mixed version such as r7c[12].

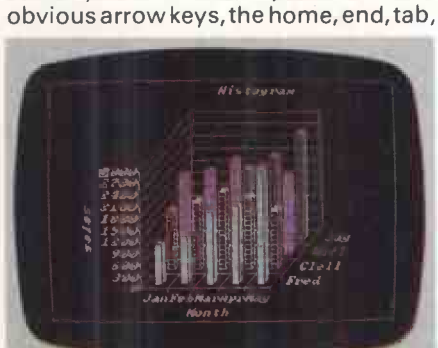
Within the spreadsheet program there are five command lists, summoned by the use of the '/' key. For instance, there is a 'find', but its options vary, giving you the opportunity to specify value, text, or error to be sought. The latter is a good idea: if you have ever been stuck in a spreadsheet full of N/A's and no idea where to start looking you'll appreciate this facility. Having found your error you can hit alt-E or -F to have the error analysed. The 'help' function is present and functions in the same way as the word processor's. The 'blank' command lets you erase a block, line, column, or, if unspecified, the current cell.

One thing to be aware of when selecting a 'column' to be blanked is the request to 'Enter number of columns'. If your cursor is resting on column 6 and you want to delete column 3, be careful! If you specify column number '3' (and why not?), you will find you blank out columns 6, 7 and 8 — the three columns that begin where your cursor is! A bit naughty . . .

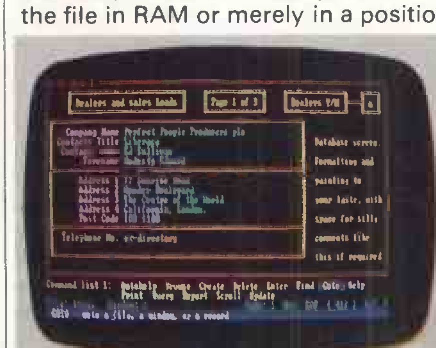
Loading a previously produced and saved worksheet is greatly helped with the display of the files available on the 'B' disk. After one has been selected you can choose between having the file resident or non-resident; this means the presence of the file in RAM or merely in a position



The usual spreadsheet format; both rows and columns are numbered



Beautifully coloured graphics: the possibilities seem quite endless



Database format is fixed or variable length — a wonderful luxury

to be 'run-in' from disk. The latter choice, of course, means that you can draw on a series of large worksheets for data without taking up RAM at all. (Just in case you load in so many worksheets that you lose track of yourself, use of the 'index' command from command list 4 gives you a list of all the worksheets currently loaded.

Other elaborations from the normal approach are the two 'copy' facilities: the standard one when encountering a formula will copy the formula to another cell, whereas 'vcopy' will shift the actual value. The set of row and column numbers can be switched off independently of each other, and to 'open up' things the 'border' command removes the line-border without switching off line or column numbers. In doing so, however, it displays a further two rows on the screen.

The 'F-calculator' function, available from command list 5, is very useful. If you have split the screen, your values are retained in the upper or lower screen while the part-screen in which the cursor was positioned is now the work field for the calculator.

The graphics (on a separate diskette if you are using floppies) are something else. From the moment you go in through 'define' and see that you can define three rows of main title, three rows of footnote, both their colour and font and the main title's size, the degree of detail (and complexity) becomes awesome.

And if you have a colour monitor, the possibilities are infinite. To give you an idea: when you decide to add a touch of colour with the 'paint' routine, you can specify border, cursor or window. If you select 'cursor' you can then select both the cursor background and the foreground; similarly with the window(s).

The 'print' options are equally wide-embracing. On selecting 'print', one selects between 'formulas' and 'text'. Within this choice there is the choice between region or block, complete worksheet and window. The output can be sent to disk for further (word-processor) modification or, of course, to the printer. The final choice is the number of copies.

The 'send' option, as mentioned above, allows communication between word processor, spreadsheet, and data manager. You can, having defined a graph from data entered into, say, a number of spreadsheets, shift both blocks of data and the graph illustrative of the data into the body of a word processing document.

In using the worksheet, I picked up a 'ghost' after opening both a horizontal and a vertical window and 'zooming' into one part of it. A value of 34.00 kept disappearing and reappearing as the cursor moved around the screen. It wouldn't stay away, but attempting to use it in a formula produced 'error 100' in the destination cell and 'error 1' in the narrative line. Ho, hum! Another minor 'bug' appeared when a copy was made of a row of values. Although all the values had been copied, some of the cells remained blank until the cursor had been passed over them, whereupon the value was finally revealed. Very odd . . . However as soon as the windows were 'unzoomed' and 'closed' all was well and the ghosts went away.

The manual supplied for review was a development copy complete with warts. Diagrams were missing and, spelling errors abounded but the release version should be an improvement on this.

Data manager

Database work can be complex and is probably the activity most users tackle last.

Structuring the database is carried out by using the 'create' command whereupon the user will be asked to specify whether a new structure or not is to be used (this is in case an existing one is to be modified). The format can be either fixed or variable length — a new departure for micro databases. The British 'Superfile' works in variable length, but most others are fixed.

As you begin to set up the fields in the database, the next requirement will be the type. This may be alphanumeric, 'Inv name', numeric, counter, date, time, ssn (social security number USA style?), or Phone. The numeric field can be input as calculated, and the formula for calculation input straight away. You can, of course, use a function key to insert fields.

When selecting key fields all fields are displayed, with a cursor to be pointed to the required field. There is a minor anomaly here in that use of f10 doesn't (as is normal) end the selection process; you have to use 'return'. There is also a problem; when you do so, on occasion you end up with screens full of the word 'Execute' flashing past, the only way out being to re-boot. Oddly you don't get the chance of specifying whether or not duplicate keys are allowed. For example, with 'clock no.' as the main key, you would not want to allow duplicate keys, but if you were also keying the tax codes for these they should be.

With numeric fields one can specify accuracy — that is, decimal places wanted — and, more interestingly, there is the idea of calculated fields. This allows one to nominate, in addition to the field length and type, a formula which governs the value of the field in terms of the values already entered into fields in the present record, along with constants. For example, if a wages database consisted of, among other fields:

(5)	stdhrs	(hours at standard rate)
(6	thalf	(hours at time and a half)
(7)	double	(hours at double time)
(8)	rate	(the basic rate per hour)

one can define field 9 (gross pay) as:
(9) ([5]+([6]*1.5)+([7]*2))*[8]
and the result is that the input screen allows one to enter data into fields 5-8, but not 9, but on 'return' the calculated value of gross pay flashes up into field 9. Very neat.

On the review package there was a problem with the 'create' function. If an error occurred in entering a field's details and the 'f8' 'delete field' function was called, even though the entry details had been cleared from the screen they would still be in memory. This meant that when corrected details were input the new field lengths were added to the deleted ones.

Another minor problem was on 'browse', where field names are truncated to the number of characters in the fields rather than columns being spaced out. But at least you get field names, more than can be said for dBaseII.

Prices

The SMART system costs £635, but £485 with proof of purchase of either WordStar, dBaseII or Lotus 1-2-3. Modules can be purchased separately: Word Processor £280; Spreadsheet and Data Manager £350 each. All prices exclude VAT.

Conclusion

Overall, this is an exciting package. It is flexible and well-designed — with no obvious gimmickry.

Its shortcomings? Well, a few problems need ironing out; and the extent of interaction between the three units of the system is limited — multiple word processing screens are fine as far as they go, but a split screen with, say, word processing on one side and a spreadsheet on the other would be better.

The SMART system is being imported into the UK by 01-Computers of Battersea, who kindly loaned the review copies and manuals.

This review was carried out on an IBM PC, but the package is available for the IBM PC, compatibles and the Apricot. For further details contact the supplier: Paradigm (UK) Ltd on (01) 228 5008. END

Upgrade to suit

Are you thinking of upgrading your VIC 20 to a Commodore 64 but afraid of losing your existing programs? Andrew Bennett suggests a quick and painless method of converting your old VIC programs.

If you've upgraded from a VIC 20 to a Commodore 64, or intend to, you may have wondered if you'll lose the use of your existing programs. This article will help you to convert your programs for the '64, which in turn will give you a better understanding of both machines.

Programs usually consist of one, or a mixture, of the following five parts:

1 The usual Basic keywords (PRINT, for example).
2 POKEs and PEEKs into areas of memory.
3 User-defined character sets and high resolution graphics.
4 Sound effects and music.
5 Machine code, either as full length programs or as subroutines for Basic.

If you use a disk drive with your VIC you'll have no problems loading your programs into the '64, but if you use a cassette, life is a little more complicated. Although the VIC and the '64 use very similar cassette systems, VIC programs will not load off tape into the '64. The only solution is to get a friend (or a friendly dealer) with a disk drive to transfer your programs to disk and then into the '64, where you can save them to tape ready to convert at home.

Basic keywords

The '64 and the VIC use the same Basic as Commodore's first computer, the PET. Each machine has the same Basic keywords which perform in exactly the same way.

On the VIC, you can type program lines up to 88 characters long, but on the '64 you're restricted to 80 (the '64 will run lines over 80 characters but they then become difficult to edit).

The command most affected by the change of machines (excluding the above) is the PRINT statement. The '64 has a 40-column by 25-line screen compared with the VIC's miserly 22 columns by 23 lines. This means that your neatly formatted VIC screens will now fill only the left half of the 64's screen. It's a straightforward if time-consuming job to move the text around within your program's PRINT statements to achieve a good layout, changing TABs and SPCs to take into account the bigger screen size.

While doing this you might be able to use the '64's eight extra colours; these are accessed using the Commodore key and the number keys. (It's best to leave re-doing the screen formatting parts of your VIC programs until last as it's a purely cosmetic operation.)

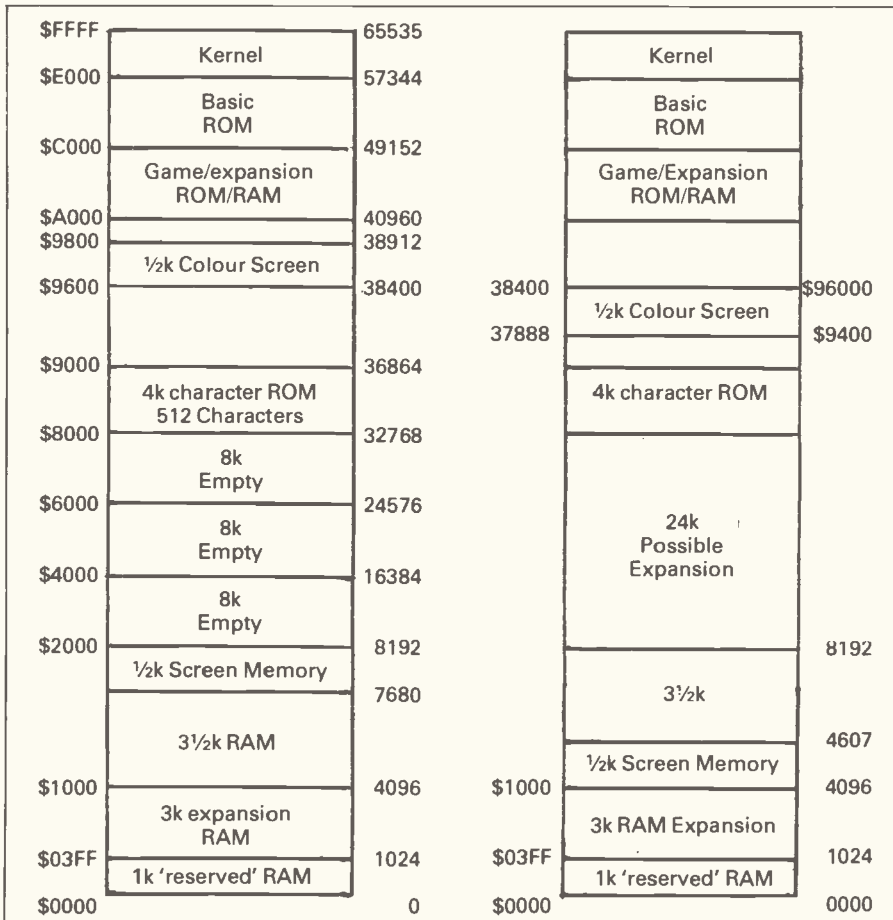


Fig 1 VIC 20 memory maps

POKEs and PEEKs into areas of memory

The memory maps in Figs 1 and 2 show how different the memory maps of the two machines are. Fig 3 shows the differences in greater detail.

The screen and colour memories of the two computers work in the same way: you have to set the colour on the colour screen before a character will show up on the normal screen. On the VIC, the contents of location 36879 dictate the border and screen colours, while on the '64 they are handled separately by location 53280 for the border colour and location 53281 for the screen colour. These take a value between 0 which is black and 15 which is grey 3. Any program that POKEs and PEEKs to and from the screen (a game, for example) will have to be considerably rewritten to take into account the '64's bigger screen. On the '64, any moving character which wrapped round onto the next line on the VIC will continue moving on the same line for some 18 characters.

Further problems stem from the fact that the VIC's memory map changes depending on the amount of expansion that has been added. A program for a VIC with 3k expansion will have to be converted slightly differently from one for an 8k expanded VIC (Fig 1 should be

$FFFF	8k Kernel ROM
$E000	4k I/O ROM
$D000	4k RAM
$C000	8k Basic ROM
$A000	8k RAM/cartridge
$8000	8k RAM
$6000	8k RAM
$4000	8k RAM
$2000	Basic RAM
	Basic RAM
$0800	Screen + Sprite Pointers
$0400	1k 'reserved' RAM
$0000	

Fig 2 Commodore 64 memory map

of assistance here).

User-defined character sets are handled in much the same way by both computers. On the '64, however, the ROM which holds the '64's normal character set co-habits with the '64s I/O ROM at 53248 ($D000). If your program has its own characters stored as data statements at the end of the program, you'll simply have to convert the part of the program that reads in the data. Even if your program accesses the VIC's character machines for the VIC's character set, very few changes will have to be made. The '64's character ROM starts at location 53248 ($D000) but before it can be accessed your program must 'turn off' the I/O ROM. This is done with two simple POKEs:

POKE 56334, PEEK(56334) AND 254

POKE 1, PEEK(1) AND 251

The '64's character set can now be extracted from the ROM. As on the VIC, the letters are first with @ at the beginning (at 53248 on the '64). After the required number of characters have been read in, two more POKEs put the I/O ROM back in place in the '64's memory map:

POKE 1, PEEK(1) OR 4

POKE 56334, PEEK(56334) OR 1

New character sets can be placed in any one of seven places on the '64 but when used with Basic location 14336 is the best place for them. To switch from a character set in ROM to one at 14336, simply POKE location 53272 with 30. To protect your character set at 14336 from being overrun by your Basic programs, the top of Basic must be set to 14080. This is done by POKEing locations 52 and 56 with 55, which leaves about 12k of memory available for your Basic program.

Computer	Extent of Basic memory	Position of Screen	Position of Colour Screen
Unexpanded VIC	4069–7679 ($1000–$IDFF)	7680–8191 ($IE00–$IFFF)	38400–38911 ($9600–$97FF)
VIC + 3k	1024–7679 ($0400–$IDFF)	7680–8191 ($IE00–$IFFF)	38400–38911 ($9600–$97FF)
VIC + 8k (or more)	4608–???? ($1200–$????)	4096–4607 ($1000–$IIFF)	37888–38399 ($9400–$95FF)
Commodore 64	2048–40959 ($0800–$9FFF)	1024–2023 ($0400–$07E7)	55296–56319 ($D800–$DBFF)

(????—upper limits depend on amount of expansion)

Fig 3 Breakdown of differences between VIC and Commodore memory

On the VIC, high resolution graphics are achieved by filling half the screen with a blank user-defined character set and then doubling the character size so that 256 characters fill the entire screen. On the '64, things are slightly easier in that you put aside 8k of memory for the 320 × 200 high resolution screen. High resolution mode is entered with the following:

POKE 53265, PEEK(53265) OR 32

POKE 53272, PEEK(53272) OR 8

The last of these POKEs tells the '64 where to find the hi-res screen, in this case 8192 ($2000). On the '64, the colours for this mode are given by the contents of the screen matrix (1024-2023), whereas on the VIC the colours for points which are plotted come from the colour screen. Like the VIC, the '64's high resolution screen is laid out as rows of characters. To plot a point (X,Y) on the '64 the following should be used:

BYTE = 8192 + 320*INT(Y/8) + 8*INT(X/8) + (Y AND 7)

POKE BYTE, PEEK (BYTE)
OR 2 ↑ (7–(X AND 7))

This is similar to the method used on the VIC.

Another mode that both computers have in common is multi-colour mode, which allows up to four colours to be shown in each character square. On the VIC, this is enabled by placing a colour code greater than seven in the colour square corresponding to the required character. The same method is used on the '64 but the mode must first be 'turned on' with the following:

POKE 53270, PEEK(53270) OR 16

After the above the mode is almost the same as both computers. On both, the resolution of the screen is halved so that bit pairs represent the four colours; the main difference being the location from where the computers access the colours. Fig 4 shows the differences.

Sound effects and music

One of the main advantages the '64 has over the VIC is sound. The VIC has three tone and one white noise channel, giving a range of five octaves. The '64 has three channels offering nine octaves. Each of the '64's channels can take a different waveform from a

Bit Pattern	VIC	Commodore 64 Hi-Res	Commodore 64 Characters
00	Screen Colour	Screen Colour	Screen Colour
01	Character Colour	Upper 4 Bits of Screen Memory	Background Colour #1 (53282)
10	Border Colour	Lower 4 Bits of Screen Memory	Background Colour #2 (53283)
11	Auxiliary Colour (36878)	Colour Memory	Colour Memory

Fig 4 Multi-colour mode bit patterns

selection of triangle, sawtooth, pulse and white noise. The '64's SID (Sound Interface Device) chip also offers enveloping (where the note's shape is changed by setting Attack, Decay, Sustain and Release) and various filters. Of course, when you are converting from the VIC you'll want your program to sound the same as it did on the VIC. You'll be able to enhance your VIC sounds later by using more of the SID's facilities.

Volume control

Both computers handle the volume control of their sound in the same way. This is done by POKEing a certain memory location with a value between 0 and 15 (15 being the loudest). On the VIC, this location is 36878 and on the '64 it's 54296.

Each of the VIC's three channels or voices is pre-set to give notes in a certain range depending on the voice. On the '64, any note in a nine octave range can be played through any of the three channels. Playing a note on the VIC is simply a matter of setting the volume and then POKEing a number between 128 and 255 into one of the three channels.

This process is slightly more complicated on the '64 in that the SID chip has to know which waveform is to be used and the shape of the note to be played before any sound can be heard. To enable the '64 to have a larger range than the VIC, two locations must be set for the pitch of each note. I suggest that you first set the Attack/Decay register of the voice you are using to 136, for example, and the Sustain/Release register to zero. You should also set the waveform of the voice to either triangle or sawtooth. These values will give a note that sounds almost like that of the VIC. If your VIC program uses white noise (location 36877) then set the waveform to noise.

Once your program is running properly you can experiment to obtain better sound effects. The '64's *User Manual* contains a chart giving the values for the note that you wish to play.

Machine code

Converting machine code from the VIC to the '64 is not as hard as it might at first appear if you have a working knowledge of machine code; both computers use one of the 65XX family of CPUs. Like the Basics of the two machines the machine codes are exactly the same, and if you've learnt 6502 on the VIC you'll find 6510 familiar.

You'll find that illegal calls to the VIC's ROM will not work on the '64 but legal ones will, since Commodore has left the Kernel jump table alone. The first 1k of memory is exactly the same on both machines except for locations 0, 1, 2, 784, 785, 786, 197 and 203 decimal.

A	10	K	37	U	30	/	55	6	19	*	49
B	28	L	42	V	31	£	48	7	24	@	46
C	20	M	36	W	94	+	40	8	27	↑	54
D	18	N	39	X	23	−	43	9	32	←	57
E	14	O	38	Y	25	0	35	=	53	SP	60
F	21	P	41	Z	12	1	56	f1	04		
G	26	Q	62	,	47	2	59	f3	05		
H	29	R	17	.	44	3	84	f5	06		
I	33	S	13	;	50	4	11	f7	03		
J	34	T	22	:	45	5	16	RET	01		

Fig 5 Machine code value locations

On the VIC, locations 1 and 2 hold the start address for programs called by the USR command in the conventional lo-hi 65XX fashion.

On the '64, the two lowest locations are used by the 6510 in the memory paging system. USR calls on the '64's user locations 784-786 so when you're converting programs with USR in them, remember to POKE the address of the machine code subroutine into locations 785 and 786 on the '64.

Any VIC programs that use locations 784 — 787 for storage will have to use alternatives. If your programs use location 197 or 203 to find which key is being pressed, you should note that the '64 reads the keyboard in a different way to the VIC. These locations now have the values shown in Fig 5.

Remember that on the '64 you have 4k of memory (at $C000 or 49152 decimal) set aside for your machine code programs or data. If you have a simple monitor/assembler, such as Superman for the VIC, you should find that this will work on your new '64 but the X command (exit to Basic) will cause the '64 to crash.

Conclusion

With the information and tables in this article you should be able to convert most machine code utilities to the '64, but games and most full-length programs will be beyond all but the most determined 'assemblerites'.

As the '64 is a much 'bigger' machine than the VIC in more aspects than memory, you should try to keep in mind when converting your programs that you now have available a much larger screen resolution, sprites and the advanced SID chip.

You'll find that converting your old programs will help you adapt quickly to your new machine.

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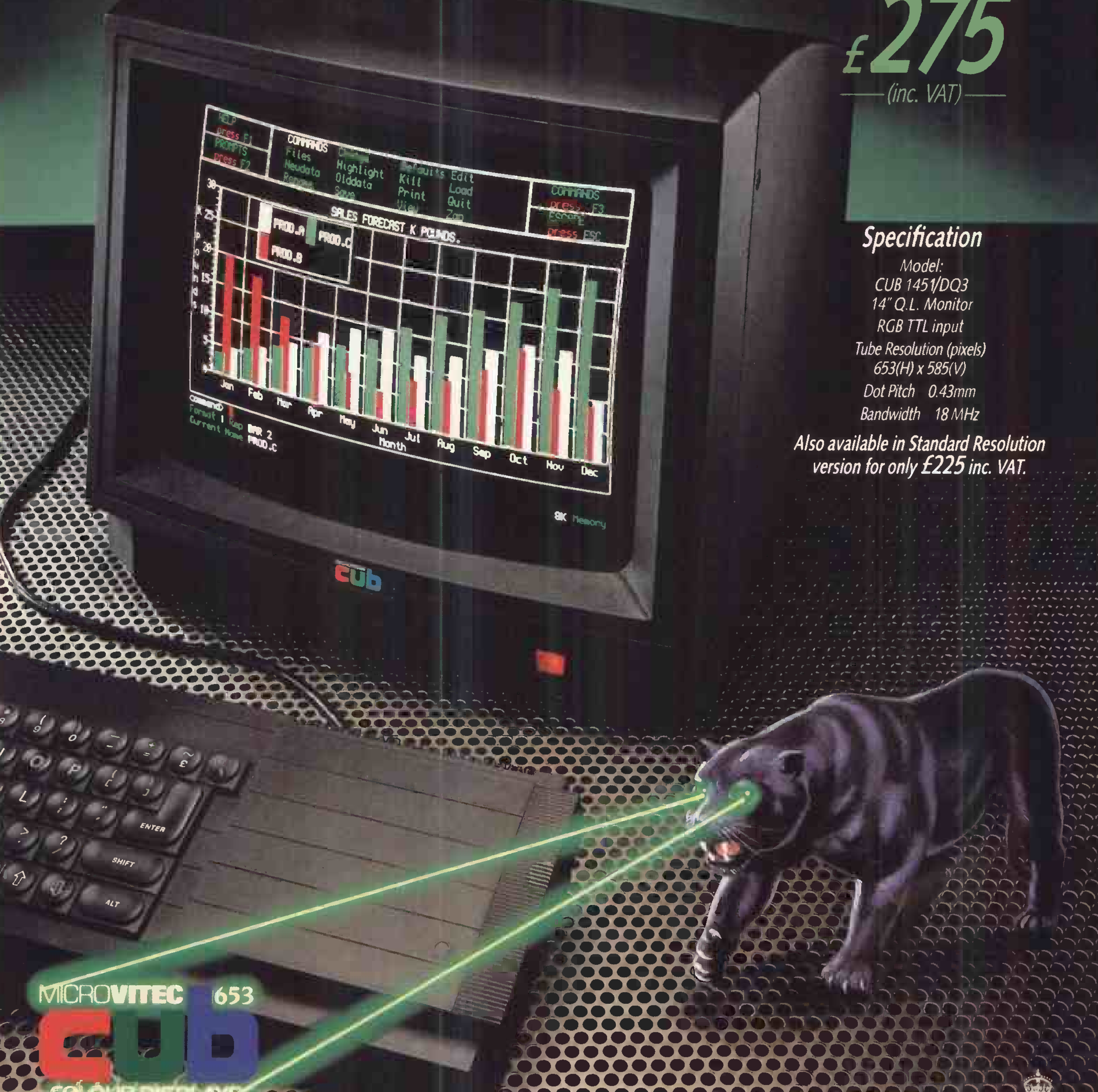

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To serve and obey

Mention robotics and most people conjure up mad scientists, human frailty and world doom. But nightmares apart, it's an intriguing and beneficial area of research. Andrew Bangham explains how you can set up your own computer-controlled device using a BBC Micro.

Ever thought about building your own toy robot, or making Meccano or Lego machines run under computer control? What about making a mechanical mouse wend its way around the sitting room? All you need is a micro such as the BBC, radio control-type servo-motors, an ordinary DC model motor, some wire and a few connectors.

It is possible to control a model maker's servo-motor directly by using a BBC Micro, two wires to supply 5v power and one to connect the servo-motor control pin to either the user parallel port or the printer port. These little servo-motors are delightful; small and light enough to be used in model aeroplanes, yet remarkably powerful.

Futaba, for example, produces a large range of well-documented motors. Each unit includes a small DC motor, a gear box, a position sensor and a feedback amplifier. The motor usually moves a lever (via the gear box) through 90 degrees and the internal feedback system ensures that the position of the lever is dictated by the control wire.

Servo-motors

Servo-motors are digital. To control the position of the lever a voltage pulse (0 to 5v) is applied to the control wire; it is the duration of this pulse which governs the position of the lever. For example, a one millisecond pulse commands the servo-motor to move its lever to one end of its throw, and a two millisecond pulse moves it to the other end.

Sending the servo-motor one pulse of, say, 1.5 milliseconds (to move the lever into the centre position) will be of little use: the motor will leap into action but will be unable to continue. It must be frequently reminded; and this is done by sending a continuous stream of pulses. If the pulses are all the same length then the lever will remain in one place and the servo-motor will resist any attempt to move the lever mechanically (if you force it out of position then it will immediately return to the set point). If the pulses are of a different length then the motor will move the lever to execute the command.

A muscle is a good way of describing the way in which digital servo-motors work, as both require a stream of pulses to maintain a constant position. Animal nerve/muscle systems are remarkable linear servo-motors. They have a good power-to-weight ratio, respond fast and are energy-efficient. Like digital servo-motors, muscles have to receive a continuous stream of nerve action potentials in order to function: a tetanus. In other words muscles and servo-motors have to be refreshed; servo-motors need about 50 pulses per second.

Fig 1 summarises the requirements of the servo-motor. The computer communicates to the motor through a port; in this case the user port. (The printer port, however, may be a safer choice: since the outputs are buffered, there is less risk of mistakes in the external circuitry damaging the computer.) Whatever happens you should take care not to short any outputs to ground, and not to connect any devices with the wrong polarity. Power can be drawn from the 5v supply in the analogue port, though care should be taken when using larger motors. Electric motors constitute an inductive load and although I have had no problems with this, use of a diode may prevent voltages being fed back into the computer. Many servo-motors have a large capacitor to accommodate the current surges.

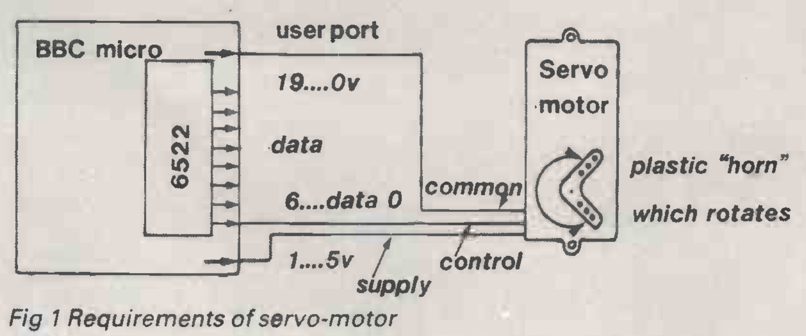

Fig 1 Requirements of servo-motor

If the microprocessor outputs the number 255 (&FF) all wires will be five volts. Likewise the number 0 (&0) is represented by all wires being set at 0 volts, and 240 (&F0) is represented by the four most significant wires (or bits) being set at five volts and the four remaining ones being set at 0 volts.

When the microprocessor outputs a number (bit pattern) this is maintained for less than a microsecond before the next number is arrived at. To trap the bit pattern an interfacing chip is used (in the case of the BBC Micro user port this is a 6522). If the microprocessor writes a bit pattern (that is, number) to the 6522, the 6522 can maintain that pattern until it is told to change it or 'latched'. In fact a single 6522 has not just one but two similar user ports: port A and port B. Port A is used for the printer and has a driver chip to send the output over long distances, but I used port 'B' — although more fragile, it saves having to disconnect the printer. (The *User Guide* explains how to handle the user port on pages 435-437.)

The 6522 uses memory locations &FE60 to &FE6F, so those addresses do not contain memories but the various registers of the rather complex 6522 chip. Two methods can be used to put bytes into, or read bytes from, these memory locations. They can be POKEd (?&FE00=&FF) or PEEKed (PRINT ?&FE60) directly, or they can be approached the *proper* way using OSBYTE &96 for reading and OSBYTE &97 for writing. The latter has the advantage of being processor-independent, so if you have a second 6502 processor system it will work. (Incidentally, does *anyone* have a second 6502 processor system?) The former method has the adavantage of speed and was used for this reason.

To output a value to user port B, instruct the 6522 to switch to output

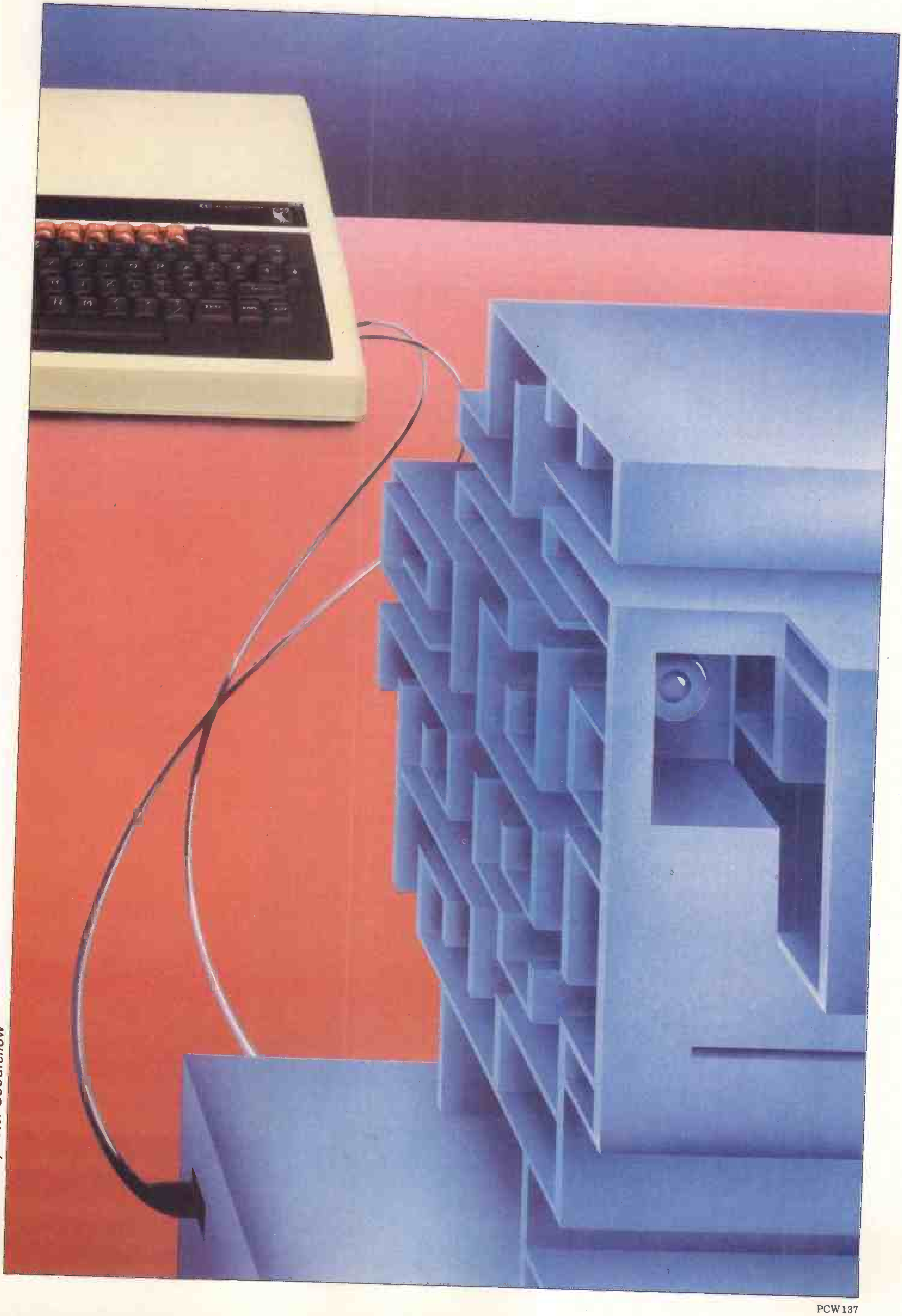

Illustration by Peter Goodfellow

mode, POKE the value &FF to the data direction register B

?&FE62=&FF

and the pattern of voltages on user port pins 11 to 18 will be dictated by the value (between 0 and 255) POKEd into the data output register B

?&FE60=value

A value of &FF (255) will make them all five volts, &0 all zeros, and so on.

A Basic program can be written which sets all the data pins to five volts, immediately turns them off again and then loops continuously to produce a stream of pulses.

For example:

```
10 ?&FE62=&FF
20 NOW=TIME
30 FOR 1%=1 TO 200
40 ?&FE60=&FF :REM all on
50 ?&FE60=&00 :REM all off
60 NEXT       :REM next pulse
70 T=TIME-NOW
80 PRINT "TIME PER LOOP=";T
```

But there are two major problems. Firstly, it takes too long to go round the loop; the loop produces 20 pulses per second and 50 are needed. Secondly, although the pulse length lies between one and two milliseconds, it cannot be controlled. Inserting a couple of null statements such as:

45 Z%=0:Z%=0

will cause the motor to move to a new position but it's hardly a credible way of controlling a motor. Basic can be used to decide the commanded position for the motor but cannot be used to drive it as this requires machine code. No problem: the BBC Micro operating system makes it relatively easy to use assembly code as part of a Basic program which can then automatically assemble this to machine code. Furthermore, the BBC Micro makes it unusually easy to handle interrupts.

Computer interrupts

But first of all let's see how to write a machine code program to produce a single pulse. To start the pulse load the accumulator (which is analogous to the display register of most calculators) with the number &FF (255), then store the accumulator contents in what the processor thinks is memory cell &FE60 but what is really the 6522's output register. This will make all data pins five volts.

LDA £&FF /backslash starts a remark

STA &FE60 /store accumulator in memory cell number &FE60 (hexadecimal)

The processor will be made to wait for roughly three quarters of a millisecond by loading the Y register with 255 (&FF) and decrementing it by one, checking to see if the result is a zero and, if not, then looping back to decrement Y again.

LDY £&FF

.LOOP DEY /this takes two cycles — one microsecond

BNE LOOP /three cycles if it branches

The total time for a single loop is five cycles or 2.5 microseconds (256 loops takes 640 microseconds).

To turn the pulse off after a variable time, a loop can be used again, but instead of loading the Y register with &FF it should be loaded with the contents of a variable called 'angle'. The larger the angle, the longer the pulse will last. Finally zeros are output to the user port and the pulse is over.

```
LDY angle
    .LOOP2 DEY
    BNE LOOP2
LDA £&00
STA &FE60
```

With this arrangement the pulse can be made to vary from approximately 0.64 milliseconds to approximately 1.3 milliseconds. Clearly this method is an answer to the problem. The pulse can be made longer by adding another loop if necessary. A full working program is given in Listing 1, but before consulting it consider how to replace one pulse by a stream of pulses.

A pulse must be produced roughly every 20 milliseconds. This interval can be timed using the event timer. Like TIME the event timer works in centiseconds. It can be instructed to generate an interrupt pulse whenever it crosses zero: if it can be made to count up the two centiseconds (20 milliseconds, or 50 per second) from &FFFFFFFFFE to &0000000000 then generate an interrupt and if that interrupt pulse forces the microprocessor to reset the timer and run the pulse generating program outlined above, then a stream of pulses will be produced.

The 6502 processor has a maskable interrupt pin. If a signal is received on this pin the processor drops whatever it was doing and starts to handle the interrupt. The operating system makes extensive use of interrupts and the machine runs under continuous interrupts — TIME is constantly updated, bytes are transferred to input buffers, and so on. All these things continue even when an ordinary program is being run or edited and are carried out using interrupts. The BBC Micro enables extra routines to be added which can be executed whenever the appropriate interrupt occurs. The operating system already recognises many possible sources of interrupts, automatically identifies them and passes them as 'Events'. An Event 5 is generated when the interval timer crosses zero, enabling and then trapping this event is 6502 interrupt handling made easy.

To start the interval timer it must be given a starting value. An OSWORD call with the accumulator (A%) equal to 4 will write a value to the timer. The value to be written must occupy five bytes at an address pointed to by X%=low byte and Y%=high byte of the 16-bit (two byte) address. Some space for these five bytes can be reserved with a DIM statement.

```
10 osbyte=&FFF4 :REM osbyte
   address
20 DIM timer% 12
```

```
 10 osbyte=&FFF4
 20 A%=&97 :X%=&62 :Y%=&FF
 50 CALL osbyte:REM set up port B for
    output
 66 NOW=TIME
 70 CLS
100 DIM timer% 12 ,read% 12
110 xtimer=timer% MOD 256
120 ytimer=timer% DIV 256
122 xread=read% MOD 256
124 yread=read% DIV 256
125 PROCInitial
130 t=.02   :REM sec between pulses
140 time%=&FFFFFFFF -(t*100) +1
150 timer%?4=&FF
    :REM load highest byte
170 !timer%=time%    :REM set up timer
171 REM enable events to start pulses
174 *FX14,5
175 A%=4 :X%=xtimer :Y%=ytimer
    :CALL &FFF1
185 REM get ready to watch timer
186 A%=3 :X%=xread :Y%=yread
187 I=0 :value%=100
189 NOW=TIME
190 REPEAT
191   value%=128+128*SIN(I)
196   PRINTTAB(10,10)"value ="value%"
   I="I
200   ?angle=value%
202   wait=TIME
203   REPEAT
204     CALL &FFF1 :PRINTTAB(2,5)!read%"
   "TIME
205     UNTIL TIME>wait+10
208   I=I+.5 :IF I>10 THEN I=0
210   UNTIL TIME>NOW+2000
211 REM disable events
215 *FX13,5
219 END
220
230
240 DEF PROCInitial
250 DIM space% 200
260 FOR C=0 TO 2 STEP 2
261   portb=&FE60
270   P%=space%
280   angle=P%
290   P%=P%+1
300   [OPT C
310   .eventhandler
311   \save registers first
320   PHP:PHA:TYA:PHA:TXA:PHA
340   LDA £&04
350   LDX £xtimer
360   LDY £ytimer
370   JSR &FFF1 \reset timer
380   LDA £&FF
390   STA portb
395   \wait approx. 1msec
400   LDY £&FF
410   .LOOP DEY
420         BNE LOOP
425   \and countout pulse
430   LDY angle
440   .LOOP1 DEY
450         BNE LOOP1
452   \stop all output pulses
455   LDA £&0
457   STA portb
460   PLA:TAX:PLA:TAY:PLA:PLP
470   RTS
480   ]
490   NEXT C
495 REM point to eventhandler
500 !&220=eventhandler OR (!&220 AND
    &FFFF0000)
510 ENDPROC
520
530
```

Listing 1

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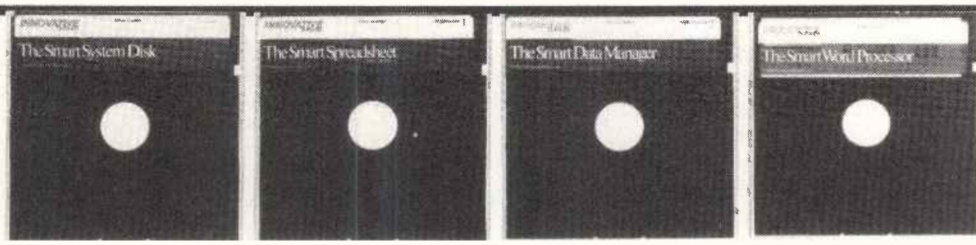

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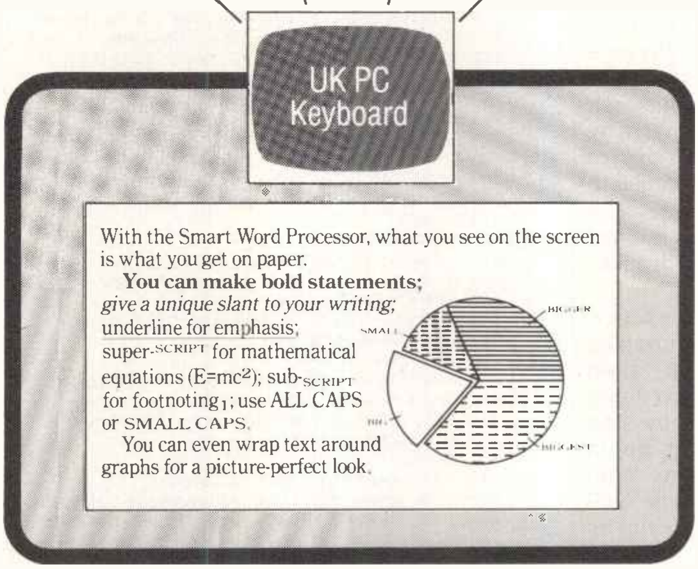

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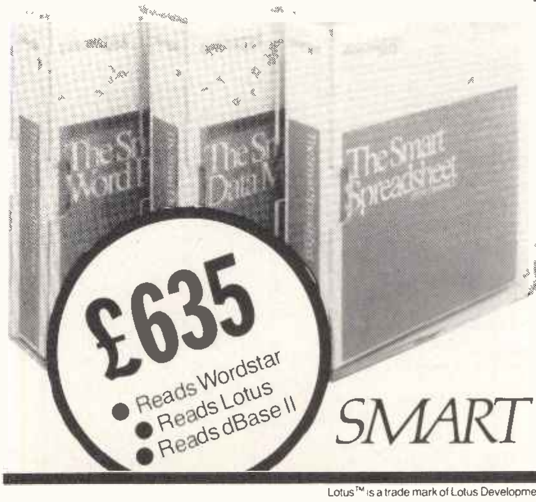

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```
30 X%=timer% MOD 256
40 Y%=timer% DIV 256
50 !timer%=&FFFFFFFE :REM 2
   centiseconds countdown
60 timer?4=&FF :REM fifth byte
70 A%=4
80 CALL osbyte
```

The Basic program above will start the timer counting down two centiseconds. If Event 5 is first enabled using *FX14,5 then as soon as the timer hits zero the processor will jump to whatever routine is pointed to by the address in &220 (low byte first followed by the high byte) (obviously the address of the pulse generating program must be inserted into the vector at &220).

The program shown in Listing 1 loads the Event vector with the address of the Event handler routine on line 500. The Event handler routine first saves all the registers on the stack (a last-in, first-out buffer), then resets the timer, delivers a pulse and finally reinstates all the registers (X,Y,A and status registers). The 'C' loop assembles the program; by stepping from 0 to three, in steps of three, the operating system is forced to list the assembled program as it is assembled. By stepping to two instead of three listing of the assembly process can be suppressed.

The Basic program sets up the timer, assembles the Event handler, enables the Events, starts the timer, then repeatedly sets the commanded angle to new values (actually a lumpy sine wave) until twenty seconds are up, at which point it turns off the events. With a motor connected the motor will follow the lumpy sine wave, moving its 'horn' to each commanded angle in turn. Everything stops after twenty seconds. If the events are not turned off they will continue even though the Basic program may have finished — the servo-motor handling routine will have become a temporary part of the computer's operating system.

This program works well but is a little restrictive as all eight data lines on the output port produce the same pulse shape.

More than one motor can be handled simultaneously by rethinking the way in which the pulse is terminated. Clearly there is no time to count down eight different values, turning off each motor as its counter times out. An alternative method is to generate a look-up table of 256 values; the timing loop loading and outputting each byte (pattern) in turn. As the table would take too long to produce (since bit patterns would still have to be generated) the trick is to utilise the 'AND' instruction. A logical 'AND' returns one *only* if both inputs are ones, otherwise it returns zero (see Fig 2).

Listing 2 shows a Basic program to position up to eight servo-motors simultaneously. Simple key presses

```
L.
 10 MODE 0
 15 REM ****************************************
 16 REM        This is important
 17 REM ****************************************
 20 osbyte=&FFF4
 30 A%=&97 :X%=&62 :Y%=&FF
 40 CALL osbyte:REM set up port B for output
 50 CLS
 60 DIM p%(8)
 70 DIM timer% 12 ,read% 12
 80 xtimer=timer% MOD 256
 90 ytimer=timer% DIV 256
100 xread=read% MOD 256
110 yread=read% DIV 256
120 PROCinitial
130 FOR I%=angle TO angle+8:angle?I%=128:NEXT
140 t=.02  :REM sec between pulses
150 time%=&FFFFFFFF -(t*100) +1
160 timer%?4=&FF     :REM load highest byte
170 !timer%=time%    :REM set up timer, enable events
180 *FX14,5
190 A%=4 :X%=xtimer :Y%=ytimer :CALL &FFF1
195  REM ****************************************
196  REM           this is filler
197  REM ****************************************
200 CLS
210 PRINT"PRESS  F for faster rate  S for slower rate of change"
220 PRINT"         1 for motor 1 forwards  ! backwards"
230 PRINT"         2                                  ..."
240 PRINT"         3    etc"
250 PRINT"       L for lower pulse frequency   H for higher"
260 PRINT''''"SPACE BAR TO FINISH"
270 PRINTTAB(25,8)"POSITION OF THE FIRST MOTOR PLOTTED AGAINST TIME"
280 PRINTTAB(25)"In this program the motor position is controlled "
290 PRINTTAB(25)"by pressing keys, however the motors could"
300 PRINTTAB(25)"follow any pattern(s)"
310 delta=1
320 NOW=TIME
330 motor=0 :@%=&00020005
340 REM layout screen, plot motor 1 angle and display others
350 PRINTTAB(0,15)"delta............"
360 FOR I%=1 TO 8 :PRINT"Motor ";I%;" position " :NEXT
370 PRINT"pulse frequency..."
380 VDU 28,17,31,79,0
390 MOVE398,98 :DRAW 1202,98 :DRAW 1202,602
395 DRAW 398,602 :DRAW 398,98
400 VDU 24,400;100;1200;600; :VDU 29,400;100;
410 x=0 :MOVE x,2*(?angle)
420 REPEAT
430    IF INKEY(-68) THEN delta=delta+1
440    IF INKEY(-82) THEN delta=delta-1  :IF delta<1 THEN delta=1
450    IF INKEY(-87) THEN t=t+.005 :time%=&FFFFFFFF -(t*100) +1 :!timer%=time%
460    IF INKEY(-85) THEN t=t-.005 :time%=&FFFFFFFF -(t*100) +1 :!timer%=time%
470    position=FNmotor(delta) :IF position=-1 THEN 490
480    p%(motor)=position
490    PRINTTAB(0,15)delta
500    *FX21,0
510    FOR I%=1 TO 8 :PRINTp%(I%) :NEXT
520    DRAW x,2*(?angle)
530    x=x+4 :IF x>800 THEN x=0:MOVE x,2*(?angle) :ELSE :DRAW x,2*(?angle)
540    UNTIL INKEY(-99)
550 *FX13,5
560 PRINT"bye"
570 END
580
590
600 DEF FNmotor(rate) :REM returns -1 if no changes
610 REM moves motor to new position value of which is returned
620 REM the number of motor repositioned is returned in  'motor'
630 K%=INKEY(5)
640 IF K%<&21 OR K%>&38 THEN a=-1 :GOTO 720
650     motor=(K% OR &30) - 48
660     s=K% AND &10  :REM 0 backwards 16 forwards
670     IF s=0 THEN rate=-rate
680     a=angle?(motor-1)+rate
690     IF a>255 THEN a=255
700     IF a<1 THEN a=1
705  REM ****************************************
706  REM     this sets angle of each motor in turn
707  REM ****************************************
710     angle?(motor-1)=a
720 =a
730
740
750
755  REM ****************************************
756  REM       What remains is important
757  REM ****************************************
760 DEF PROCinitial
770 DIM space% 600
780 FOR C=0 TO 2 STEP 2
```

Listing 2 *. . . continued*


Kuma
~ a unique pool of expertise
EPSON
Hardware plus KUMA software
SHARP
Hardware plus KUMA software
NewBrain
Hardware plus KUMA software
AMSTRAD
Hardware plus KUMA software
TATUNG Einstein
Hardware plus KUMA software
CASIO
Hardware plus KUMA software
commodore 64
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ELECTRONIC MAIL BOX
PRINTERS
Dealer and Distributor enquiries welcomed
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Horseshoe Road, Pangbourne
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Hardware Software
TATUNG EINSTEIN
AMSTRAD CPC 464
EPSON PX-8
CASIO FP 200
COMMODORE 64
Hardware Software
SAGE
SHARP 700
SHARP A
SHARP PC-5000
SIRIUS
APRICOT
EPSON HX-20
EPSON QX-10
NEWBRAIN
SPECTRUM
ELECTRONIC MAIL
PRINTERS
NAME
ADDRESS
POST CODE
PHONE NOW or SEND FOR DETAILS
PANGBOURNE (073 57) 4335
Kuma Computers Ltd.
Unit 12, Horseshoe Park, Horseshoe Road, Pangbourne,
Berks RG8 7JW
Telex 849462 TELFAC KUMA
COMET: KUMA TELECOM GOLD: KUM ØØ1

"AND" truth table		
input 1	2	output
0	0	0
0	1	0
1	0	0
1	1	1

Fig 2 'AND' truth table

change the commanded angles. The Event handler program starts the same way as before but loads 256 memory addresses with &FFs — a simple process which takes about 1.2 milliseconds. Then all the pulses are started and the table is filled with a list of exceptions. For example, if motor 0 (connected to data bit 0 on the output port) is to receive a pulse which stops after a timing count of 128, then the 128th byte of the above table is loaded with &FE (bit zero is zero) which replaces &FF. Likewise if motor 1 had to be turned off after a count of 10 then the 10th byte of the table would be loaded with &FD (bit one is zero). Next a short wait before the timing loop itself. The timing loop starts with the accumulator set to &FF (all bits on). This is ANDed with each byte of the table in turn and output.

In the example above the first nine bytes of the table contain &FF and since &FF(accumulator) AND &FF(table) is &FF, nothing happens. However, when the 10th byte is encountered the operation is &FF AND &FD yielding &FD which turns off the pulse going to motor 1. The next byte of the table contains &FF but since the accumulator now contains &FD, &FD AND &FF yields &FD again and motor 1 remains off. This continues until it reaches the 128th element of the table at which point the operation is &FD AND &FE yielding &FC which leaves motor 1 off and also turns off motor 0. Thus by ANDing the table elements in turn, the motors can be progressively turned off without having to time each one separately. (Note that the exceptions were also loaded into the table by ANDing in case two pulses had to be turned off simultaneously.)

The Basic progam checks the keyboard to see which motor is to be adjusted then POKEs the new value into the appropriate angle (motor 0 is controlled by angle, motor 1 by memory cell angle+1, and so on).

Since the whole eight motor Event handling routine only lasts about 2½-3 milliseconds in every 20 milliseconds the interruptions slow Basic programs down by about 12·5%.

Since this is hardly noticeable under most circumstances the computer appears to run the Basic program and the Event handler program at the same time.

```
790   zeropage=&70    :REM free for users
800   portb=&FE60 :osword=&FFF1
810   P%=space%
820   angle=P% :P%=P%+8   :REM potentially 8 motors
830   table=P% :P%=P%+256   :REM· 256 possible pulse lengths
840   lowtable%=table MOD 256
850   hightable%=table DIV 256
860   ?zeropage=lowtable% :zeropage?1=hightable%
870   [OPT C
880   .eventhandler
890   PHP:PHA:TYA:PHA:TXA:PHA
900   LDA £&04
910   LDX £xtimer
920   LDY £ytimer
930   JSR osword
940   LDY £&0
950   LDA £&FF
960   .fill  STA (zeropage),Y
970          INY
980          BNE fill
990    \Start pulse. for some motors it may be possible to start
1000   \before filling table and so reduce the wait loop below
1010  LDA £&FF :STA portb
1020   \fill table with exceptions
1030  LDA £&FE:LDY angle   :STA (zeropage),Y
1040  LDA £&FD:LDY angle+1:AND (zeropage),Y:STA (zeropage),Y
1050  LDA £&FB:LDY angle+2:AND (zeropage),Y:STA (zeropage),Y
1060  LDA £&F7:LDY angle+3:AND (zeropage),Y:STA (zeropage),Y
1070  LDA £&EF:LDY angle+4:AND (zeropage),Y:STA (zeropage),Y
1080  LDA £&DF:LDY angle+5:AND (zeropage),Y:STA (zeropage),Y
1090  LDA £&BF:LDY angle+6:AND (zeropage),Y:STA (zeropage),Y
1100  LDA £&7F:LDY angle+7:AND (zeropage),Y:STA (zeropage),Y
1110  \table is now loaded. fill in some time
1120  LDY £&60
1130  .wait DEY
1140         BNE wait
1150  LDA £&FF  \all pulses on
1160  LDY £&0
1170  .loop AND (zeropage),Y  \but mask off with each exception in turn
1180         STA portb
1190         INY
1200         BNE loop
1210   \all pulses should now be finished
1220  PLA:TAX:PLA:TAY:PLA:PLP
1230  RTS
1240  ]
1250  NEXT C
1260 !&220=eventhandler OR (!&220 AND &FFFF0000)
1270 ENDPROC
1280
```

Listing 2

Conclusion

All kinds of programs can be produced to command motors to move.

To control an ordinary low voltage (less than 12 volts) DC motor a relay is required. The most obvious one to use is the tape recorder controlling relay. Just connect pins 1 and 7 (see page 499 of the *User Guide*) of the cassette recorder socket in series with your motor and battery and you can switch the motor on and off.

Using
A%=&89
X%=0 :REM turns motor off
CALL &FFF4 :REM osbyte call
X%=1 :REM turns motor on
CALL &FFF4
you should be able to hear the relay clicking.

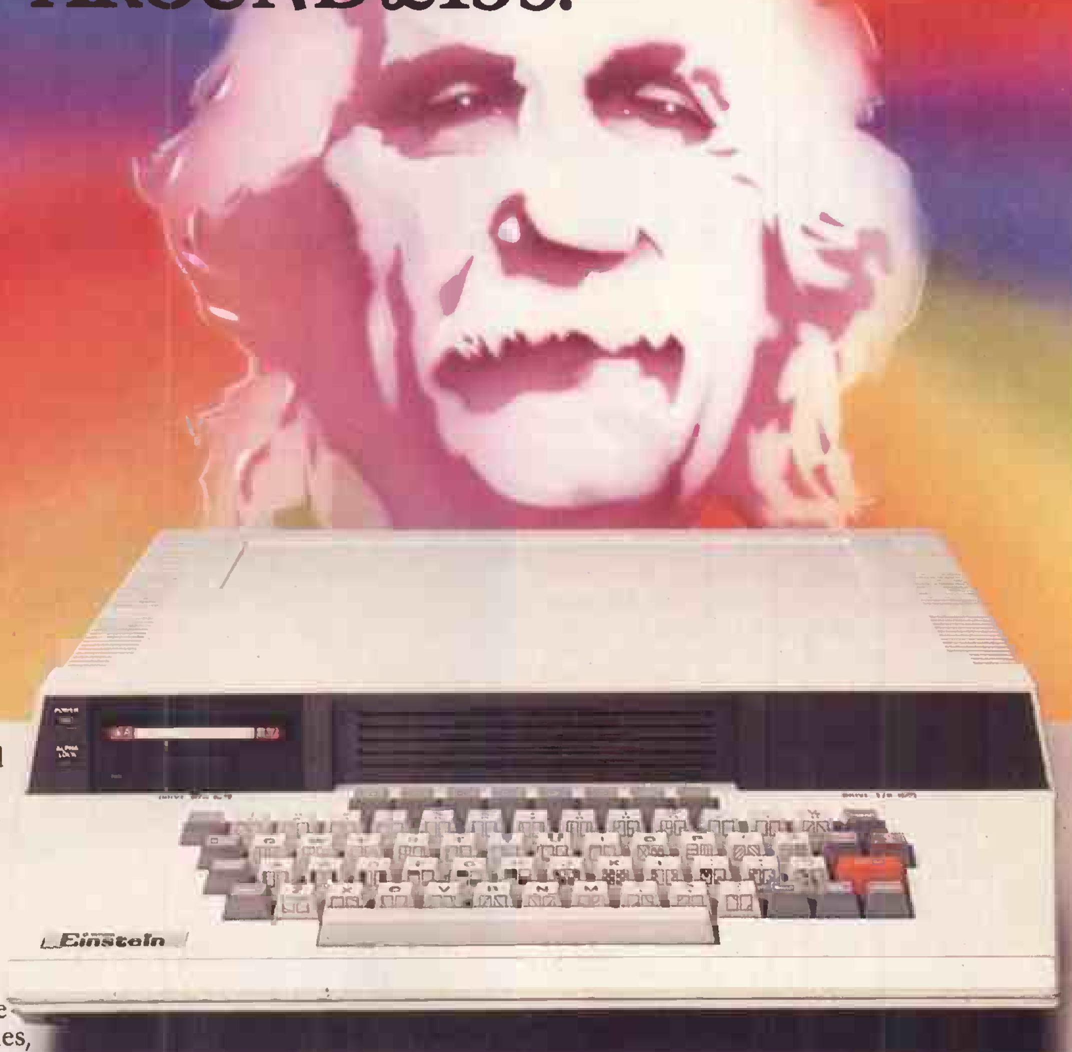
To control more than one ordinary small DC motor the user port can be used but this time rather more simply than with servo-motors. Not enough current can be drawn from the port to drive (as opposed to control) a motor directly so a buffer and power supply must be inserted between the data pin and its corresponding motor.

A convenient chip is a ULN2803A (R.S.303-422) which contains eight independent Darlington drivers. These behave rather like switches and are connected in series with the motor and its power supply; five volts on an input pin switch it on while 0 volts input switches the circuit off. Each driver can be controlled directly by the user port data pin and will switch up to 500 milliamps at five volts (absolute maximum of 2.5 watt motors).

Connect a five volt supply voltage to the supply pin (10) and ground to pin 9, and each data output pin to the appropriate Darlington input pin; for example, input 1 is pin 1 and its output pin 18, input 2 pin 2 output pin 17. The motor is connected between the five volt supply and the appropriate Darlington output pin. When the input is high (five volts) its output is shorted to ground switching on the motor, but when it is low (0 volts) the output pin voltage becomes the same as the supply voltage and the motor is switched off. No other power supplies or components are needed.

Just imagine: this could be the way to start a family of robots. Think of the possibilities. Could you produce a robot that BREAKs its own controlling program? END

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.

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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
Connection to both TV and optional colour monitor, most printers and other computers via RS232C interface. Also twin joystick ports, 8 bit user port, exclusive Tatung Pipe.

BUILT-IN FLEXIBILITY
Powerful Crystal BASIC. Multi-lingual plus ability to run CP/M.†

BUILT-IN VERSATILE SOUND
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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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DIAL 100 AND ASK FOR FREEFONE EINSTEIN FOR YOUR NEAREST STOCKIST.

†CP/M is a trade mark of Digital Research Inc.

~CHECKOUT~

Power to the printer

Home enthusiast or businessman, choosing a printer for your micro can often be a difficult and expensive decision. Tony Hetherington tackles the Alphacom 81 and the Brother HR-5 which meet most user requirements and don't cost an arm and a leg.

Sooner or later every home user considers buying a printer. However, until recently, the choice has been between buying a low cost ZX style printer or paying more than twice the cost of your micro for a better one. Both the Alphacom 81 and the Brother HR-5 fall neatly between the two stools and offer a reasonable 80 columns of printing at around £150.

Alphacom 81 vs

Alphacom 81

The Alphacom 81 is the cheaper of the two machines and is aimed squarely at the home user. But if your micro isn't on the list of available interfaces then you won't be able to use it. At the time of writing the list includes Commodore 64/VIC 20, BBC B, Dragon, Atari and a more general RS232 (for the Spectrum and NewBrain among others). Consequently few users will be excluded, but if you have two micros then you'll have to buy a second interface (the first one is included in the price).

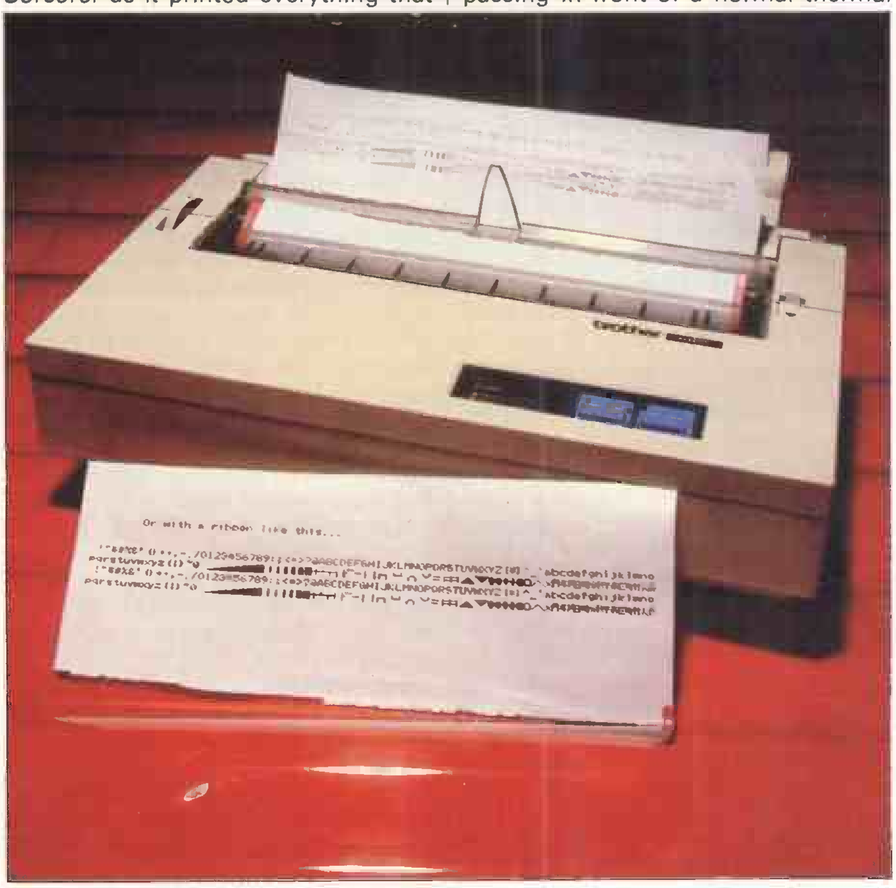
This dependence on a machine-specific interface has both advantages and disadvantages. For example, the user of the printer has all the instructions he needs for his machine and no more, whereas shops will have to stock the printer and all available interfaces.

Physically the Alphacom 81 printer is uninspiring — design is merely functional. The cream casing houses the paper roll and the printer mechanism and nothing more. Its only features are On/Advance and Off switches and a hole at the back for the interface cartridge.

The On/Advance switch is the only problem in an otherwise faultless printer. The first press of this switch turns the printer on with subsequent ones advancing the paper. Unfortunately, nothing indicates that the machine is on which is rather irritating and could present a few problems. I would advise users to turn the printer off when not in use as it gets very hot. (I must stress that I had no problems with it but feel it would be advisable to keep it cool.)

Dean Electronics, the company behind the Alphacom, claims that it is a high speed thermal printer operating at 100 characters per second. This is true except that it only prints 80 characters to a line and the resulting paper feed slows it down to a speed which is much nearer 80cps.

But thermal printers have their shortcomings: they need special paper and print quality is usually poor. Special paper is required as the printer forms letters by burning the relevant dot



Brother HR-5

pattern onto the paper's coating. Consequently, the dots have 'fuzzy' edges and letters lack definition. Although the result is readable it doesn't reproduce well (*PCW* doesn't accept program listings on this or any other type of thermal paper). Such a printout is also not good enough for word processing.

Looking at all these shortcomings, one might wonder what the Alphacom *can* be used for and why it is better than cheaper thermal printers?

Well, the main drawback with cheaper thermals — and hence the Alphacom's advantage — is paper width. The Alphacom's 80 columns are clearer, easier to read and print a lot faster than 32-40 column widths.

I tested the Alphacom 81 with a Commodore 64 and found it particularly useful for development listings and hard copies, such as adventure game reports. I was particularly impressed with its recording of my feeble attempts to solve the problems of *Infocom's Sorcerer* as it printed everything that appeared on the screen without slowing the game down.

As mentioned above the printer comes with a special interface for your particular machine. You also receive a general and an interface manual: the latter includes details and examples of the commands you will need to make the most of the printer. These commands enable you to print both ASCII and graphics characters which can be either upper or lower case and formatted into pages. Also print can be underlined, reversed or elongated (each character reaching double width).

Finally, the printer can be placed into graphics mode. This is where each bit of a pixel is represented by a dot on the printer and characters are closed up allowing the printer to be used for graphics or screendumps.

Brother HR-5

Flexibility is the key to the Brother HR-5 which is the youngest, smallest and cheapest of the Brother printers. Described as a 'thermal transfer printer' it has a curious mechanism.

As with the Alphacom, letters are burned onto the paper, only in this case the Brother burns them from a ribbon passing in front of a normal thermal printerhead. The ribbon is enclosed in a cassette and is easy to install and remove. This process is slower than conventional thermal techniques but the print is darker and better defined. Although the quoted printing speed is 30cps (it takes about 2.5 seconds to print a line of 80 characters), it winds on the ribbon at the end of every line which effectively halves the real printing speed.

A further advantage of this system is that it uses better quality paper. For best results it's advisable to use glossy or shiny paper which is available in either a roll or standard sheets. This is a definite plus over the Alphacom 81 as this type of paper is cheaper to buy and A4 sheets are easier to store.

But if speed is more important and normal thermal quality will do, then simply remove the ribbon and insert a roll of thermal paper.

The Brother printer can be powered either by four SPII batteries or from the main power supply. (Batteries have a limited life and the review set expired after several days as the paper ran out with the cassette ribbon not far behind.)

The Brother is nicely styled in a lighter cream casing than the Alphacom 81's and is pleasant to look at. Smaller and weighing less than the Alphacom it features online and line feed switches on its front panel, together with an alarm light accompanied by a bell whenever the paper or ribbon runs out. The On/Off switch is tucked neatly to the left-hand side and the back edge is just big enough to house the Centronics and optional RS232 interfaces. The Centronics interface gives Dragon and BBC compatibility, and others at a cost.

A choice of standard interfaces will please many, but certainly not home users whose machines lack a Centronics interface. Adding a compatible interface can cost up to £40. (This, on top of the £10 price difference, would make the Alphacom 81 a better choice for home users.)

The Brother will no doubt find its home in a briefcase alongside one of the many portable computers. Such applications would make best use of its features: lightness, standard interface and battery power.

Prices

	£
Alphacom 81 printer + one interface + one roll of paper	149.95
Two rolls of paper	5.50
Brother HR-5 printer + one roll of plain paper + two cassette ribbons	159.95
Mains power adaptor	14.75
Ribbon cassette	2.45
Paper — Thermal (per roll)	4.75
Paper — Plain (per roll)	2.60

Conclusion

When I began writing this review I thought that these two printers might mark the merging of two computer markets. But I was wrong.

The Alphacom is the latest in a line of printers which started with the 32-column Alphacom 32 and the Brother HR-5 has descended from a series of bigger 'brothers' — so the gulf still has to be bridged. The Alphacom's place is definitely in the home whereas the Brother is for people on the move. END

Painting by numbers

In the last three years Psion has worked closely with Sinclair to produce software for its machines. Mike Liardet takes a look at Abacus and Easel, two of the four programs bundled in with QL, and now being enhanced for the IBM PC, Apricot and Sirius.

Although Psion has concentrated mainly on the lucrative games market with such delights as a flight simulator, scrabble and chess, it has not entirely ignored the more serious Spectrum user. Both spreadsheet and database software figure in Psion's Spectrum catalogue in the form of Vu-calc (reviewed in *PCW*, September 83) and Vu-file. Evidently Sinclair must have been highly impressed with Psion — nearly two years ago it was awarded the enviable task of implementing the 'bundled' software for the new QL.

Psion's contribution to the QL amounts to four packages covering the four commonest applications for a personal computer — database, word processing, spreadsheet and graphics. We'll examine Abacus (spreadsheet) and Easel (graphics) here.

Although the QL is priced at the level of a games machine, Psion's software is eminently comparable to that available on machines costing five to ten times the price of a QL. The development of this software has been a major new venture for Psion; it has taken a team of highly-skilled programmers (working on a mainframe VAX) over 18 months to produce. Now that the project has been completed, Psion will not confine its activities to the QL. It is planning, in mid-July, to release all the packages in PC and MS-DOS versions, so owners of machines like the IBM PC and ACT Apricot will also get the benefit of Psion's labours.

At the time of this review QLs were in extremely short supply, so Psion invited me to spend the day evaluating the software on its own in-house QLs. I was also given a pre-release version of Abacus for the Apricot. Although Psion was at great pains to emphasise that the Apricot version was not fully completed and debugged, it stood up very well to my machinations and demonstrated: (a) that Psion really is quite close to releasing an MS-DOS version; and (b) it will be close to the QL version.

Abacus

Like the other packages on the QL, Abacus is provided on a single microdrive cartridge. These cartridges are not much larger than a fifty pence piece, contain about eight feet of tape in a continuous loop, and have the storage capacity of a low-density floppy disk (about 100k). The software is loaded by switching the machine on, inserting the cartridge in the microdrive and typing '1run mdv1 boot'. This rather cryptic command is needed because current versions of the QL do not automatically boot from a cartridge but need to be 'told' to do so. The time taken to load the software is not significantly different from the time taken to load software from a floppy disk.

When the software is first loaded a copyright screen appears, followed by the main working display (Fig 1). The QL has three text display modes: 40, 64 or 80 characters per row. Abacus can operate in any of these modes: in fact, it has a facility for changing between different display modes in mid-session. Most users prefer 80-character width but if the QL is displaying through a poor-quality TV, it may be necessary to work in 64 or even 40-character mode. Naturally, in 40-character mode, less information can be displayed and some of the prompts are more terse, but the software is functionally unchanged.

The principal working display is neatly divided into three areas. The top four lines of the screen are reserved for 'prompts' with the main spreadsheet display below (empty to start with), and an input line and status information immediately below that. All four packages use the same general screen arrangement which greatly eases the overall learning effort. They also all make use of the QL's colour display capabilities, using four different colours for most displays.

The Abacus spreadsheet is organised in a fairly standard way. The sheet has 64 columns, labelled A to Z, AA to BL; and 255 rows, labelled 1 to 255. With the QL in 80-character mode and with standard width columns, the main display can accommodate a rectangle of seven columns by 16 rows. One cell on the display is always highlighted — this is the 'cursor', or action point. Any formulae, labels or numbers that may be typed are assumed to belong to that particular cell and the results are displayed there accordingly. This action point can be moved one cell up, down, left or right by pressing the appropriate arrow key.

Attempts to move the cursor off-screen are dealt with in two different ways: if the arrow key is pressed and released, the screen is redrawn shifted one row or column along, to accommodate the destination cell, and the cursor is displayed in that cell. If the arrow key is held down or pressed very rapidly, there is not enough time to redraw the whole screen before the next character is transmitted so only the column or row headings are changed. Once the key is finally released the display is redrawn correctly. Although this sounds complicated it actually enables very rapid moves across the spreadsheet, with no delays for displaying intermediate areas that you are not interested in.

The operation of Abacus is controlled by specially assigned single keystrokes. As far as possible, Psion has standardised on the use of these special keys across all four packages. The QL has five function keys labelled F1 to F5. It also has arrow keys and an ESCAPE key, and these operate in the same way for all the software.

The arrow keys move the cursor action point(their use is fairly obvious in spreadsheeting and word processing).

The ESCAPE key causes the currently selected operation to be abandoned. Unfortunately, if this is used following a sequence of selections and subselections of commands it does not just 'undo' the most recent choice, but everything right back to the beginning. Following an escape keystroke, a multiple command sequence must be reentered from scratch.

The function key F1 is used for 'help'. Press this key at any time, even in the middle of entering a formula, and help information relevant to the current context is displayed. In order to conserve usage of RAM, the help information is stored on the microdrive cartridge, so it's advisable to leave the cartridge in place throughout the operation of the system. The QL has two microdrives, so this is no great disadvantage — the other is always available for loading and saving data, and so on.

Function key F2 enlarges the main display area to overwrite the prompts at the top. In Abacus, this increases the spreadsheet display capability from 16 rows to 20. Pressing F2 a second time restores the prompts display.

F3 selects 'command mode'. Abacus has 18 commands, such as 'Copy', 'Save' and 'Quit', which are all displayed in the prompt area after F3 is pressed. A command is then selected by pressing its initial letter. As there are only 26 letters in the alphabet some of the commands have slightly obscure names: 'echo' is used for 'replicating' formulae, but is not called 'copy' or 'replicate' because 'c' and 'r' are already in use for other commands.

F4 is used when the main spreadsheet display is split into two windows ('windowing' is one of the 18 commands). F4 jumps the cursor from one window to the other.

F5 is used for 'jumping' the cursor. After pressing F5 the destination cell coordinates can be entered, for example A1 or BG250, and the cursor is moved there directly with a redraw of the screen if necessary.

Modelling

As with most spreadsheet systems, the raw input for Abacus models consists of numbers, text and formulae. Numbers are simply keyed in and are entered into the current cursor cell once the ENTER key is pressed. Text is treated in a similar manner, except that it must be pre-announced by using the quotation character keystroke. If this is omitted, Abacus assumes you are entering an erroneous formula.

Formulae perform the spreadsheet calculations and are built out of references to other cells, constants and arithmetic operations. For example, the formula A1 + 10 * B2 would produce the result 110 if cell A1 contained 100 and B2 contained 10. The result is displayed instantly, as soon as the formula entry is completed. If A1 or B2 are altered for any reason, this formula and any other that references them would automatically be recalculated. This is fairly standard spreadsheeting but Abacus also has some additional unique formulae facilities:

'row =': if a formula is preceded by 'row =', it will automatically be replicated across the row currently occupied by the cursor. Before doing the replication, Abacus prompts for the range of columns to receive the formula, but because it chooses sensible defaults, it is normally only necessary to press ENTER in response. The result of this is that model building can proceed quickly and simply, a row at a time rather than a cell at a time. There is also a 'col =' facility that performs the same function on columns.

Row and column names: the first row and column of a spreadsheet are normally used for annotation. On a typical financial spreadsheet, the column headings would be month names and the row headings would be titles for particular items. These titles can be used in formulae: for example, if three of the rows in the spreadsheet are labelled Sales, Costs and Profits, then the formula Profits = Sales – Costs can be entered and the entire Profits row will be set up accordingly. The cursor does not need to be in the Profits row for this to happen and the names can be abbreviated providing they remain unambiguous. Column calculations can be specified in like fashion. In order to do this, Abacus must be able to distinguish between row and column names so obviously they must be unique — scarcely a serious limitation. However, the facility is limited in one respect — it only functions as a short-cut for formula input. Once a formula has been entered using row or column headings, it is translated into the internal format of cell references and the original formula is lost. Thus the profit formula above might result in cell B10 getting the formula B8-B6; C10 getting C8-C6, and so on, but the original formula is unrecoverable. This contrasts with financial planning spreadsheets where calculations are both entered and retained in this row-formula notation. However, financial planning software is notoriously slow compared with pure spreadsheet software; and Abacus certainly offers speed of operation even if the row formulae are not retained as such.

Special functions: Abacus provides a number of special functions not commonly available in spreadsheets, but very useful for display designing, and so on. For example, row = month (col() –1) can be used to set up a row containing the names for the months, leaving the first column blank; the 'row =' copies the formula right across the row. It is identical in all columns but in column B, 'col ()' evaluates to two (the second column) so the 2-1th month is displayed (that is, January). In column C the third column, the 3-1th month (that is, February) is displayed, and so

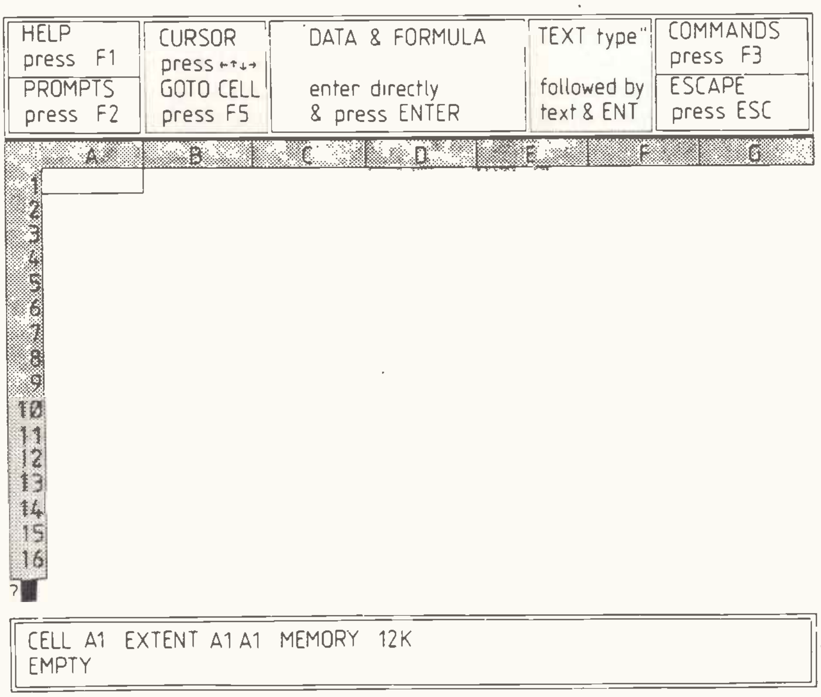


Fig 1 Main display (80 characters)

on. If more than 12 columns are required, months are repeated.

Other special functions include 'rept', 'len' and 'width' which can be useful for underlining and primitive graphing. For example, if cell A5 contains rept ("=",len(A4)), then whatever A4 contains will be underlined by "="s. The "width()" function could replace "len (A4)" above and the full cell width of the column would be filled with "="s. To create a bar graph for a column of numbers starting at Z9 the formula col=rept ("*",Z9) would suffice, but of course this produces a very rough graph. There are far more elegant graphing facilities available in Easel.

Finally, there are date functions, text functions, conditionals and a number of other useful modelling functions — all in addition to the more mundane trigonometry, net present value and other standard functions.

Formula storage: on most spreadsheet systems, when a formula is copied or replicated it is copied into each and every cell. If the formula is lengthy this can consume a lot of storage and if the formula is subsequently corrected, the entire replication process must be repeated.

Following replication in Abacus (using "row =", and so on), the formula is stored only once and each cell just refers to it. Abacus automatically adjusts its usage of the formula in accordance with the position of the cell referring to it, thus simulating the usual relative replication. The formula is also adjusted when it's displayed so this feature is almost invisible to the user; this is just as well as it would be almost impossible to use Abacus otherwise. This feature only ever manifests itself in two respects: more efficient use of storage, so bigger models can be created; and the omission of the replication process following a change to the formula — all cells that referred to the old formula automatically get the new one.

Bearing this in mind, Abacus is promising very large model capacity for the forthcoming MS-DOS versions but the QL Benchtested capacity is a little disappointing. Out of 128k of RAM in a standard QL, only 80k is available for applications software and the Abacus code consumes 68k, so these results were recorded with just 12k of RAM for the spreadsheet. Psion is currently optimising the QL Abacus code and aims to release another 18k for the spreadsheet, which should more than double its storage capacity. There are also expansion memory boards in Sinclair's pipeline which make a huge difference, but in the meantime QL Abacus on a standard QL can only accommodate small- to medium-sized models.

Special commands

Abacus offers 18 different commands. These are used for global operations on the entire spreadsheet such as loading and saving data, printing, and so on.

'. . . no serious comparisons can be made between Psion's software and anything else running on a £400 computer. On low-cost hardware the packages are in a class of their own.'

The following facilities are offered:

Communications with other Psion packages: Psion has designed a special file format that can be used by every package. Using this 'export' format data can be written to a file by one package and read by another. In particular, Abacus data can be transferred to the Easel graphics for drawing graphs, or to the Quill word processor for document integration. Spreadsheet data can also be picked up by the Archive database should the need arise.

In many respects, this facility greatly mitigates the disappointment that the Psion packages do not run under the QL's multi-tasking system. Theoretically, the QL can support several different applications all running simultaneously and you can switch between them at the touch of a button. This idea is a non-starter for the Psion software, as each package uses up all 128k of RAM with nothing left for anything else. However, it's better that the packages can communicate with one another than that they can all run simultaneously, so in this respect Psion has done the best it can with the available hardware.

Windowing: the spreadsheet display can be split in two, either vertically or horizontally. The display of each half is then dealt with independently of the other so that completely different parts of the spreadsheet can be held onscreen simultaneously. This facility is useful for holding important areas of the spreadsheet (for example, the bottom line) on display while other areas are being altered.

Spreadsheet editing: a selection of commands which can be used for adding and deleting lines into the spreadsheet. There is also a command for amending formulae — this can be quicker than retyping from scratch if the formula is complex. It also obviates the need to recopy after the change. If a copied formula is amended all previous copies are amended simultaneously.

Sorting: a whole column, or a part, can be sorted using the 'Order' command. This can deal with a mixture of numbers, formulae and text. Numbers are arranged in ascending order, before text which is arranged in alphabetical order. Only one column is affected by sorting. Other data in the row is left in the original position. Unlike Lotus 1-2-3 it's not possible to use sorting for 'records' which extend across several columns.

Formatting: a variety of different display formats can be selected. Numbers or text can be left-, right- or centre-justified within a column. Numbers can be preceded by monetary symbols such as $ or £ displayed in scientific or financial notation.

Printing and file operations: there are commands for saving the spreadsheet onto a named file on the microdrive cartridge, loading it back again and merging files into an existing spreadsheet model. Printing can be directed either at the printer or at a file.

During file operations the performance of the microdrives is quite interesting. The Benchmarks recorded just eight seconds to load a file but 80 seconds to save it. Evidently, saving

Benchmarks

Maximum number of columns: 64.
Maximum number of rows: 256.
Numeric precision: 14 digits.
Abacus tested on a standard Sinclair QL with 128k RAM.

1 (a) Number of rows of formulae accommodated: 56.
  (b and c) Recalculation time: 20secs (2.5 rows per second).
  (d) Horizontal scrolling: two columns per second.
  (e) Vertical scrolling: 2.5 rows per second.
2 Number of rows of numbers accommodated: 57.
3 Numbers of rows of text accommodated: 58.
4 Time taken to load/save 56-row model on microdrive: eight (load), 80 (save) seconds.

Benchmark (a) with additional 128k RAM board: 8832 cells (680 'rows').

data also involves verification with automatic correction if the verification fails. Thus saving a file must always take at least twice as long as loading and even longer if it fails to verify immediately.

Documentation

I didn't see the full QL documentation but a draft of the Abacus section lacking an index and contents page. This ran to over 50 pages, liberally illustrated, with clear instructions on using the software. If the rest of the documentation is up to this standard and is well indexed there should be few complaints.

The Abacus software is also very well documented with 'help' screens. The help facility is context-sensitive, so whenever you press the HELP key you get information pertinent to the activity you are attempting, with the further option to explore help for other areas.

Easel

Easel is a completely separate package from Abacus, on its own cartridge and with its own documentation. It can be used independently of all the other Psion packages but in particular it complements Abacus very neatly.

Having 'exported' part of an Abacus spreadsheet, this can be graphed by exiting Abacus and running Easel. The recently exported file can then be imported to Easel where a graph is displayed instantly. A typical export from Abacus might include several rows of the spreadsheet; for example, Costs, Prices and Profits across all 12 months of a year. All associated information, such as the month-name column headings, can be carried over by the export file where Easel sorts it to produce a graph. The graph can be printed out on a number of different graphics printers: the plots shown in Fig 2 were produced on an Epson MX-80.

Data can also be typed in directly with Easel. It employs a cursor which dictates the column in which the entered data will be graphed. The cursor can be moved from column to column using the left-right arrow keys. When a number is entered it is immediately plotted in the current column with axes automatically rescaled if necessary. Because of this and an intelligent use of default display options, it's possible to enter and see a graph in the time it takes to type the numbers.

Although Easel is billed as a 'business graphics' package it is also capable of plotting mathematical graphs as Fig 3 shows. For the technically minded this is a demonstration of Fourier Analysis: a plot of five harmonics summing to produce a square wave.

Prices

Sinclair QL including four Psion packages £399. MS-DOS versions (projected prices): £175 each, except Archive — £275. A substantial discount is available if all four are purchased.

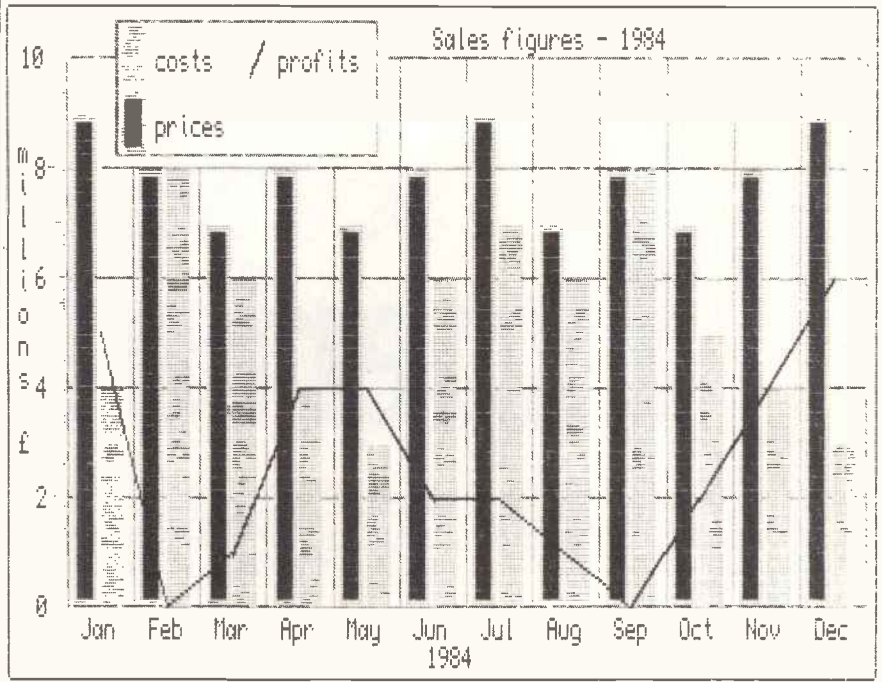


Fig 2 Sample graph produced on an Epson MX-80 printer

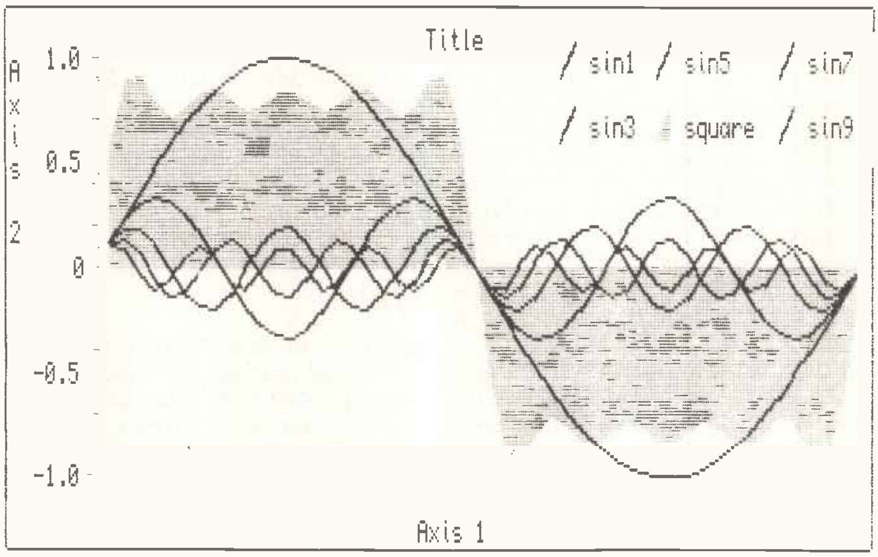


Fig 3 Mathematical graph produced with Easel

Conclusion

A common mistake made when comparing software is not to compare like with like, but I am deliberately going to do this here. This is because no serious comparisons can be made between Psion's software and anything else running on a £400 computer. On low-cost hardware the packages are in a class of their own.

Psion obviously recognises this — hence the forthcoming MS-DOS and IBM PC versions. Having seen a prototype of the MS-DOS Abacus it's clear that Psion is well down the road with the spreadsheet software at least. Assuming all goes well and it meets its targeted launch date (early September), Psion will be offering an integrated suite of word processing, database, spreadsheet and graphics at about the time this is published.

If the QL versions are anything to go by Psion will have a very interesting offering with a greater range of functionality than Lotus 1-2-3, which does not really offer word processing and is fairly weak as a database. Of course, at the time of writing the MS-DOS versions were not released; Lotus has launched Symphony and Ashton-Tate has Framework — to name but two future rivals for Psion.

The QL version of Abacus, available today, is functionally the equal of many MS-DOS spreadsheets. The QL Easel is simply excellent. Add the two other packages with links between all of them and a whole Sinclair QL for just £400, and how can you resist?

For more information contact: Sinclair on Camberley (0276) 686100 or Psion on (01) 723 9408. END

Expert advice

ES/P Advisor is claimed to be a powerful, cost effective tool for building expert systems on micros. Patrick Chang puts it to the test and forms his own 'intelligent' conclusions.

The Department of Health and Social Security (the DHSS to you, me and three million plus others) seems finally to have come to the conclusion that it can't understand its own rules. This may not be news to you, but the interesting thing is that the DHSS is looking seriously at using computers with expert system software as the only way of getting out of its present embarrassing predicament.

Expert systems are designed to absorb complex information and use the data in an *intelligent* way to arrive at the correct conclusion. One of the best known applications is of a computer mimicking a hospital consultant by analysing a patient's symptoms and providing the correct diagnosis.

Up until recently expert systems had only been developed on large expensive mainframe computers. However, recently, micro versions have become readily available. ES/P Advisor is one of this new breed.

Billed as a low-cost, entry-level tool for those wishing to build prototype or small-scale expert systems, ES/P Advisor is available for MS-DOS or PC-DOS (128k RAM).

ES/P Advisor, implemented in ESL's Prolog, consists of the Knowledge Representation Language (KRL), the KRL compiler and the ES/P consultation shell (see Fig 1). Knowledge is coded

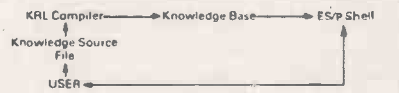


Fig 1 The ES/P Tool Structure

using the KRL to give a knowledge source file. This file can then be submitted to the KRL compiler whose task is to convert it into a knowledge base file for the consultation shell. The ES/P shell provides the front-end and allows the user to interact with the compiled knowledge base. Rules must always be *either/or* choices — fuzzy logic is not supported.

The package comes with five *show-them* knowledge bases on how to:
(1) conduct one's own conveyancing to sell a property;
(2) conduct PAYE procedures;
(3) bake bread;
(4) work out an opening bid in contract bridge; and
(5) decide when Statutory Sick Pay is due.

These knowledge bases are obviously designed to highlight the strength of ES/P Advisor in clerical and managerial applications.

Building a prototype system

In order to test Advisor I chose a non-trivial domain of application. But not *too* non-trivial. After all, the two classic non-trivial expert systems, Dendral and Macsyma, each took about 38 man years to build. My aim was to construct a system for advising how to select visual aids and media facilities for teaching and learning purposes in a large educational institution. Hence, the acronym MEG, for MEdia-Guide.

MEG consists of *rules* and, depending on what answers it receives, proposes various suggestions.

The institution I selected was the Polytechnic of Wales. Over 60% of the information needed for the knowledge base can be found in the Institution's Media Unit handbook. Additional information was acquired by asking members of the Media Unit and culled from personal experience with the unit.

In consultation, the system begins by asking the user about conditions concerning the session for which advice on visual and media aids is being sought. For example, will the lecturer be present? Is the session largely used for practical work or theoretical studies? Would visual aids enhance the learning process? And so on.

Given the domain and the readily available information, prototyping the system took place rapidly. Within a night, a skeletal system was running on the IBM PC. By the second night, the main parts of the prototype system were fully coded. After a third night spent massaging or rubbing out jumpy features, the prototype system was completed. But like all prototype expert systems, MEG needs to be refined before it can be used with confidence.

The KRL syntax used for coding the knowledge is simple and neat. The structure of the knowledge source file consists of a header, a title and sections (see Fig 2).

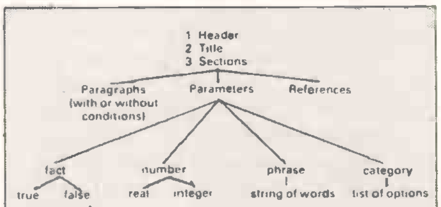


Fig 2 The Knowledge Source File

The header is used to identify the knowledge source file. This is followed by a title preceded by the word *title*.

For example:
title 'A Guide for Visual Aids and Media Facilities.'

After the header and title, the rest of the knowledge source consists of sections. Sections are made up of paragraphs, parameters and references. Paragraphs consist of text which are displayed when activated. References are like GOTO statements: they tell the compiler to *jump* to another section to continue processing from there. As in reading Prolog clauses, the compiler reads the section from top to bottom. Conditions can be strung together to give complex logical relationships involving parameter and constant values enclosed in braces.

For example:
```
{va helpful > 4 and
  lecturer_choice=extracts}
    reference suggestion_10.
```

Where the conditions are: if the parameter va_helpful (va for visual aids) has a rating of greater than 4 and the lecturer wishes to use extracts from books, then examine the advice in the section named suggestion_10. As shown in Fig 2, parameters can be facts, numbers, categories or phrases.

For instance:

real_life_sitn: 'there is a need to analyse a real life situation'
fact
askable
'Will the learning process require' & students to'
'analyse a real life situation?'

The keyword *askable* forces the question to be displayed when the parameter is first activated. Facts are either true or false. Numbers can be integers or reals. A negative number must be in decimal form — hence −10 should be written as −10.0. Phrases are used to store strings of words; for example, for names and addresses. Categories consist of specified lists of options.

Once invoked, the compiler displays a menu consisting of a list of the sources it already knows and a prompt at the bottom of the screen for a source file to be submitted. (The 40k prototype MEG knowledge source took seven minutes to compile).

The compiler converts the near-English representation of the KRL into Prolog clauses for the ES/P shell. Hence, the compiler and the shell perform the work of an inference engine. Compilation options include:

list, to request a listing summary file;
print, to direct a summary to the printer;
nocheck, for logic gurus to sidestep the consistency check; and,
return, for the defaults.

When errors are detected, messages are displayed by the compiler and processing is suspended until the user instructs the compiler to continue. Sometimes the compiler's pointer to a mistake's location is not spot on. One may get some surprising error messages when the disk is full. ESL stressed that one does not need to know Prolog to use the tool. In general, this is true.

At the end of the compilation, a statistical summary of the source file is displayed (see screenshot 1). If the compilation is a success, an executable, knowledge base file is created. This can now be submitted to the ES/P shell for the consultation proper to begin.

The ES/P shell is the most attractive component of the tool to look at. The front-end is friendly, professionally packaged and very pleasant to use. When the shell is invoked by typing ESP, a menu of knowledge bases is displayed and the system prompts for a selection (see screenshot 2). Colour and screen handling facilities are utilised to give yellow lettering on black and reverse out on bands of blue. The name of the section under examination is displayed on the top centre of the screen window. When a parameter is activated, its name is displayed on the top left corner as the current goal to be investigated. When a paragraph is activated, its text will be displayed in the middle of the window.

The shell expects a knowledge base file. If an uncompiled source file is offered, the shell will try to read it, complain about the syntax and dump you back into the operating system. When a valid file is specified, the introductory paragraph is displayed to advertise the aims of the knowledge base and the consultation show begins. When a parameter is first encountered either in a condition or when its value is needed but not yet established, the system proceeds to induce the value from a rule or by asking the user.

For example, with the following conditions

{**not lecturer_talking and not aval_to_consult and actions_required**}
reference suggestion_6.

The system will try to establish each parameter in a process known as *backward chaining*: that is, reasoning backward. If any of these parameters needs the value of another which has not been established, the required parameter is immediately investigated to obtain its value. Hence, in order to establish that suggestion_6 is relevant, it needs to collect the right evidence, by establishing that the lecturer is not talking — that is, not giving a lecture; that he is not available for consultation and that practical actions are required for the learning process. If any of the parameters fail to meet the condition, then section 'suggestion_6' is rejected and processing continues with the next statement in sequence. The consultation ends when a final advisory text is output which is marked by the keyword *quit* in the knowledge source file.

The shell supports a list of commands (see screenshot 3) which can be requested by typing *help* or ? These include:

val X — to force the system to obtain the value parameter X immediately;
status — to display the current values of all parameters,
print;
recap; and,
trace.

Other commands include **explain, how X** and **why N**. These three commands are, of course, very important as an expert system worthy of the name must be able to report what it is up to.

Documentation

The ES/P manual is slim, well-written and well-illustrated by short examples, but the tutorial, though adequate, is not comprehensive. Some facilities deserved further explanation: in particular, how numbers are computed, how conditions are examined by backward chaining, and how sections are referenced by forward chaining.

One very important feature is the claim that ES/P Advisor can be interfaced with a Prolog interpreter to allow Prolog clauses to be embedded in the KRL source files. The manual does not demonstrate how this can be done.

Conclusion

ES/P Advisor is a viable entry-level, cost-effective tool which offers clerical and managerial workers an opportunity to examine the relevance of expert systems in their respective areas of work.

Although it is specifically designed for text animation, it could also be used to construct an expert system based on the knowledge of an expert, rather than that contained in a manual or rule book, or for interests such as gardening, cookery, repair guides and so on.

ES/P Advisor is not designed to support *fuzzy* or uncertain deduction, and despite the fact that it is specially designed for text animation, its range of application is wide given the wealth of knowledge available in the printed form. At £600, the ES/P package is an excellent entry point into the expert system field.

Further information on ES/P Advisor (price £600 incl VAT) is available from Expert Systems Limited on (0865) 242206. END

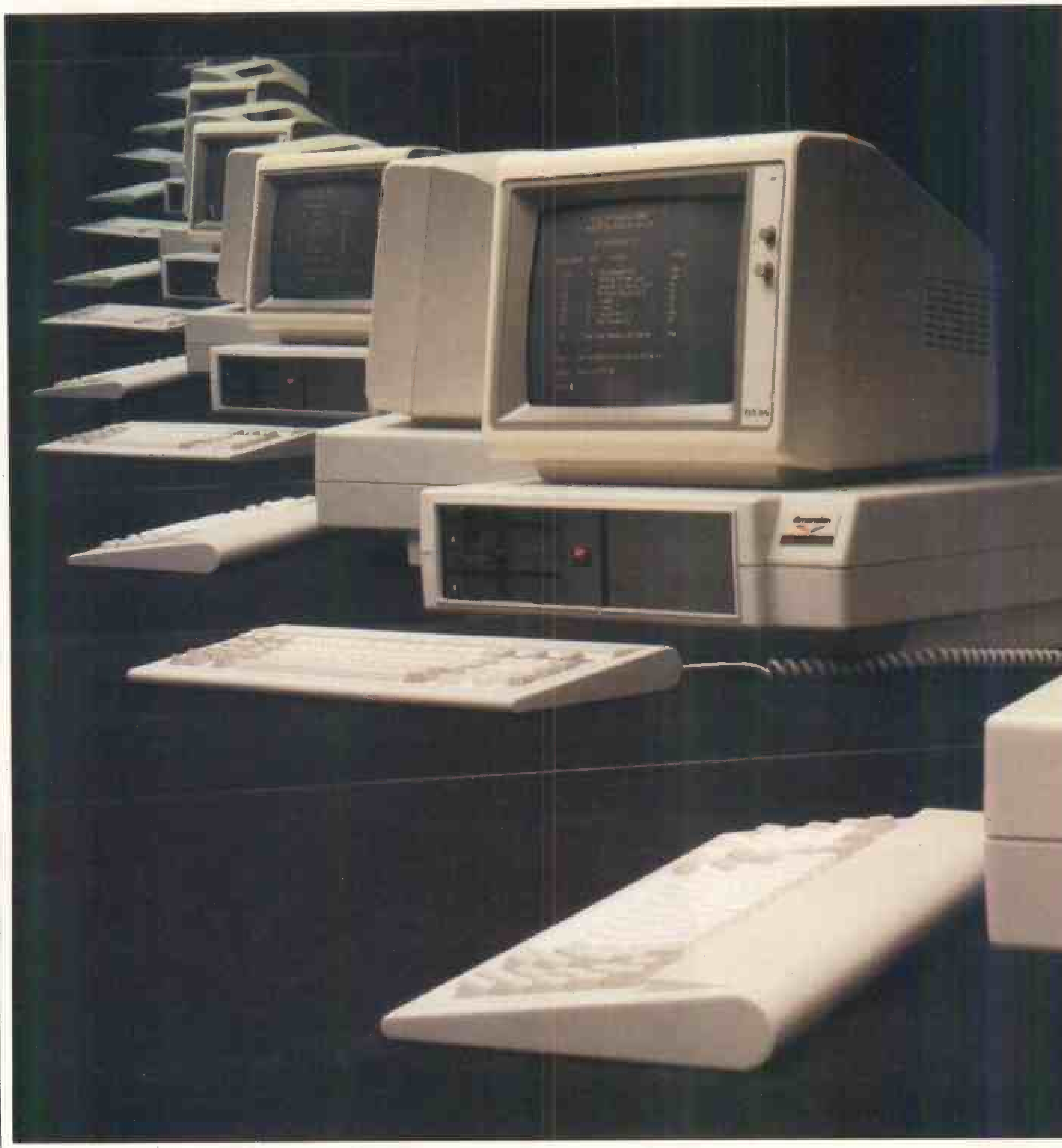
(1) Statistical summary of source file

(2) The system prompts for a selection

(3) List of commands

Dimension 68000

A machine with the capability to emulate the IBM PC, Apple II and Kaypro micros would seem to be a practical proposition. But it might also prove to be an expensive mistake. Peter Bright takes a look at the 'multi-faceted' Dimension 68000.



It had to happen. First we had the unfriendly micro, then we had the friendly micro, now meet the world's first schizophrenic micro. As well as being itself, the Dimension 68000 thinks it's an Apple II, an IBM PC and a Kaypro portable.

This is the first micro in the UK which can emulate more than one other machine at the flick of a switch. It is achieved by clever use of both hardware and software. The basic Dimension uses a Motorola 68000 processor with up to 512k of RAM on the main board. When you upgrade your machine there is no longer any need to throw away your software and start again — simply add a more powerful processor for the more difficult jobs.

Hardware

The Dimension conforms to the traditional three-box design: main unit, keyboard and display. The main unit is metal-cased, so there shouldn't be any radio frequency problems, and it looks very traditional — finished in cream with a black blanking plate at the front next to the disk drives.

The front of the main unit houses twin half-height 5¼in floppy disk drives and the reset switch. The switch signal can be intercepted under software control, so you can stop inquisitive fingers from blowing the system.

The rear panel houses an RS232 serial port, a Centronics printer port, a games paddle port, the composite video output and the keyboard socket. In addition there are six blanked off slots which can be removed if you wish to install expansion cards. The back panel also houses the ducting for the relatively quiet internal cooling fan.

The overall impression of the construction is one of solid dependability.

Ease of servicing is good — to get inside the main unit simply slacken six screws and remove the lid.

The main board sits at the bottom of the unit and takes up most of the available space. The build quality was good with no obvious signs of patching. A major part of the board on the review machine was taken up by RAM chips — up to four banks of 17, 64k chips gives a total onboard capacity of 512k. If you need more memory you will have to plug it into the expansion ports. The machine also comes with 8k of ROM which is used to hold the bootstrap loader, some basic diagnostics and the ROMBIOS routines for the operating system.

From the outset the Dimension was designed to be based on a bus system, allowing extra boards to be plugged in. Micro Craft, the US-based manufacturer, seems to be very eager that third party manufacturers should produce add-on cards for the machine. This eagerness extends to providing a system builder's toolkit and offering financial incentives.

The main board houses six slots for expansion cards. On the review machine three of these were occupied by 6512 (a 6502 with an external clock), Z80 and 8086 slave emulation processors (see 'Emulation' section). You can also add RAM cards, RS232 cards, and so on.

The main processor in the Dimension is the Motorola MC68000 CPU. This truly massive chip sits on the far right-hand side of the main board; and is powerful enough to allow the machine to be a practical proposition if you add more serial cards and a multi-user operation system. Unfortunately time did not allow me to try it out as a multi-user system.

Although the review machine was supplied with twin 5¼in, 40-track floppy disk drives, the casing has space for two more or for a hard disk.

The disks and their associated controller (a NEC 765) are highly programmable to allow them to read the different disk formats necessary for Apple, IBM and CP/M-80 emulation. They are capable of half stepping and so can read most protected Apple disks. In fact, when the machine is running under Apple emulation the drives even sound like Apple disks!

Even if you are not running emulation, you can still persuade the disks to read alien formats by using the FORMAT utility supplied with the machine under CP/M-68k. This utility allows you to read IBM PC single and double-sided CP/M, Tandy TRS-80, Kaypro, Cromemco SD and Osborne SD. I tried this out on some Kaypro CP/M-80 disks and it seemed to work fine.

The Dimension comes with a composite video output as standard, so you should be able to plug most popular monitors into the machine with no problem — as long as they support composite video. The review machine was supplied with a Taxan amber monitor which was fine. (As a matter of taste I still prefer green screens to amber.)

The default display on the Dimension is 80 columns × 25 lines. The 25th line is usually used to display system status. When you first boot CP/M it shows the disk formats that your floppy drives are set to read, and how much RAM is available.

The most interesting aspect of the Dimension's display is that its size can

Average IBM PC clone keyboard, although the Caps Lock and NUM Lock keys with built-in LEDS are innovative be altered under software control. In addition to the standard 80 × 25, the system comes with utilities to create 80 × 50, 20 × 20, 40 × 24 and 100 × 25 displays. Some of these configurations look very strange — 80 × 50 was virtually unreadable on the Taxan monitor because it was flickering so much. It is possible that a more expensive monitor wouldn't have this problem. The keyboard is a straight copy of the one on the IBM PC; but whereas the PC has one of the best keyboards available, this copy is merely average. Whoever manufactures it must be making a mint because this copy seems to be used by virtually every PC lookalike I have seen.

The keyboard is connected to the main unit via a coiled cable and a DIN plug. There's not quite as much cable to play with as on some other systems as it has to plug into the back of the machine.

The keys are divided into three functional areas: 10 function keys on the left; followed by the qwerty typing area; and the numeric keypad/cursor control area on the right. The only improvement over the standard IBM keyboard is that the Caps Lock and Num Lock keys have built-in LEDs which make it easy to see if they are engaged.

The keys don't have the solid feel of the IBM. However, they do have the advantage of having lumps moulded onto the 'F', 'J' and numeric '5' keys. I'm told these make it easier to position your fingers if you are a touch-typist. I'm not a touch-typist so they made no difference in my case.

One final point about the keyboard is that the review machine came with an American keyboard with no '£' sign. It's a small point but very annoying.

The main unit houses twin half-height 5¼in floppy disk drives

System software

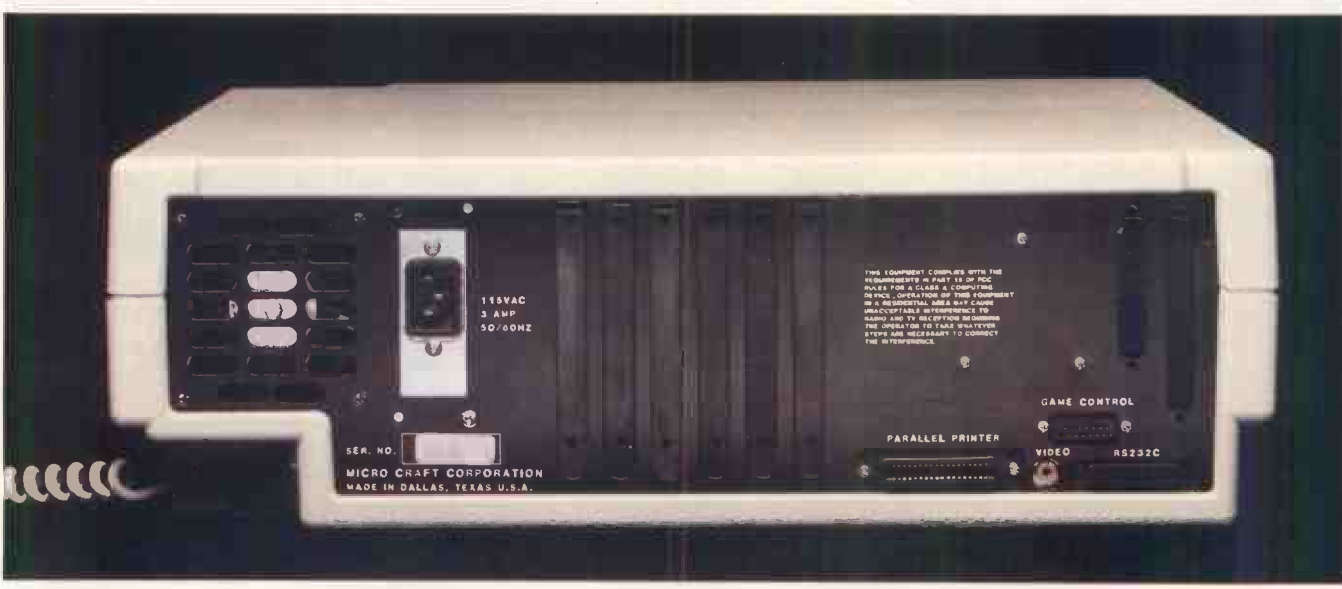
The Dimension supports a wide range of operating systems. In single-user mode it uses CP/M-68k; however, in multi-user mode it supports the less well-known Mirage, with Unix and Bos being ported onto the machine at the moment.

Mention CP/M-68k to anyone who knows about micro-operating systems, and the response is likely to be either 'What?' or 'Isn't that the DIY kit?'

CP/M-68k is the Motorola 68000 version of CP/M. It was written in the early days of Digital Research deciding to put CP/M on every microprocessor it could lay its hands on. It has been the poor relation of the CP/M family for a long time — the attitude from Digital Research seems to have been 'Here's a C complier, here are some routines . . . get on with it.'

The majority of 68000 implementations have been in powerful multi-user 'super micros' where single-user CP/M is not appropriate. Consequently very little applications software has been ported onto this processor/operating system.

This may change soon — I know of at least one company which is taking advantage of the apparent mess which Sinclair has made of QDOS by porting CP/M-68k onto the QL. This one machine has the potential to sell in high enough numbers to justify independent software vendors moving their



At the rear of the machine six presently blanked-off slots will allow the installation of expansion cards software onto CP/M-68k.

CP/M-68k on the Dimension seems to work well enough. It feels more like the old CP/M 2.2 than newer versions such as 3.1. It still has STAT which was dropped on 3.1 and it doesn't have SDIR or any of the fancy new CP/M features.

The first thing you notice about this version of CP/M is that it is relocatable and has to be relocated depending on how much RAM you have. Micro Craft has provided four submit files to make the process easier. These are called SYS128, SYS256, SYS384 and SYS512.

The Dimension version of CP/M-68k does have a couple of nice touches which are worthy of note. The first is the addition of a RAMDISK utility. This allows you to set aside a portion of RAM as a silicon disk. This is accessed as drive K: by CP/M-68k and provides an easy way of speeding up applications, especially those that rely on overlays. RAMDISK 256 sets aside a 256k block of RAM, RAMDISK 0 switches the RAMDISK off.

The second feature is a print spooler. This intercepts text going to the printer and writes it to an area of RAM where it is held until the printer can print it. This saves you having to wait for the printer and means that you can get on with something else while the printer is still printing.

RAM is allocated to the spooler with the SPOOL command. The syntax is exactly the same as the RAMDISK command; for example, SPOOL 64 would set aside 64k of RAM for the spooler.

The review machine was also supplied with the Mirage multi-user operating system.

The major claim to fame of the Dimension is that it can run programs that weren't originally designed to run on it. At the moment it can emulate the IBM PC, the Apple II and the II+ (but not yet the IIe or the IIc), and a range of CP/M-80 2.2 machines including the Kaypro which I tested here. In theory there is no reason why someone shouldn't write his own emulator given the time and experience.

When the machine first arrived I was very curious to see how Micro Craft had managed to convince a machine with a dirty great 68000 processor in it that it was really an Apple II or an IBM PC or a Kaypro, all of which use different processors and have different architectures to the Dimension.

When I took the lid off all was revealed — there sitting in the expansion slots were a 6512(Apple), an 8086(IBM) and a Z80(Kaypro *et al*).

When, say, an IBM program is loaded, the instructions are executed not by the 68000 but by the 8086. This is fine until the program decides it wants to talk to the outside world and finds that memory addresses, disks, display and keyboard aren't where expected.

This problem is overcome by a combination of hardware and software. All the device controllers are highly programmable and so can be programmed to different settings. Also the 68000 handles all the I/O along the bus so that it is possible to program the 68000 and the device controllers to imitate the hardware of the target machine and fool the application program into thinking that the Dimension is really an Apple or an IBM.

This is no mean feat when you consider that Micro Craft wouldn't have had access to the source code for any of the systems. Also, because the emulation programs are written in 68000 code, Micro Craft neatly sidesteps any danger of the likes of IBM suing it for ripping off the code in the IBM ROM.

IBM emulation: The review system came complete with no less than four different IBM emulation programs: IBM, IBMGRF40, IBMMONO and IBMEXP18. The first three emulate 80 × 25 colour graphics, 40 × 25 colour graphics and monochrome text respectively. IBMEXP18 was an experimental enhanced version of the emulation which at the time of writing hadn't been fully debugged.

Assuming that your program is set up to run on a colour graphics IBM, you can call up the emulation program by simply typing 'IBM'. This pulls in the emulation program which is about 22k long and then displays a sign-on screen telling you what your system configuration is, and asking you to put an IBM boot disk in drive A.

It is possible to alter the default system configuration by specifying parameters when you call the IBM program. For example, the default system for the review machine was: 412k of RAM, an 80 × 25 graphics display adaptor, two double-sided disk drives, one parallel printer interface and one serial interface card.

If for some reason I had decided that I only wanted 256k of RAM to be allocated to the PC emulation I could have typed 'IBM MEM=256'.

The second main parameter is 'INTENSITY'. If the applications program uses different display intensities then they will be displayed by the emulator as reverse video. None of my test programs needed this but I have a feeling it could look a little strange.

For people 'in the know' the 'CONFIG=$$$$' parameter can be used to specify exact hardware emulation and is the software equivalent of the DIP switches on the main board of the PC. The only trouble is that the argument for CONFIG is a two-byte hex word which is worked out by referring to a table in the reference manual. I have a feeling that most people will stick with the default settings!

Micro Craft claims about 80-90% compatibility with the IBM PC for its emulation. I think this is about right. I tried Microsoft's *Flight Simulator* on the system and it booted up quite happily. The only problem was that it didn't work correctly. Although the display was fine and the instrumentation responded to keyboard input, I couldn't make the thing fly. At first I put this down to pilot incompetence, but then I tried the same disk on my Olivetti and I flew it with no problems.

I can only conclude that there was a small bug in my version of the emulation software. It did all the difficult things (video and keyboard scanning) fine, but fell down on other points.

Micro Craft shows a refreshing honesty about compatibility problems. Included in the emulation disk was a README file which listed all the known problems with the emulation software. These included direct I/O to the NEC 765 disk controller, games port not emulated, specker channel 2 not emulated and BASICA won't run because the IBM ROM is copyright IBM.

The experimental release 1.18 which was included is said to support direct I/O to the NEC 765 and have improved support for the RS232 port (although it is still not fully supported).

To exit emulation mode you can either use the time-honoured CTRL ALT DEL key combination or hit the reset key. Either way you will be asked to confirm that you wish to leave emulation mode and be returned to CP/M-68k.

Apple emulation: The Apple emulator presently covers only the Apple II and the II+. Emulation is entered by typing 'APPLE' (surprise, surprise!). The sign on screen is very different from the IBM version. Whereas options have to be entered as parameters on the IBM version, here they can be toggled on and off by using the function keys. Much more friendly.

All the Apple expansion slots are emulated and are as follows: 16k language card in slot 0, parallel printer card in slot 1, serial card in slot 2, 80-column card in slot 3, two Apple disks in slot 6 and the mass storage unit in slot 7. The system also emulates the lower case conversion to allow lower case characters to be entered.

All the above emulations amount to a fully expanded Apple II. The only odd option is the 'Mass Storage Unit'. This is a software device that allows Applesoft Basic programs to access CP/M-68k text files.

The emulator program is designed to run under DOS 3.3 or ProDos. I tested it under DOS 3.3. When I first tried to use the emulator I wasn't very successful until I read a section in the manual about a file called APCODE.0.

Benchmarks

BM1	1.6
BM2	5.8
BM3	11.3
BM4	10.7
BM5	13.4
BM6	23.2
BM7	41.5
BM8	29.2

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

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This is what the manual says about APCODE.0.

'APCODE.0 contains certain information that allows the "booting" process to proceed faster. Also, the information stored in APCODE.0 may be needed by the programs and the operating system on the computer. In order to respect certain information that is proprietary to Apple Computer Inc, Micro Craft Corporation cannot send an emulation master diskette with APCODE.0 already in place.'

In other words if the emulator is to work properly it needs bits of DOS 3.3 which are the property of Apple and which Apple isn't about to give away.

Micro Craft gets around this nasty little problem by shipping free with every system a utility disk called 'The Filer' made by Central Point Software. Central Point Software has licensed DOS 3.3 from Apple, so the disk contains the relevant routines. Now the only problem is to copy them over to your emulation disk.

Micro Craft has taken care of this as well. First you enter emulation mode and boot the Filer disk, then you hit the reset switch and hey presto a menu appears saying 'F1 to save APCODE.0'. You hit F1 and the routines are copied to your emulation disk.

As soon as I had found out my success rate at running Apple programs increased, so these are obviously useful routines to have around. The only question is: is it legal?

I'm not sure that it is. Included with 'The Filer' documentation is this notice:—

'DOS 3.3 and Applesoft are copyrighted programs of Apple Computer, Inc licensed to Central Point Software, Inc to distribute for use only in combination with The Filer. Apple software shall not be copied onto another diskette (except for archive purposes) or into memory unless as part of the execution of The Filer. When The Filer has completed execution Apple Software shall not be used by any other program.'

I'd be interested to hear what other users think, but it sounds as if copying those routines isn't legal.

Kaypro emulation: This is just the same as the previous two: put the emulation disk in drive B, a Kaypro boot disk in drive A, hit the right keys and off it goes.

In fact the Kaypro emulator was the only one of the three emulation programs with which I had reliability problems. It had a nasty habit of bombing out or not returning to CP/M when I hit the Break key.

Machine emulation is certainly the most impressive feature of this machine. On the whole it has been executed well; according to Micro Craft the latest release of the IBM emulator is an improvement over the version tested which in turn is pretty good.

I especially like the honest attitude which Micro Craft has adopted about what its system will and won't do.

Applications software

No applications software was supplied with the review machine. This is one of the major areas that worries me. As I said before, very few applications programs are available under CP/M-68k. You could run the machine in emulation mode and run, say, IBM software, but this is only viable as an upgrade option.

I am not sure if you are better off in multi-user mode. At the moment the system is only available under the Mirage operating system. This is hardly a mainstream micro, multi-user O/S so your choice wil be limited again. If or when Unix and BOS are implemented the situation should improve.

Although the system wasn't supplied with any applications software, it did come with a Basic interpreter for Benchmark purposes.

The Dimension is shipped with a version of Basic known as Unibasic. Apparently this is shipped in different versions — the review machine came with the AS version which is very like Applesoft Basic. This similarity extends to being able to run Applesoft programs directly on the Dimension. Even most of the PEEKS and POKES are the same.

You'll notice that I say *most*. The pages of the manual relating to the differences were missing. If Unibasic really is compatible with Applesoft Basic at the PEEK and POKE level then it will merit a review on its own.

One thing that is certain is that Unibasic version AS is very slow. When you look at the Benchmarks, don't forget that they were run on what is virtually a full-blown 32-bit processor . . .

Documentation

The standard of documentation supplied with the review machine varied. The CP/M-68k documentation was standard Digital Research — everything was there, but this doesn't mean it was easy to understand.

The Dimension documentation was supplied in a tightly-packed A5 binder. In fact the binder was so packed that it was difficult to get it out of the box.

The documentation was easy to understand and logical. However, I am not sure that a novice would have found it so straightforward. The manual makes no attempt to be a tutorial — the information is pitched at a higher level than is usual these days. This is not necessarily a bad thing. This is not a beginners' machine, so there is no reason to pitch the documentation at the beginners' level.

Prices

The Dimension 68000 is imported into the UK by Tashkl Computer Services of Wembley. As the machine was originally priced in dollars, the UK selling price is liable to vary.

	£
Base model with 512k of RAM	3950
Emulation cards	495
Price of review machine	5175

Conclusion

Technically the Dimension is a very innovative product, and the machine emulation is well executed for the most part. My only worry is whether this is a case of building a machine for its own sake rather than because the market needs it.

The Dimension operates at three levels: as a single-user CP/M-68k machine; as a standard multi-user machine; and as a mixture running emulation.

As a standard single-user machine it is overpriced and runs an unpopular version of CP/M. As a multi-user machine it could be competitive with the right operating system. As an emulation machine it is unique as far as I know.

But I am not sure how large the market is for this kind of multi-personality machine. I feel that its major appeal will be to people who are upgrading from, say, an Apple II but who still want to be able to run their old software.

It is not a machine for beginners, it is *not* particularly friendly and the documentation is *not* written for beginners. As long as you bear this in mind you will be OK. END

Technical specifications

CPU:	Motorola MC68000 also 6512, Z80 and 8086 slave processors
RAM:	Up to 512k on board
ROM:	8k
Keyboard:	IBM PC copy
Display:	Software switchable — default 80 × 25
I/O:	Bus cards, games, RS232, parallel printer
Operating systems:	CP/M-68k, Mirage (DOS 3.3, ProDos, PC-DOS and CP/M 2.2 under emulation)

NUMBERS

Factorials & primorials

Mike Mudge explores factorials and primorials which are near to prime.

Definitions

(i) A *prime number* is a positive integer which is divisible only by itself and unity. Thus the infinite sequence of prime numbers begins 2,3,5,7,11,13 . . .

(ii) The *factorial* of a positive integer, n, written n!, is defined to be the product of the positive integers less than or equal to n. Thus 6! = 1X2X3X4X5X6 = 720.

The sequence of factorials begins 1,2,6,24,120,720 . . .

(iii) The *primorial* of a prime number, p, written p*, is defined to be the product of the prime numbers less than or equal to p. Thus 7* = 2X3X5X7 = 210.

The sequence of primorials begins 2,6,30,210,2310 . . .

(iv) An integer, q, is said to be near-to-prime (NTP), if, and only if, either q+1 *or* q−1 are prime. (Note that if both q+1 and q−1 are prime then q is the mean of a prime pair; see Brun's Constant *PCW*, July).

Elementary Facts.

Factorial n is NTP for n=1,2,3,4,6,7 . . . since 2,3,(5,7), 23,719,5039 . . . are prime.

Primorial p is NTP for p=2,3,5,7,11 . . . since 3,(5,7), (29,31), 211,(2309, 2311) . . . are prime.

At least the first twenty-nine NTP factorials and the first seventeen NTP primorials are known; however, virtually nothing is known about their frequency of occurrence nor about their significance in analytic number theory.

Problem

Readers are invited to design and implement an algorithm for the determination of both NTP primorials and NTP factorials; attempting to reproduce and, if possible, extend the present results. Any possible suggestions as to the significance of these numbers would be most welcome.

Submissions should include program listings, hardware description, run time and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order) and a prize of £10 will be awarded to the 'best' entry received by 1 December 1984. Please address submissions to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffs WV4 5NF. Tel: (0902) 892141.

Review — Number Theories — March 1984

The original title was to have been Number Theory Nostalgia to emphasise the dates of the original solutions.

Submissions included the first Pro Pascal seen, from a Sirius 880 running at 5MHz; together with the expected Basic and Assembler programs running on NewBrain, Spectrum and BBC Model B computers.

(a) Complete solution *Math Quest Educ Times* vol 25 1876 p76. (ax^5 . . .dx^5), $a+b+c+d=x, x-a=p^5 \ldots x-d=s^5, x=(1/3)(p^5+ \ldots +s^5)$ where $p=3m$, $q=3m+1$, $r=3m+2$, $s=3m+3$.

(b) *Amer Math Monthly* vol 2. 1895 pp128-9.

(c) *Amer Math Monthly* vol 5. 1890 p114 also vol 8. 1901 pp48-9. Consider the solution 3^5-D, 3^5, and 3^5+D . . .

(d) *L'intermédiaire des math* vol 11, 1904, pp16-7; the only known exception is 23.

(e) *L'intermédiaire des math* vol 24, 1917 pp23-41; the only known addition being $8191 = 1+2+ \ldots +2^{12} = 1+90+90^2$.

This month's winner is John B Cook of 34 Joan Crescent, East Burwood, 3151 (232-2126), Australia, who used a TRS PC-2 with printer, as necessary.

John used 6.71 hours CPU time on (e) while Teilhet's limit of 600 in (d) was extended to 1800 in about 1½ days.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

END

LEISURE LINES

by J J Clessa

Quickie

Divide 10 pounds of sugar into three portions so that three times the smallest portion equals the middle portion, and four times the middle portion equals the largest portion.

Prize Puzzle

A test of logic this month.

On the island of Nonesuch there are five species of birds:

— the Auk
— the Bluebird
— the Cockatoo
— the Drongo, and
— the Egret

Four birdwatchers, Peter, Quentin, Roger and Stanley, are located at different parts of the island when five different birds fly over in rapid succession. Each man makes his own identification of the birds, and the results are:

	Peter	Quentin	Roger	Stanley
Bird 1	Bluebird	Egret	Cockatoo	Egret
Bird 2	Auk	Auk	Bluebird	Auk
Bird 3	Cockatoo	Bluebird	Drongo	Cockatoo
Bird 4	Egret	Bluebird	Egret	Bluebird
Bird 5	Bluebird	Drongo	Auk	Drongo

In fact, none of the birdwatchers identified all the birds correctly, but conversely, no one had them all incorrect either. No two birdwatchers had the same numbers of incorrect guesses, and each of the five birds was correctly identified by at least one birdwatcher.

What were the five birds?

Answers, on postcards only, to *PCW* Prize Puzzle September 1984, Leisure Lines, 62 Oxford Street, London W1, to arrive not later than last post on 30 September 1984

June Prize Puzzle

A massive response to the June puzzle — almost 400 entries were received, most of them with the correct solution. The problem was easily solved by micro by testing all possible 6-digit square numbers for the required conditions. The required numbers (excluding solutions with leading zeros) are:

$494209=(703)^2$

and

$998001=(999)^2$

The winning entry drawn at random from the pile came from Dr David Vaux of the John Radcliffe hospital, Oxford. Congratulations Dr Vaux. Your prize is on its way.

END

Beat the clock

The performance of different sort methods can change dramatically when a re-sort is required. Tony Williams pitched some minimal memory sorts against his stopwatch.

If you use a microcomputer to sort large files you may find the amount of available memory a serious limitation. For example, a file of 400 records, each 80 characters long, will require 32,000 bytes not including the space for overheads and the program (a record is a unit of information: that is, a person's name, telephone number and address). Large files will certainly require the use of a disk so that parts of files can be sorted and merged.

Obviously, the more disk manipulation used, the slower the job becomes — to a point where the process is of little interest to most users. However, files of a useful size can be sorted on a micro without the use of a disk, particularly if care is taken in the design of the record so as to minimise its size. It will also be wise to choose a sorting method which does not make demands on memory for temporary workspace.

Minimal memory methods

A number of 'minimal memory' methods are available and some theoretical and practical comparisons of their performance have been published. There is less information on re-sort performance, which is a pity because very often one is not interested in the time required to set up a sorted file as the time required to add or delete a few records and then re-sort them.

Sort techniques, at least for minimal memory methods, all depend upon comparison and are closely related to search methods. It is first necessary to define the search key; if your records comprise name, telephone number and address you might decide to sort the records in alphabetic order of names. The name part of each record then becomes the key.

Let's assume that our keys are numeric and are to be sorted into ascending order (we could just as well sort into descending order if desired). The most obvious and simple technique is usually called sequential sorting. Consider the sequence of digits 3 4 2 1 5; it is required to sort these into 1 2 3 4 5.

The procedure is to take the first (that is, 3) and compare this in turn with each of the others until a smaller one is found (2). 2 is then compared with the remainder of the sequence until the smallest is found (1). 1 is then removed from the sequence and the digits shuffled to the right to close the gap. It is then placed at the head of the file and the process repeated on the rest of the file, and so on. This is the only method which allows you to print each sorted record as it's produced: with the other methods it is necessary for the whole of the file to be sorted before it can be printed. This is perhaps its only virtue but not to be ignored if you are working with a slow printer.

The number of comparisons required is often taken as a measure of speed and in this case is approximately $n^2/2$ where n is large and equal to the number of records. The method takes approximately the same time no matter how well the file is initially sorted, so is unlikely to be a good choice for re-sorting.

Another method, attractive because of its compact program, is called bubble sorting. Consider again the same sequence: compare the first digit with the second; if the second is smaller swap them, compare the second with the third, if the third is smaller swap, and so on, to the end of the sequence.

This gives 3 2 1 4 5 as a first attempt; the process is repeated on the whole sequence until no further swaps are made. It is slow on unsorted files but better than sequential and promises to be good on well-sorted files, and for a completely sorted file requires only n comparisons.

The bubble sort can be improved by searching for the best place to put an out-of-order record when this has been detected by a comparison. This can be done by applying a sequential search as in the sequential sort method, producing a program that is somewhat faster for an initial sort and dramatically faster at re-sorting. The use of a binary search gives even better performance for an initial sort (a binary search consists of halving the search area, finding in which half the target lies, halving that area, and so on), but the program is quite long and complicated.

The Shell method is somewhat similar to bubble sorting but instead of comparing adjacent keys, those some distance apart are compared and exchanged if necessary. The distance apart diminishes at each pass through the file. It's common practice to make the distances a half, quarter, eighth, sixteenth, and so on, of the file length but other sequences are used. A very compact Fortran version is given by

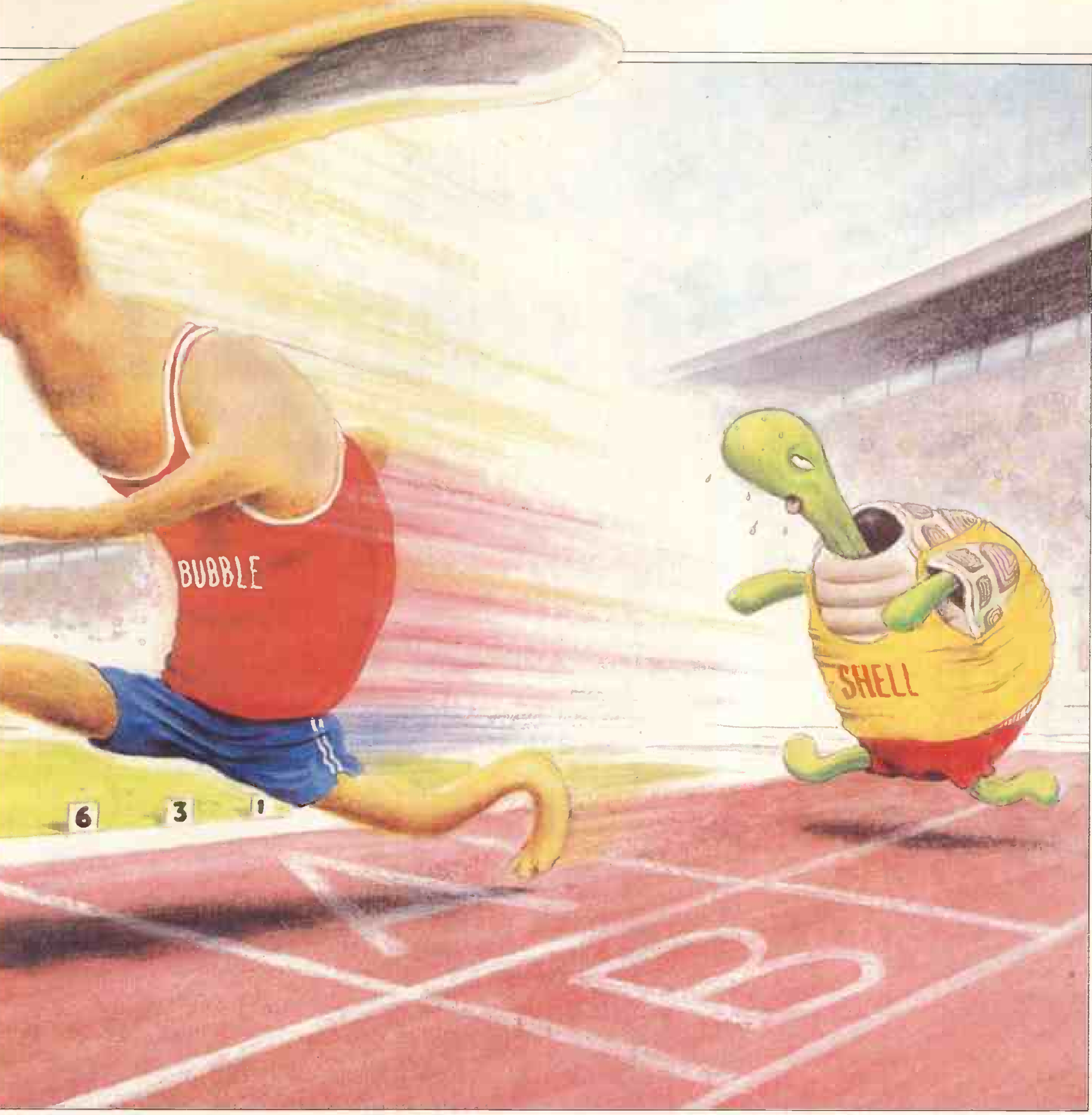


Illustration by Nick Davies

Berztiss *(1)* and a Basic version by Mike Niklaus *(2)*. The method always makes the same number of comparisons which, according to Berztiss, is of the order $n^{3/2}$.

The sort performance tests were executed using a file consisting of records 66 characters long. The sort operated on the characters 0-9, A-Z and a-z in that order of precedence with all other ASCII characters ignored. The records were held in memory as a sequence of bytes (not array elements) without pointers to minimise memory demand. All programs were written in machine code for a Commodore 8032. For the re-sort tests the four 66-byte records 1 . . . 1, a . . . a, m . . . m and z . . . z were appended to the file.

The basic sequential sort and basic bubble tests were executed on a file of 390 records. The results, shown here, were so poor that no further tests were made on these methods:

	Sort time (sec)	**Re-sort time (sec)**
SEQUENTIAL:	77	43
BUBBLE:	143	93

The table below shows the byte length for each of the programs (it does not include additional common subroutines):

	Program length: byte
SEQUENTIAL	535
BUBBLE	406
BUBBLE/SEQUENTIAL	468
BUBBLE/BINARY	519
SHELL	659

Conclusion

These results indicate that the best all-rounder is the bubble/sequential program. It's a quick sorter, a very quick re-sorter and uses only a modest amount of memory. If you are desperate for space then the bubble sort would be your choice but it's very slow. The Shell method is outstanding for initial sorting and is easy to program.

As an additional guide to choice, I executed a further trial on the Shell and bubble/sequential methods. This consisted of sorting 969 records, each 24 characters long, using the whole of the record as the key. The time in seconds to sort, re-sort with four added lines and re-sort with 20 added lines was 16.5,7.0 and 7.5 for 'Shell' and 198 (yes 198!),3.0 and 9.5 for bubble/sequential. This illustrates that the choice of method must be guided by requirements and the ideal would be to maintain a library of sort routines.

References

1 *Berztiss AT* Data Structures, *Academic Press New York 1975*
2 Best of the Commodore PET Newsletter, *Commodore Business machines UK Ltd 1980*

END

Sensible solution?

Sensible Solution is a powerful and flexible database intended for use on networked micros. And Kathy Lang believes it will be of particular benefit to system developers.

Most data management systems are intended to be used by one person at a time. If you have a networked microcomputer system where several people each have a computer but can share the same information, such packages are not suitable, because there is always the danger that two people will be trying to change a single record at the same time — with unpredictable consequences for the accuracy of the data, and, at worst, a system crash. In recent months, more packages suitable for running on shared systems have become available at £1000 or less.

In the June issue I looked at System Builder, a database which enables several users to share information on a micro which operates like a conventional mainframe; each user sharing not only the processor but a common pool of information. This month, I'll be looking at Sensible Solution, an American package designed for use on networked microcomputers, where each user has a terminal, keyboard and processor, and shares only the hard disk storage and the information it contains.

In order for such sharing to be practicable, the package must be able to prevent more than one user changing the same item of information at the same time. This is done by 'locking' the information, allowing only the first user attempting to make a change the ability to do so. Such locking may be at field level, so that only one item, such as a name or account number, is locked; at the record level, so that only a single customer's record is protected from two people trying to change it simultaneously; or file level. Whichever method is used, control over access to files is the province of the operating system, so sharing can only be implemented by using operating system features which permit locking.

Of these possible methods of locking, file locking is the easiest to implement, and is widely available. However, it imposes severe constraints on the user's flexibility of working. One reason for the extent to which the development of more flexible approaches has lagged behind the development of the hardware, is that there is a wide variety of operating systems for networked micros; and such systems tend to be highly hardware-specific — that is, they are often available just on one range of hardware. Although they may all look alike if you are running single-user software (running either CP/M or MS-DOS single-user programs), the approaches to implementing the multi-user features, such as record locking, have been many and various.

For this review I used a Data Dynamics Sig/Net multi-user micro (a British system), on which Sensible Solution has been implemented through the MCNOS operating system.

As you might expect from a system designed for shared use, Sensible Solution contains a variety of powerful features. It is in essence an applications generator; that is, every task which the user wants to carry out — entering data through a screen display, reporting on the printer, selecting sections of the information for screen enquiry — is carried out by a 'program' written in Sensible Solution's own language. For the beginner, such programs are constructed by the package itself, through a program generator; such programs may be modified by the user, or they may be created from scratch.

```
The Sensible Solution Language
Version 2.0

            MAIN MENU

 1) Execute A SENSIBLE SOLUTION
    Program
 2) Data Dictionary Maintenance
 3) Screen Painting
 4) Source Code Editor
 5) Initialise A Data File
 6) Compile Source Code
 7) Rekey A Data File
 8) Restructure A Data File
 9) Program Generator
10) Inquire

## Enter Your Choice From Options
   Above
```

Fig 1 Main Menu

Sensible Solution is, in the main, a two-level package, consisting of the features it offers a system designer, plus the features which it enables a system designer to offer naive users. An expert user would be able to use the system in a more direct way, but would still need to create or generate Sensible Solution programs to carry out tasks. It allows you to invoke its functions (including running programs) via a single menu (shown in Fig.1), or directly from the operating system; the system designer can use the programming language to create screens which contain other menus for naive users. Once into a function or program, commands are in general issued by pressing the ESCape key to display a menu of options occupying several lines at the top or bottom of the screen.

Sensible Solution uses a fixed format, fixed length record structure, but allows you to associate a number of files (where a file contains a set of records all with the same structure) together during processing, so the combined record structure can be very flexible. Definitions of all fields in all files are stored in a single data dictionary. This means that you may not duplicate field names within one database, even if the fields are in different files. However, the advantage that any reference to a field will automatically pick up the correct field, without you explicitly having to tell the system that the Part Number referred to in a customer's order is the same field as the Part Number in a stock record.

It may by now look to many readers as though Sensible Solution has a lot in common with other systems based on procedural languages, such as dBaseII and Condor, but with the advantages of a more powerful facility for associating several files together, plus the ability to lock records and thus permit file-sharing. However, Sensible Solution lacks any in-built commands, so you can't carry out information processing directly by executing a single command with parameters on the command line — you could simulate this approach,

Package	Sensible Solution
Maximum file size	OSL
Max record size	Memory limit
Max no fields	1000 (255/screen)
Max field size	255
Max digits	15
Max prime key length	72
Special disk format?	No
File size fixed?	No
Link to ASCII files?	Yes
Data types	C,N,D, Overlay
Fixed record structure?	Yes
Fixed record length stored?	Yes
Amend record structure?	By copying
Link data files?	Yes
No data files open	16
No sort fields	1 at a time
No keys	9 + record no
Max key length (chars, fields)	72, 1
Subsidiary indexes kept up-to-date?	Yes
Data validation	Good
Screen formatting	Paint-a-screen
Unique keys	Optional
Report formatting	Default, paint-a-screen
Store calculated data	Yes
Totals & Statistics	Yes
Store selection criteria	Permitted
Combining criteria	And in Inquiry And, Or in programs
>1 criterion/field?	Yes
Wildcode selection?	String within
Browsing methods	Any Key
Interaction methods	Menus, Full Tailoring
Reference Manual (max 5*)	**
Tutorial Guide+ (max 5*)	***
Reference Card+ (max 5*)	N
On-Line Help+ (max 5*)	**
Hot-line?	D

Fig 2 Features and constraints

but by building the 'commands', as Sensible Solution programs. It is, therefore, most likely to be suited to environments where a system designer is setting up applications for others to use, and for expert users who need a powerful multi-file database management system.

Constraints

The major constraints on use of Sensible Solution are shown in Fig 2. Few of these are likely to worry the average user, since they are much more generous than usual — in most cases you will run up against operating system and memory limitations first. The restrictions which could become important are more subtle. Firstly, to increase speed of access, Sensible Solution stores data records in 128-character blocks, so a record which contains 140 characters would use two blocks with a lot of wasted space at the end of the second. This would mean that users would need to think about the appropriate location of fields, not only in terms of the data structure itself, but also in terms of storage efficiency. Another limitation is that a single screen format may occupy only one physical screen; you can have more than one screen format accessed during a program, but this could involve more overheads in file updating than using explicitly linked screens.

A positive point not obvious from the table is that, by obeying some simple rules, you can create a group of single fields (character, numeric or date) which can be treated as a one-dimensional array. Another useful feature is that date formats may take several forms, including the DD/MM/YY format popular in the UK; you specify your preference when the system is initially set up.

File creation

Before data can be entered into a file, four steps have to be taken. Firstly, you must define all the fields which the records will contain, including identifying up to 10 key fields, and store this information in the data dictionary. Secondly, the data and key files must be initialised. Thirdly, you must format a data entry screen (which may contain fields from records in several different files). Finally, you must create, or ask Sensible Solution to create, a program which will enable the fields in each record to be filled in via the screen format, and the record saved in the file.

There are several approaches to carrying out these tasks. In the early stages of using Sensible Solution, most people will follow the method suggested in the tutorial manual, and set out a screen format and define its fields in one operation, using option 3 on the main menu. This allows you to 'paint-a-screen' with captions and prompt text wherever you like, including the option to draw boxes and lines by having Sensible Solution follow the movement of the cursor.

Once the overall screen layout is decided, your next step is to define the position and nature of each field. To do this, you position the cursor at the start of the first field you wish to define, press ESCape to get the bottom line's display of options, and indicate that you wish to add a field. An option is selected either by entering its single letter abbreviation — usually its first letter, for example 'D' for delete a line of the screen format — or by pressing the space bar once for each option until that desired is highlighted, and then pressing Return. This device makes it possible to have the most commonly used option as the default, for which you only need to press Return. But even though 'Add field' is the default option here, that still means you must press ESC followed by Return once for each field to be set up.

Once you have indicated that you wish to add a field, you are then presented with a list of parameters for defining it, such as its name, the file into which it is to be saved (since one screen format may contain information from several data files — this defaults to the filename entered for the first field), length, type and so on. Here you may specify a validation mask, to ensure that correct data is entered; validation allows both the format of the data (two letters followed by three numbers in an account code, say) is correct, and that the content is accurate. It is possible to specify that only certain values are valid (individual values and/or ranges for both letters and numbers) or that certain values are invalid. You can also specify that all or part of a field is mandatory.

You can also ask for data to be stored in upper case, however it is entered, specify that a field is to be a key field, and so on. However, if you don't need any of these options — if just name, length and type are the only varying items — there seems to be no way to display all the defaults and to accept them all at once. You have to press Return once for each parameter, even if you want the default values and you can't say 'Create another field just like the last except that its name should be . . .' So, all in all, setting up field formats in this way is rather tedious.

An alternative and faster method of defining fields is to edit the data dictionary directly, from option 2 on the menu. This displays a split screen, the upper half containing file information, the lower half showing the specification of one field at a time. Using this method you can set up a field specifying just those parameters you need, though you still can't automatically set up a group of identical fields. This option also allows you to print a copy of the file format.

Whichever method is used to create the definition, the file must then be initialised, and a Sensible Solution program created to allow data entry to, and amendment of, the file. You can request Sensible Solution to do this for you, by invoking option 9 (which also initialises the data file if it has not yet been done). This sets up a group of Sensible Solution command statements which will constitute a source program, and then compile it into an executable program. Alternatively, you can set up your own program, either by amending the one generated by Sensible Solution, or by creating your own.

Data input and updating

Entering and changing information involves executing a Sensible Solution program containing appropriate ENTER and calculation statements. Fig 3 shows the program set up to handle data entry to the Benchtest file. When run, this program interacts with the control available from the keyboard, so that in practice it doesn't run for ever! For instance, to save a record you press ESC and then 'S' which transfers control to the statement labelled SAVE.GRP, and then returns to START; when you have finished entering or amending records, you can press ESC and invoke the Quit option to stop execution of the entry program.

When entering a new record, simply fill in the fields displayed. To select a record for amendment, you can search for a particular value contained in a key field, and/or scroll through the file in order by any key field. Searching works by matching against the number of characters entered, so to search for Smith but not Smithson you would have to enter Smith<space>. I couldn't always persuade key field searching to work correctly if the data field were full — in some cases when the whole field was entered, searching simply displayed the first record in the file.

As an alternative to interactive data entry and amendment, you can set up a Sensible Solution program which will add or update records automatically. However, there didn't seem to be any clean way to end such a program without returning to the keyboard to get the user to Quit explicitly.

```
                                   Page No: 0001
%o: PCWBT.SRR source file listing

0001              remark
0002              trap SAVE goto
                    SAVE.GRP
0003              trap DELETE goto
                    DELT.GRP
0004              mount screen PCWBT
0005 START        enter REFNUM
0006              enter BT.NAME
0007              enter DATECRE
0008              enter BT.TYPE
0009              enter BT.DESCRPN
0010              enter SUPP1
0011              enter PRICE1
0012              enter SUPP2
0013              enter PRICE2
0014              enter SUPP3
0015              enter PRICE3
0016              enter SUPP4
0017              enter PRICE4
0018              enter SYS1
0019              enter SYS2
0020              enter SYS3
0021              enter RATING
0022              enter REF1
0023              enter REF2
0024              enter REF3
0025              enter REF4
0026 SAVE.GRP     save rec in file PCWBT
                    confirm/clear buffer
0027              goto START
0028 DELT.GRP     delete rec in file
                    PCWBT
0029              go confirm
                    goto START
```

Fig 3 Sensible Solution program

Printed reports

Two options are available. You can set up a report layout using the 'paint-a-screen' approach and invoke it via a Sensible Solution program; report layouts are very similar to screen layouts, except that they allow you to specify report lines up to 254 characters wide. For lines up to 127 characters wide, a simple form of sideways scrolling is used; for wider printing, two screen lines are needed to display each report line. To create totals and sub-totals within such a report, you must include appropriate lines of Sensible Solution code in your program — there is no short-cut via the program generator for this. The alternative to a formatted report is a quick report generated by the Inquiry option, which can be directed to the printer (or to a disk file) rather than to the screen.

Selection and sorting

Any record may be selected for screen display by using the Find option on a key field; matches must be exact, but need be on only the first few characters in a field. Thus you may use Find to search for a field starting with a group of characters, but not use a 'wild code' to find a set of characters within a field.

In the Inquiry option, you can select using the usual comparison operators, <, > etc, and also for a field containing a particular set of characters; if you specify more than one field to select on, then tests are 'anded'; that is, only records which pass all tests will be displayed.

For both screen display and printed reports using Sensible Solution programs, and within the Inquiry quick report program, records may be shown in order by any key field, or by record number. If you want to display the records ordered in any other way, then you must make the field on which you want to sort a key field, and re-index the file.

Calculation

Calculations may be performed on fields from data files, employing the usual arithmetic operators on constants or field values. If you need intermediate variables, perhaps to accumulate a total, you have to set up a 'dummy' or memory variable in a file which you would reserve for the purpose. (The file would not take up any space, since no data would be stored — it is merely a device for reserving areas of memory for working storage.) You can simulate one-dimensional arrays by creating a set of fields of the same type and length, with names which will result in the fields being stored next to one another. Sensible Solution stores all variables in the data dictionary in alphabetical order of field within file, so you would just give your array elements names like ZZA, ZZB, and so on, to ensure contiguity. You can then use a memory variable together with the name of the first variable in the list as a pointer to whichever variable you actually need — a value of two would point to the second field in the list, for instance. This feature could be extremely useful when processing grouped information, such as accumulating sales information by month.

Multiple files and file sharing

Sensible Solution allows you to access fields from up to 16 files on a single screen, and to use program statements to check that where several files are in use, the correct record is updated where it could be ambiguous.

The use of a data dictionary requiring every field name to be unique to the whole database does away with the need to specify where any particular field is located. File sharing is allowed by specifying either file locking or individual record locking, with a variety of options available to the programmer and the user when contention for a record arises.

Tailoring

Given that Sensible Solution contains a (somewhat crude) programming language, most forms of tailoring are available. Using the dodge for creating memory variables, together with the facility for one Sensible Solution program to call another, you can set up menus to help users who need only to use programs set up by others. You can also create data entry and display programs to suit most circumstances. The tools provided are powerful and flexible, but some are rather more primitive in their implementation than I would have liked.

For example, the only form of branching provided is a simple "GO" — either GOTO a label or GOSUB..RETURN. No structured programming here! GOTO can branch either to a specific label, or to one of several based on the result of a memory variable, thus giving the effect which is achieved in many languages by a CASE statement. On the other hand, there is no explicit iterative execution — no equivalent of FOR...NEXT, although you can of course simulate that with IF and a memory variable. Nor is there a DO...WHILE, though again that can be simulated.

In addition to enabling you to chain several of its own programs together, Sensible Solution also allows you to

invoke other executable programs (those with the suffix .com in CP/M-80, for instance) directly. So it would be possible to devise a completely integrated application which would, for instance, set up a data file which could be read by a word processor, branch to the word processor to run standard letters, and then return to Sensible Solution.

Links with outside

Sensible Solution data files are held in plain ASCII text form, in units of 128 characters, with each field occupying a fixed amount of space. If your existing data file can be converted to this format (and any programming language, including Basic, can write such files) it can be read by Sensible Solution.

For writing text files, you can either use the data file direct, or create a text file on disk in a variety of formats, using the Inquiry option.

User image

I found Sensible Solution an extraordinary mixture of the helpful, the obscure and the tedious. Personally, I do not favour the two-level approach, whereby you have to set up a predefined set of instructions before you can actually do anything. On the other hand, Sensible Solution attempts to cover this by providing a program generator to cope with simple cases, which works quite well. I also liked the approach of providing commands within formatting and data entry screens, and the ability to get to the appropriate part of the system from a single menu.

The approach used to set up and edit Sensible Solution programs from scratch is much less helpful. At each stage, instead of entering a command line which is then checked, you have to create a command line on a question-and-answer basis for each element in the command.

The other aspect of the package which is irritating is Sensible Solution's cavalier attitude to carriage returns. For instance, the main menu has 10 options. If you want any of the single digit options, you must enter the number and press Return. If you want item 10, you must type 10 and *not* press Return — if you do, Sensible Solution assumes that this is a null response to its request for a file name on which to inquire, and returns you to the main menu . . .

Benchmarks

BM1	Time to add one new record Inst (5secs)
BM2	Time to select record by primary key Inst (3secs)
BM3	Time to select record by secondary key Inst (3secs)
BM4	Time to access 20 records from 1000 sequentially on 3-character field (same field as in BM2 key) 1min (18mins 53secs*)
BM5	Time to access record using wild code Inst (3secs)
BM6	Time to index 1000 records on 3-character field 15mins 40secs (1hr 26mins*)
BM7	Time to sort 1000 records on 5-character field NA
BM8	Time to calculate on one field per record and store result in record 10mins 25secs (49mins 27secs*
BM9	Time to total three fields over 1000 records 6mins 25 secs (23mins 20secs*)
BM10	Time to add one new field to each of 1000 records 5mins 40secs (28mins 53secs*)

Time to import a file of 1000 records: (47mins 47secs*)
First times quoted are for hard disk version. Times in brackets are for Sirius with floppy disks; * = estimated from time for 150 seconds. NA = Not Applicable; can only index

Documentation

Sensible Solution comes with two manuals in a single binder. Both are printed on large pages of a non-standard size — smaller than A4, larger than A5 or the IBM PC manual format. The text has been prepared with a typewriter, so there are no subtleties of typography to help the reader, nor does either manual have an index. The first manual is a tutorial introduction to Sensible Solution, using sample files supplied with the package. This provides a good introduction to most of the features of the package, including a gentle introduction to using the programming language. However, anyone who had met a programming language before would, I think, feel the lack of any overview of its capabilities.

This is even more obvious in the Reference Manual. This consists of a section on each of the menu options, followed by a description of each command (not in alphabetical order). Even when you have worked through the tutorial, the reference manual is quite hard going because of the lack of a model of the approach taken by the package. This lack, combined with the absence of an index, makes it quite hard to work out where to look for particular features.

Summary

Package Type	Database management system with subset of features for simple applications. Full system has record locking and multi-file features
Ease of Use	Good for system designers, if rather tedious at times. Difficult for novices
Error Messages	Good — has Trace facility in programming language
Documentation	Tutorial manual quite good, reference adequate
Costs (ex VAT)	£548 single user, £775 multi-user
Supplier	UK distributor: O'Hanlon Systems, tel: (0753) 78844 A London dealer: Small Turnkey Systems, tel: (01) 272 3530

Conclusion

Sensible Solution provides powerful and flexible features for people who need to design database management systems for others to use. Its combination of facilities and the use of the Inquiry option for naive users' *ad hoc* reports makes Sensible Solution a good package for use in such situations.

The programming features leave a certain amount to be desired in some respects — notably the lack of structured forms of conditional execution. The selection and ordering features provided as standard are also less powerful than one might have expected.

On the other hand, the package does provide the ability to relate multiple files together in a straightforward way, and to allow file sharing through record locking in multi-user environments. Despite the need to spatter programs with GOTOs, the programming language is readable and reasonably easy to use. For system developers, Sensible Solution would be a useful tool, but would probably be beyond the scope of most ordinary users. END

Olivetti M24 vs MAD1

The IBM PC has spawned many lookalikes but none so far has posed a serious threat to the machine's popularity. Peter Bright assesses two new clones, the Olivetti M24 and the MAD1, which appear technically superior to the PC.

How do you compete with the IBM PC?

Until recently the answer (especially in the US) seemed to be that you don't. PC clones have generally been substandard in some way and have not presented a real challenge to the PC in the mass market.

Now a new breed of clone seems to be appearing, which is technically more advanced than the IBM PC but which can still run PC software. Both the machines tested here are technically ahead of the PC: the MAD1 uses the new Intel 80186 16-bit central processor and the Olivetti M24 uses a very fast Intel 8086.

When it comes to marketing, the two machines are very different. The Italian electronics giant Olivetti has teamed up with AT&T in the US to try to meet IBM head on in the mass market. MAD, on the other hand, is looking for low volume high price sales at the top end of the PC market.

Olivetti M24

Hardware

From the beginning the M24 was designed to be IBM-compatible. Given that fact, the machine does a good job of not looking too much like an IBM clone. The main unit has a smaller 'footprint' than the IBM but is slightly taller. Above that sits the display which can be tilted or swivelled any way. The whole unit is finished in different shades of grey with a black stripe along the front.

At the front of the main unit are two IBM-compatible, half-height 5¼in floppy disk drives, a power light and the reset button. The disks are disturbingly quiet — once or twice I was convinced they weren't working!

My major worry about the disks is that the air for the cooling fan is sucked over them into the machine. Consequently all my disks gathered a heavy coating of dust — although this didn't cause any problems during the test, I have a feeling that it could be a problem over a more prolonged period.

The back of the machine houses the fan, printer port, RS232 port and slots for expansion cards. The RS232 and printer ports are very badly designed. For a start, the printer port uses a 'D' plug even though it's a Centronics port. The only reason I can see for doing this is to force IBM-alike users to pay over the odds for special cables. In addition, both the printer port and the RS232 port are recessed into the back panel, which makes it very difficult to get a proper connection when you plug in a cable.

The Olivetti has two different keyboards: the IBM lookalike (as shown above) or the Olivetti design

Access to all the internals is straightforward. If you want to get to the power supply, disk drives, video circuitry or the expansion board, you simply slacken two screws on the back panel and slide the lid off the main unit.

To get at the main PCB it's necessary to turn the unit upside down, undo two more screws and slide the bottom panel off. This is a much better arrangement than on the IBM where the main PCB is buried below the disk drives.

The PCBs themselves were very early beta test versions and had been heavily patched; this didn't seem to affect the operation of the system — everything was 100% reliable.

The only serious problem I had with the system occurred when I tried to install the optional bus convertor. This plugs into a slot in the video board and allows expansion cards to be plugged into the system. (I accidentally shorted the convertor against the chassis and when I switched on I blew up the main PCB. I hope that later machines will include a piece of plastic to insulate the chassis and make this impossible.)

The great advantage of the bus convertor is that it will take both Olivetti and standard IBM expansion cards. The Olivetti cards are designed to make use of the extra data lines on the 8086, so they have to be plugged into specially expanded slots on the board. IBM cards can fit into any of the other slots.

Benchmarks: Olivetti M24

BM1	0.8
BM2	2.5
BM3	5.2
BM4	5.2
BM5	5.7
BM6	10.0
BM7	15.3
BM8	16.6
Average	7.7

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

The Benchmark timings show that the Olivetti is a very fast machine (certainly much faster than the IBM). This is largely due to the fact that it uses an Intel 8086 processor running flat out at 8MHz as opposed to the IBM which uses an 8088 running at 4.77MHz. This increase in speed is only apparent when you see both machines running the same software — then you wonder why you put up with the IBM for so long.

The review machine was supplied with 245k of RAM which is the most that can be accommodated on the main board. Extra RAM can be plugged into the expansion slots.

The Olivetti also came with two different keyboards: one was laid out in the same style as an IBM keyboard and the other was of Olivetti's own design. They are both equipped with nine-pin 'D' sockets for Olivetti's mouse. The IBM-style keyboard is equipped with 83 keys while the Olivetti home brew keyboard boasts 102.

I preferred the layout of the Olivetti keyboard. Although it has more keys, there is more space between the different groups of keys which makes it easier to find the required key. The extra space is provided because the Olivetti keyboard has its function keys running along the top of the keyboard, whereas the IBM version packs the function keys down the left-hand side.

Although I preferred the layout of the pukka Olivetti keyboard, I suspect that most users will go for the IBM version if only to avoid confusion when they are running IBM software.

I tried both keyboards and didn't like the feel of either of them: they both felt plastic and fragile. After I had been using the IBM-style keyboard for a while the space bar started to stick. I eventually fixed it by striking it a sharp blow with an Inmac acoustic coupler — it hasn't caused any trouble since!

The display is wonderful. The review machine was supplied with a monochrome monitor which plugs into the video board on the back of the main unit via a large 'D' plug.

Instead of the normal green or amber display, the Olivetti uses a shade of blue/white on a black background. Although this may sound strange, it's very neat and easy to read.

At one level the Olivetti is compatible with IBM high-res graphics, but it also offers a higher resolution of 640 x 400 pixels when used with custom Olivetti software.

Although the system is only supplied with a black and white screen, it's also quite happy to support grey scaling in addition to normal black and white. The result is that IBM programs will usually run better if you pretend that you're using a colour system and grey scaling rather than a straight monochrome screen.

I only fully appreciated the screen when I put the Olivetti next to a standard IBM PC. Whereas the characters on the IBM screen look fat and bloated, the Olivetti's are compact and easy to read. The Olivetti also updates its screen much faster than the IBM; this may seem a small point, but these things are important when you spend a long time sitting in front of it.

System software

The Olivetti is shipped with MS-DOS version 2.11. This is the international version of MS-DOS which allows different local keyboards to be set up. In addition to the national character sets, Olivetti has also included drivers for the two different system keyboards.

Having said that the machine is shipped with MS-DOS, I must admit that I never had occasion to use it. Instead I used my PC-DOS version 2 master disk which I usually use with real IBM PCs; this worked with no complaints. The only problem is that PC-DOS is not set up to take the time and date from the Olivetti's real-time clock, whereas the pukka Olivetti version of MS-DOS will do that automatically.

Applications software

In the course of testing the Olivetti I experimented with a wide range of applications software which was originally designed to run on the IBM PC. It all worked with the exception of a database package which was written in IBM BASICA. IBM lookalikes won't usually run BASICA programs because some of the routines are contained in the IBM ROM, which is copyright IBM. Manufacturers understandably don't want to pay IBM's licensing fees. Most lookalikes get around this problem by using GWBASIC, which is virtually the same as BASICA but which does not rely on the IBM ROM routines.

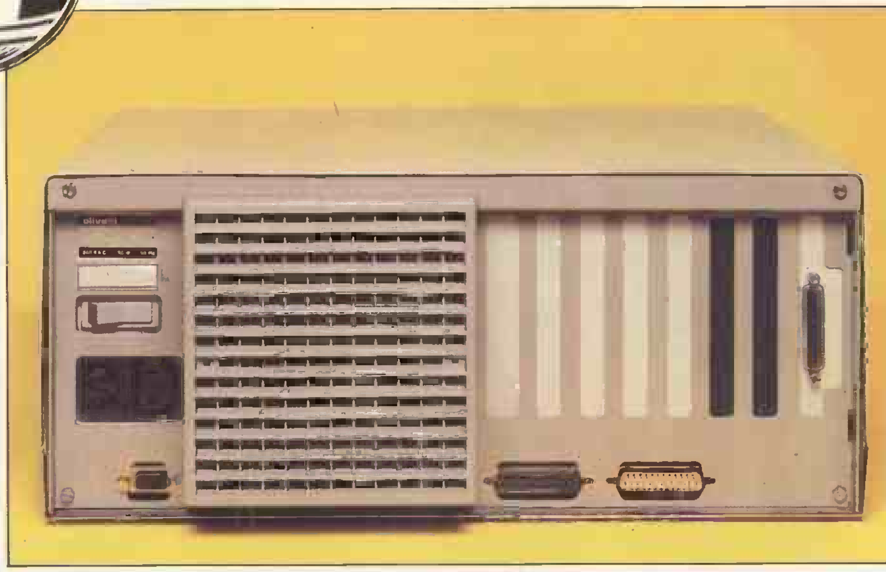
The Olivetti was supplied with GWBASIC for Benchmarking purposes. This is a fast machine; the only systems which beat it have great, hulking Motorola 68000s in them.

Due to the Olivetti's fast screen handling, packages like WordStar and Microsoft's Flight Simulator look better on the Olivetti than on the PC.

A good test of the more esoteric aspects of compatibility is to use the Perfect Link communications package from Perfect software. This not only makes heavy use of the RS232 port but also accesses the disk controller to allow the drives to read alien disk formats. The Olivetti worked just as well in these respects as the original IBM.

Documentation

The system documentation was supplied in ring-bound A5 folders. I received a wide range of documentation ranging from pre-release to final packaged versions. In the final versions the folders are housed in see-through plastic boxes.



Back of the machine: fan, printer port, RS232 port and slots for expansion cards

The information in the manuals was well presented and well laid out with no pretensions towards being tutorials. They presented the information clearly but without the 'now press button A' approach.

Prices

The Olivetti M24 is competing head on with the IBM PC for a slice of the mass market. A typical system with 128k of RAM, twin disks and monochrome screen will set you back £1939, which is cheaper than a comparable IBM. A colour monitor will cost you an extra £629.

MAD1

Hardware

The MAD1 is imported into this country by MBS Microtex in Eton, and its most obvious selling feature is its looks. The system comprises four boxes: display, keyboard, disk drives/power supply unit and the main systems unit; and is constructed of high impact plastic with the two main units finished in dark grey, the keyboard in light grey and the display in off-white — a striking combination.

MBS Microtex is selling this machine as 'the BMW of the micro industry'. The company is hoping that businesses will buy IBM PCs for the workers but that the boss will want something different — a MAD1, preferably.

Due to the disk drives/power supply and the main systems unit being housed in different boxes, the individual units can be kept very small. They both measure only 12.5in wide by 15.5in deep by 2.5in high. If you stack them on top of each other you have a system which takes up very little desk space, or if you place them side by side you have a very low profile unit.

Setting up the machine is not as easy as the Olivetti. As the main electrics are housed in two boxes rather than one, you need to hook up no less than four cables to hold the whole system together. All the different system ports are different shapes, so there's no danger of putting the wrong cable in the wrong hole. The only problem is that the printer port and the RS232 ports all use exactly the same size 'D' plug but they aren't marked. This is a silly omission.

The front of the power supply/disk drive unit houses a green LED on/off indicator and twin Shugart half-height 5¼in IBM-compatible floppy disk drives. The rear panel houses an illuminated on/off switch, mains input, two power sockets, a 'D' connector for all the disk control lines and a reset switch.

The front of the systems unit is blank except for another green LED on/off indicator. The story is different at the back where there are interfaces for disk, modem, video out, power in, Centronics printer port and two RS232 serial ports, one of which can be configured as a RS422 port.

All these ports are operational except for the modem which is American and illegal in the UK. Three more ports are to be found underneath the main unit: the first is a BT-style plug for the keyboard; the second is a light pen interface; and the third is a system expansion interface which is hidden away under a blanking plate.

Getting inside both the system unit

Technical specifications: Olivetti M24

CPU:	Intel 8086 running at 8MHz
RAM:	128k (up to 256k on board)
Disks:	Twin IBM-compatible 370k (optional hard disk)
Keyboard:	IBM or Olivetti layout
Display:	Monochrome or colour, 80 x 25 line
I/O:	RS232, parallel printer
Operating system:	MS-DOS 2.11, PC-DOS

and the disk/power unit is a straightforward task: you simply slacken two screws and lift off the lid. The quality of construction of both units was very high indeed. The casings come apart easily and most are held together with Allen screws rather than the more usual crossheads.

Once inside the systems unit you are confronted by two main PCBs. The main PCB takes up most of the bottom of the box; above that sits the video controller card which takes up about half the box. Both boards were very well made. Again this was an early machine so there were one or two patches, but nowhere near as many as on the Olivetti.

The most striking feature of the main PCB is a large silver chip about one inch square with connections running along all four sides. This is an Intel 80186 central processor chip. This is the first mass production micro I have seen which makes use of the 80186 chip. Despite having been available in low volume for quite some time, it has had more than its fair share of teething troubles and is only now beginning to be available in anything approaching mass volume.

The 80186 contains an 8086 processor, an interrupt controller, two DMA channels, three 16-bit timer counters and a bus controller all on one chip. Incorporating all these functions on one chip allows designers to use far fewer support chips and so reduce the overall chip count within the system.

A large part of the PCB is taken up with sockets for RAM chips. The sockets are laid out in four banks of 18 chips which, assuming you are using 64k chips, adds up to a theoretical total of 512k with parity on the main board. The review machine was supplied with 256k of RAM in place with the remaining sockets free.

The main board also has provision for the user to plug in one IBM expansion card. If you need more than one extra card then you'll have to use the expansion module which can take four more (MBS makes no guarantees that the MAD1 will run all IBM cards, so it's a question of trial and error).

The video board comes with colour capability as standard, so there is no need to buy an extra colour board. The only trouble is that MBS wasn't happy with the MAD colour monitor which is now being re-designed in the US.

The disk drives are standard 360k 5¼in IBM-compatible; the system is also available with a 10Mbyte half-height hard disk. Unfortunately, the controller card takes up the spare IBM slot, so buying the expansion module is a necessity if you want to run extra IBM cards.

The MAD1 is supplied with either an amber or a green display unit. The review machine's was amber. I'm not a great fan of amber displays — they always look slightly out of focus. This was certainly the case on the review monitor, with the bottom left-hand corner of the screen being the worst offender.

Both the amber and green screens have gauze anit-glare cloth glued to the front of the screen, which in my opinion is still the best method of cutting glare. The only problem is that it can be difficult to keep the surface clean.

The swivel display sits on top of the main unit. Tilting is taken care of by pressing a button on the back which makes a leg shoot down to hold the display at the desired angle.

The keyboard is the one area where the MAD1 makes a major departure from the IBM standard. Instead of cramming all the keys together in one line, the MAD1 has its function keys running along the top of the keyboard; and the separation of the numeric keypad from the main typing area makes the keyboard much less cramped.

Many ancillary keys in the main typing section have been moved from their position on the IBM keyboard. This made life difficult at first as I re-adjusted from the 'real' IBM keyboard on the Olivetti.

An unusual feature these days is that the keyboard has a built-in palm rest in front of the keys (from the side this makes the unit look just like a slab of grey cheese). The drawback is that it makes the unit much larger, but it does make for much more comfortable typing.

In use the keyboard is very good. The keys have a very solid feel and emit a reassuring 'click' when pressed. The 'F' and 'J' keys have lumps moulded onto their tops to make them easier for touch-typists to locate. The only thing I didn't like about the keyboard is that the NUM LOCK key is located next to the RETURN key. Time after time I unwittingly hit the wrong key and only realised when I hit DELETE and ended up with a load of full stops . . .

Although I prefer this keyboard layout to the standard IBM offering, it will cause problems to people running IBM programs who'll find that their friendly keyboard overlays don't match the keys. I suppose this is the price you pay for having a better keyboard.

Technical specifications: MAD1

CPU:	Intel 80186
RAM:	Up to 512k on board
Disks:	Twin 370k IBM-compatible, optional 10Mbyte hard disk
Keyboard:	85 keys, integrated palm rest
Display:	80 x 25 amber, green or colour green
I/O:	Two x RS232, parallel printer, lightpen
Operating system:	MS-DOS version two

Benchmarks: MAD1

BM1	0.7
BM2	2.6
BM3	5.5
BM4	5.7
BM5	6.2
BM6	10.9
BM7	16.8
BM8	17.3
Average	8.2

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

System software

The system is shipped with its own version of MS-DOS version 2 called MAD MS-DOS. Unlike the Olivetti the MAD1 doesn't like running standard PC-DOS. Although it will boot, for some reason it refuses to admit that disk B: exists. This is as good a way as any of crashing applications programs. If you boot up under MAD MS-DOS the sytem is much happier, although all is still not sweetness and light.

The first problem I encountered was that the MODE 40 command under DOS didn't work. Instead of producing large characters it produced a speckled effect on the monitor — very pretty but not much use.

Once or twice the sytem also generated unrecoverable system errors. The main symptom was an unintelligible error message flashing across the screen at great speed. The only obvious way out was to re-boot the system.

All in all, the system software had too many rough edges for my liking. However, it must be remembered that I had a very early version (I hope these problems have been cleared up by the time the system is available in volume).

Applications software

As long as you remember to boot up under MAD MS-DOS rather than PC-DOS, the MAD1 will run the majority of IBM PC software. The fact that it isn't happy running PC-DOS marks it out as being not quite as PC-compatible as the

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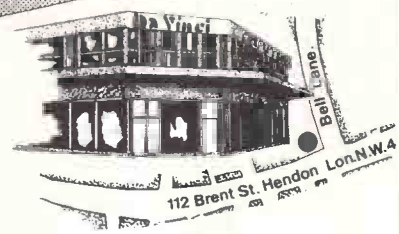

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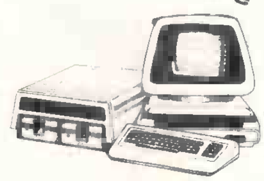

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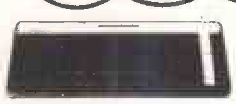

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Olivetti, so it would be a good idea to try your software before you buy.

The MAD1 wasn't supplied with Basic, but it was quite happy to run the Olivetti version of GWBASIC, so the Benchmarks were run using that; the timings show that the MAD1 is slightly slower than the Olivetti. Due to timing problems the processor in the MAD1 was clocked at 6MHz rather than the Olivetti's 8MHz.

Documentation

The documentation for the MAD1 was supplied in two A5 boxed ring-binders, and incorporated a user guide and a MAD MS-DOS guide. Both manuals are very striking to look at: predominantly black with purple and yellow triangles, circles and lines everywhere.

The manuals' text is fairly standard — it tells you what you need to know without any unnecessary frills.

Prices

The MAD1 is pitched at the high end of the market, therefore it has a correspondingly high price.

The basic monochrome system with screen, keyboard, 128k of RAM and twin disks costs £2785. The top-end machine with a 10Mbyte hard disk costs £4995.

Conclusion

There is no arguing with the fact that the MAD1 is overpriced, but then MBS makes it very clear that it's hoping to sell the machine to people who are more interested in their professional status and image than the brass tacks of pounds and pence.

When you operate on the idea that it's image that counts, then the MAD1 succeeds in its aims.

The machine looks very pretty and has sufficient compatibility with the IBM PC to allow the boss to use his minions' disks.

In order to compete effectively with the IBM PC in the mass market, a clone can either compete on price, features or both.

The Olivetti machine offers significantly higher performance than the IBM PC at a slightly lower price. With the exception of BASICA it competently ran all the PC software that I tried with no noticeable problems.

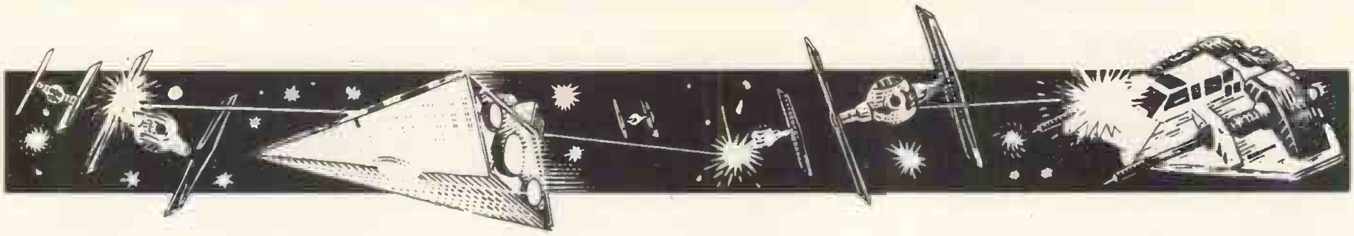
The Olivetti is the best IBM PC clone that I have come across so far. It runs visibly faster, looks nicer and has a much better display than the PC. If I were in the market for an IBM PC-type machine, I would give the Olivetti a very close look indeed.

END

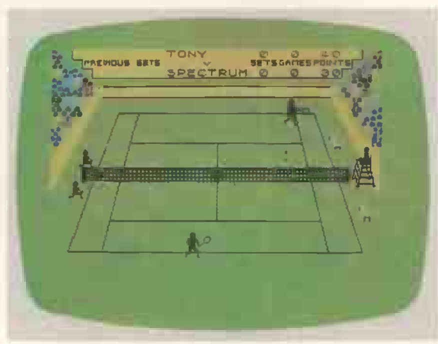
Both units are well supplied with ports: but the modem interface is illegal in the UK

A major departure from the IBM standard: function keys are well clear of the main typing area

SCREENPLAY



Now that Wimbledon's devoid of strawberries and the last tantrum has been thrown, wouldn't you like to play on the Centre Court, kick with Bruce Lee or destroy enemy forces on a war-torn beach? Tony 'Superbrat' Hetherington keeps his eye firmly on the best of the new releases for the Spectrum, Atari and Commodore 64.



'You cannot be serious...'

Title: Match Point
Computer: 48k Spectrum
Supplier: Sinclair (Psion)
Format: Cassette
Price: £7.95

Quiet, please. Spectrum to serve, love all, first set. The Spectrum serves an ace and the crowd gasps. It serves another ace then another and another, and you're left with the consolation that the game will only last three sets.

It's also possible to lose to human opponents in this exceptional tennis game which more than captures the atmosphere of the Centre Court. You'll be impressed by the smooth graphics and the amount of skill required to keep from losing in straight sets. With a subtle turn of the joystick you can spin the ball or perhaps lob or smash it. If you're exceptionally dexterous then you may be able to use the keyboard controls, but for mere mortals both Sinclair and Kempston interfaces are supported.

The screen display is the view of the court from the commentary box, and comes complete with umpire's chair and ball boys who look like refugees from Quicksilva's Ant Attack.

Match Point can be played at three different speeds or skill levels ranging from quarter final (slow) to final (fast). I prefer the 'semi-final' level as it allows both ball speeds which makes for a more interesting game.

One thing I find puzzling is that while I hate tennis and detest Wimbledon, I like Match Point. It will probably become one of the Spectrum classics and join the ranks of the Hobbit and Atic Atac as essential buys for Spectrum owners. Now that Wimbledon is thankfully dead and forgotten for another year you'll be able to get near the television to play it.

It's game, set and match to Psion.

Hong Kong fuey

Title: Bruce Lee
Computer: Atari
Supplier: US Gold/Datasoft
Format: Disk
Price: £14.95

Take a well-known character, build a game around him and you've got a guaranteed winner. That's the theory behind this game based on the legendary Kung Fu expert Bruce Lee.

The format's quite simple: it's a maze game in which you must collect objects in order to work through rooms towards a final battle with a fireball-flinging wizard.

This format fits the Bruce Lee image well as he leaps, chops and kicks through all that is placed before him. In reality you must steer Bruce through the rooms avoiding traps set for you and battling with the Ninja and the dreaded Green Yamo. These fights can become quite complicated as you run and jump in an attempt to land the killer blow. Unfortunately they have similar ideas, so you should be prepared to duck out of the way and run if necessary.

I found these fights to be the best part of the game and spent most of the time grappling with the Yamo. It seems I'm not alone in this, as one of the options available is a two player game which is a duel between Bruce and the Yamo with 10 falls deciding the match.

For those who prefer exploring chambers there are 20 to find, but however you choose to play the game you'll be impressed with the graphics.

Bruce Lee is produced by the American company Datasoft and imported into the UK by US Gold. You should be able to buy it from your local shop so watch out for more American software via US Gold.

Keeping a good thing going

Title: Sabre Wulf
Computer: 48k Spectrum
Supplier: Ultimate
Format: Cassette
Price: £9.95

Ultimate is arguably king of the Spectrum arcade games and so it was understandable that the world and his joystick waited with bated breath for the sequel to Atic Atac. This is it.

Although it's streets ahead of the usual rubbish pushed out for joystick junkies I was curiously disappointed with it, as it seems little more than Atic Atac part two.

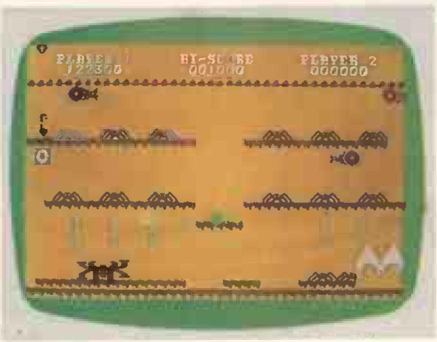
Sabre Wulf is described as a graphics adventure but is really no more than another scenario for Atic Atac. It's just as good and enjoyable to play but lacks the innovation.

This time you're trapped in a forest maze; before you can escape you must collect four parts of an amulet while avoiding the many perils that rush around the screen making strange Ultimate-style warbling noises. These perils come in many shapes and sizes including hippos, rhinos, snakes, wart hogs and tarantulas, all of which think you're the meal they've been waiting for.

You find food, water and supplies to help you in your quest, but beware of the strange orchids that bloom in the forest. You have to be very careful in stepping on these for they flower only for a few seconds and in a variety of colours; each colour has a different effect, from giving you high energy to death.

Treasure also abounds in the forest which naturally scores you points, but the main objective of your quest is to find the amulet. This quest will no doubt bring you into contact with the Wulves — horrendous creatures which will kill all but the very best.

Sabre Wulf contains all of Ultimate's trademarks — superb graphics, fast action and even a tune before the game starts.



Labour of love

Title: Hercules
Computer: Commodore 64
Supplier: Interdisc
Format: Cassette
Price: £6.95

Hercules is a platform game in the now familiar Manic Miner style but taken to its limits.

To complete the 12 labours of Hercules you must solve 50 screens. These screens are allocated to each of the labours and success in one screen leads to the next. Completion of every screen in the first 11 labours is the only route to the twelfth and final labour.

To complete a screen successfully you must get Hercules from the start position to the doorway of the next screen.

Unfortunately it's not that simple, as you have to cope with disappearing platforms, breaking ropes and critters out to get you. You don't have much time to plan your moves as it's quite likely that the platform you are standing on will burst into flames losing you one of your three lives.

Trial and error is the name of the game until you've been through many levels (and lives), at which time you may begin to anticipate what will happen. A suicidal urge may also be of assistance, as on several levels the only course of action open to you is to leap into oblivion in the hope that a platform will appear to break your fall.

One interesting feature of the game is that you tackle the labours in a random order so that you don't get stuck in one place — you get stuck in several places instead.

Interdisc is a record company better known for its work with Sting and the Human League, and this is its first computer game.

I shall be looking forward to the next game if this is anything to go by.

'We'll fight them on the beaches . . .'

Title: Beach-head
Computer: Commodore 64
Supplier: US Gold/Access
Format: Disk or cassette
Price: £9.95

Beach-head is a multi-level arcade war game which will stretch your abilities to the limit. To succeed in your mission to destroy the fortress of Kuhn Lin, you must survive four levels and retain sufficient forces to proceed to the next.

The first stage is optional but recommended as it cuts down the number of aircraft that attack you in the second stage. All you have to do is steer your fleet of nine ships through a cavern littered with mines and torpedoes. The surviving ships are then attacked by aircraft which you must shoot down before they inflict too much damage. The enemy ships then open fire and you're thrown into a duel where the survivor is the one to fire first at the correct elevation. The elevation is controlled with the joystick and a message reporting the result of the shot appears at the bottom of the screen.

The favoured few ships that survive this onslaught will land two tanks on the beach. They must advance one by one up to the fortress negotiating enemy tanks and gun positions *en route*. To win the game you must destroy 12 targets on the fortress but you'll do well to take out three targets with one tank. Subsequent tanks have a harder journey up the beach, so the game should keep its appeal for some time.

The screenshots illustrate the game's graphics but you'll have to play it to sample the superb sound effects.

Programming Spectrum function keys

Single key entry of Basic keywords is an innovative feature of the ZX Spectrum, but how about programming keys to execute a whole line of Basic? Nick Ryman-Tubb has worked out one way of doing it.

```
10  CLS
20  INPUT "Enter decimal starting address?";a
30  INPUT "Enter two digit hex number?";H$
40  X=0
50  FOR B=1 TO 2
60  P=CODE(MID$(H$,B,1))-48
70  IF P>9 THEN P=P-7
80  IF B=1 THEN P=P*16
90  X=X+P
100 NEXT B
110 POKE A,X
115 PRINT H$;" hex=";X;" decimal at address";A
120 A=A+1
130 GOTO 30
```

Fig 1 Basic hex loader progam

```
         VECTOR:  EQU  65279         ;Interrupt vector address
         LASTK:   EQU  23560         ;Value of last pushed
         ELINE:   EQU  23641         ;Address of edit buffer
         KSTATE:  EQU  23552         ;Key status
         WORKSP:  EQU  23649         ;End of edit buffer
         RAMTOP:  EQU  23730         ;Top of memory
         ERRSP:   EQU  23613         ;Error stack
         KCUR:    EQU  23643         ;Cursor address

                  ORG  50000         ;Start of program

215FC3            LD   HL,START      ;HL=start of ISR
22FFFE            LD   (VECTOR),HL   ;Set up the vector
F3                DI
3EFE              LD   A,254         ;A=MSB of ISR
ED47              LD   I,A           ;Set up the ISR
ED5E              IM   2             ;Mode 2 interrupts
FB                EI
C9                RET                ;Return to ROM
```

Fig 2 Code to set up the ISR

One of the advantages of the BBC Micro over the Spectrum is its provision of programmable function keys. Programmed function keys are a great saver of both time and space. Used in foreground mode, such keys allow you to develop and debug programs faster. Function keys also offer the opportunity to make your program menus request function key depression for invoking a menu item.

The routines offered here allow Spectrum users to create commands and assign them to function keys. The example given allows up to 10 keys to be delivered as holding a Basic line; when one is pressed that line is executed.

All function key assignment commands are preceded by an asterisk. For example, to define one of the keys the following would be input in direct mode:

*key0 <enter> PRINT "HELLO" <enter>

Once you've typed this in, whenever you press key 0 (the key with the '8' on it) in graphics mode, the program will run and the word 'HELLO' will appear on the screen. Obviously more complex programs can be defined but they must only take up one line. In this article an example command to produce a tone through the speaker is given, called by '*RASP'.

The keys defined here are the first 10 graphics keys (top row), so the use of the graphics symbols on these keys is lost.

One of the Spectrum's best features is its interrupt structure. The 'INT' line on the Spectrum's central processor (Z80A) is made active 50 times a second (that is, a square wave of period 20mS). Normally (on power up) the Spectrum operates in mode 1 interrupts where each time the 'INT' line is active, control is passed to a routine at 0038 hex in the ROM. This routine updates the (pseudo) real-time clock and scans the keyboard. However, realising that unconnected peripherals leave the data bus floating at OFF hex during an interrupt sequence, we can program the Z80 in mode 2 interrupts. In this mode the Z80 combines the 'I' register and the value of the data bus to form a 16-bit vector address (that is 'I' OFF hex). If, at this vector address, an address of our new interrupt service routine (ISR) is stored, this will be executed every 20mS instead of the Sinclair routine.

Each of the programs published here contains an assembly-type listing with the hex code, mnemonics and comments (like a typical 'sub set' program). You must type all the hex code into the Spectrum using the Basic hex loader program in Fig 1. The program will allow you to enter the hex digits (two at a time) into the Spectrum's memory. The program is very simple but for a more suitable loader, refer to *PCW*, May, page 186 or use any other hex loader program you may have. The hex must be typed in two digits at a time (this is called a byte or word of data). The start or origin of the code is 50000 (decimal), C350 (hexadecimal).

The piece of code in Fig 2 will set up the ISR as previously explained (any hex which appears must be typed into the Spectrum).

The ISR start-up code in Fig 3 scans the keyboard (to stop the system 'locking up'), saves any registers and checks the input buffer. If you press the 'ENTER' button this signals that the input buffer has been filled. The routine will check to see if it's a new command (that is, starts with a '*') or if it's one of the newly defined keys (graphics keys of value 128-138).

'Programmed function keys are a great saver of both time and space . . . such keys allow you to develop and debug programs faster. (They) also offer the opportunity to make program menus request function key depression for invoking a menu item.'

The search for command code in Fig 4 will search a table for the new 'star' command. If it's found the address of the new command routine is taken from the table and jumped to (that is, the new routine is executed).

The ISR will terminate if no new command has been recognised. The piece of code in Fig 5 will return the registers to their normal values and enable the interrupts and return control to the ROM. If a command has been recognised, the ISR does not exit through this routine.

The piece of code in Fig 6 will add a simple new command to the Spectrum. It is called by '*RASP<enter>' and will play a note through the speaker. If you

```
F3FF      START:  DI,RST  56          ;Disable any interrupts
E5                PUSH    HL          ;Save registers
D5                PUSH    DE
C5                PUSH    BC
F5                PUSH    AF
FDCB016E          BIT     5,(IY+1)    ;Check keyboard
284A              JR      Z,ENDR      ;If none pushed then exit
3A085C            LD      A,(LASTK)   ;A=last key pushed
FE80              CP      128         ;Check for graphics characters
3805              JR      C,NOPE
FE8A              CP      138
DA13C4            JP      C,RUN       ;'Run' the key code
FE0D      NOPE:   CP      13          ;'ENTER'?
203A              JR      NZ,ENDR     ;Exit if not.
2A595C            LD      HL,(ELINE)  ;HL=input buffer start
7E                LD      A,(HL)      ;A=first character
FE2A              CP      '*'         ;Is it a new command?
2032              JR      NZ,ENDR     ;Exit if not
```

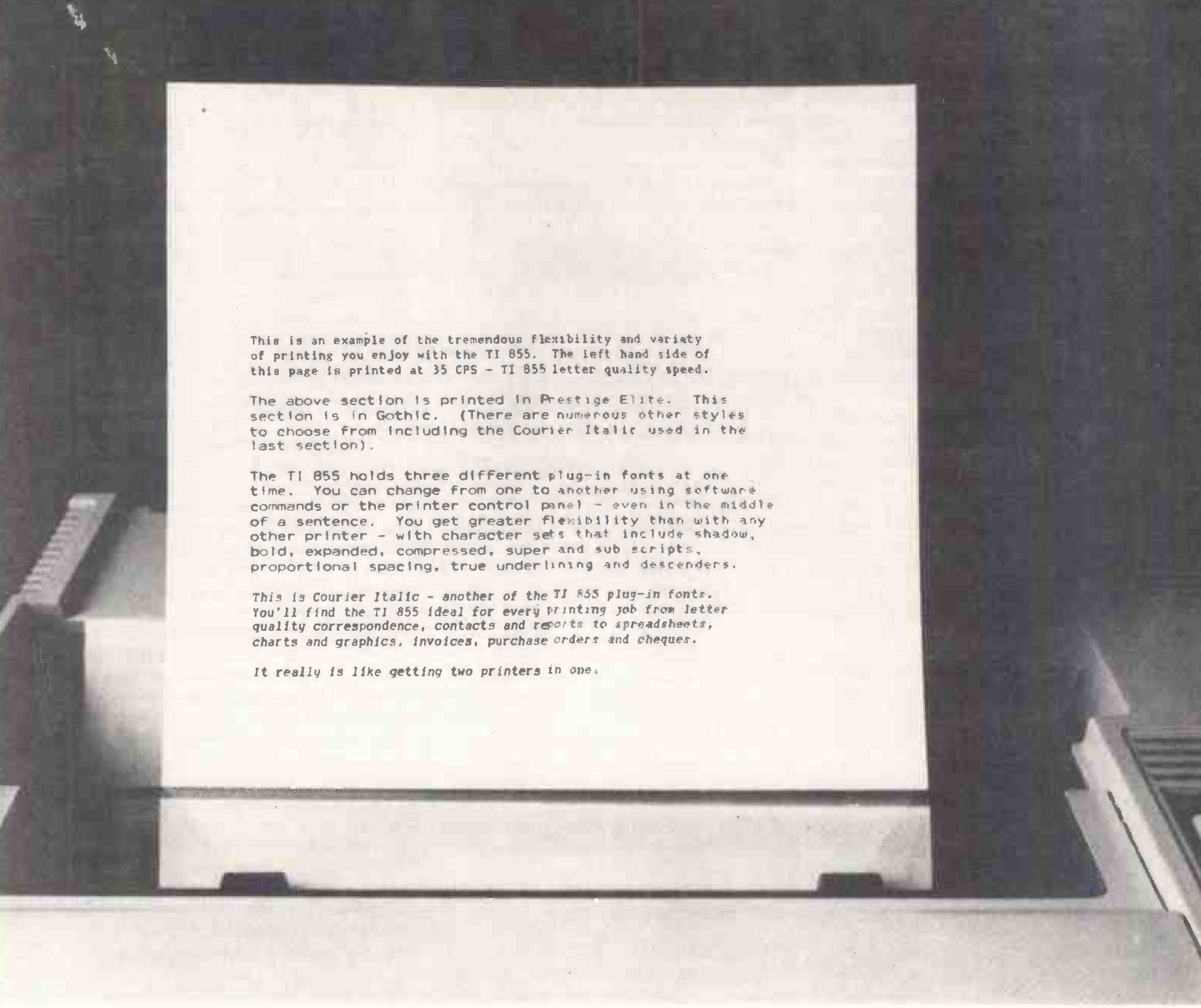
Fig 3 ISR start-up code

```
1166C4            LD      DE,LIST     ;DE=start of new cmd table
23                INC     HL
1A        SEARCH: LD      A,(DE)      ;A=character in table
B7                OR      A           ;End of command?
2821              JR      Z,FOUND
47                LD      B,A         ;B=character in table
7E                LD      A,(HL)      ;A=character in buffer
FE0D              CP      13          ;End of line?
2824              JR      Z,ENDR      ;Exit if so
B8                CP      B           ;Are they the same?
2004              JR      NZ,ENTRY    ;If not then jump
13                INC     DE
23                INC     HL          ;Bump pointerS
18EF              JR      SEARCH      ;Loop until the end.
13        ENTRY:  INC     DE
1A                LD      A,(DE)      ;Check for next word
B7                OR      A
2806              JR      Z,ENT1
FEFF              CP      255         ;End of command list
2814              JR      Z,ENDR      ;If so then exit
18F5              JR      ENTRY       ;Keep looking!
13        ENT1:   INC     DE          ;Point to next
13                INC     DE
13                INC     DE
2A595C            LD      HL,(ELINE)  ;Start of buffer+1
23                INC     HL
18DB              JR      SEARCH
44        FOUND:  LD      B,H         ;BC=position in buffer
4D                LD      C,L
13                INC     DE
1A                LD      A,(DE)      ;A=LSB of routine address
6F                LD      L,A
13                INC     DE
1A                LD      A,(DE)      ;A=MSB of routine address
67                LD      H,A         ;HL=routine address
E9                JP      (HL)        ;Execute routine
```

Fig 4 Search for command code

```
F1        ENDR:   POP     AF          ;Restore registers
C1                POP     BC
D1                POP     DE
E1                POP     HL
FB                EI                  ;Enable the interrupts
ED4D              RETI
```

Fig 5 End of the ISR



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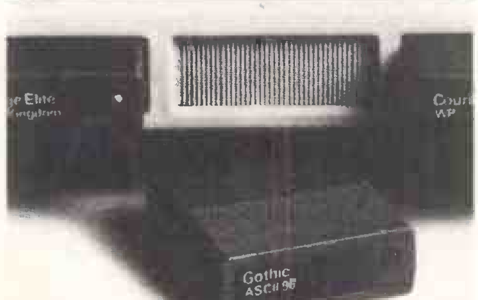

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TEXAS INSTRUMENTS

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```
110501   RASP:   LD     DE,261       ;Parameters for BEEP
216A06           LD     HL,1642
CDB503           CALL   949          ;Make the note
2A595C           LD     HL,(ELINE)   ;Start of input buffer
360D             LD     (HL),13      ;Signal it is empty
C3B5C3           JP     ENDR         ;Exit routine
```

Fig 6 Sample new command

```
0A D6 30 CD 51 C4 FD CB 01 AE 3E FF 32 00 5C CD B0 16 CD 2C 0F ED 5B 59 5C D5 2A
61 5C ED 52 44 4D 2A 74 C4 7E B7 28 08 B9 30 05 CD 41 C4 CF 0F 71 23 70 23 D1 EB
ED B0 2A 76 C4 23 73 23 72 CD 41 C4 FB C3 A2 12
```

Fig 7 Hex dumpcode for user-defined function keys

```
D6 80 CD 51 C4 3E FF 32 00 5C FD CB 01 AE CD B0 16 2A 74 C4 4E 23 46 23 E5 C5 2A
5B 5C CD 55 16 C1 E1 ED 5B 59 5C ED B0 CD 41 C4 C3 B4 12 2A B2 5C 2B 22 3D 5C D1
F9 36 03 23 36 13 EB E9 11 78 C4 17 6F 26 00 19 7E 5F 23 22 76 C4 7E 57 ED 53 74 C4
C9
```

Fig 8 Code to execute the stored Basic line

```
72617370  RASP:     DEFB   'rasp'     ;New command
00                  DEFB   0          ;End of command
BCC3                DEFW   RASP       ;Address of command
6B6579              DEFB   'key'      ;New command
00                  DEFB   0
CDC3                DEFW   KEY        ;Address of routine
FF                  DEFW   255        ;End of table
 The following code is simply storage space and pointers. You must type the hex
in as it is shown.
0000      STORE:    DEFS   2
0000      POINT:    DEFS   2
84C4      TABS:     DEFW   MEMORY
0000000000          DEFS   5
0000000000          DEFS   5
00        MEMORY:   EQU    $

                    END
```

Fig 9 Command table

wish to add further commands you can follow this example making sure you make an entry in the table ('LIST') for each new command you need; you will need an assembler to do this.

The code for user-defined function keys will be executed when the user types the command *KEYn where n is the key number in the range 0-9. The routine will convert the key number into hex and find the particular pointer to this key. You then type in the Basic line the key is to represent and press 'ENTER'. The routine saves this line, ready to be recalled when a graphics key is pushed.

The code in Fig 7 follows on from the previous code but has been given in the form of a hex dump as it is rather long.

The graphics keys can be redefined in order to hold a Basic line. When the key is pushed this line will be executed. The following keys can be defined:

8	key0	5	key5
1	key1	6	key6
2	key2	7	key7
3	key3	8	key8
4	key4	9	key9

These keys are on the top row of the keyboard and SHIFT+GRAPHICS must be pressed first to select graphics mode. The keys can only be defined in order but may be redefined as long as the new definition is not longer than the previous one. For example:

You type: *key0<enter>
FOR I=1 TO 10:PRINT I:NEXT I <enter>

Now you have defined graphics key 0 (key '8' on the keyboard) as holding this set of statements, to execute it you simply press SHIFT+GRAPHICS and then the key with number '8' on it. You can then define key 2,3, and so on, in that order. You cannot define key 4 and then key 0; they must be defined in order since in defining each one you are creating a pointer for the next key (like a linked list).

The code in Fig 8 will execute the Basic line stored as each key is defined.

The command table in Fig 9 searches for a new command. If you re-assemble the code you can add your own commands by inserting their name and address in this table.

Running the program

When the hex code from Fig 9 has been entered, save the code by typing SAVE 'keys' CODE 50000,304 <enter>; once this has been done (and checked) type RANDOMIZE USR 50000. You will see no effect except that the screen is cleared. Now type *RASP <enter>: the Spectrum will not give you the normal syntax error of a question mark but will emit a tone on the speaker. You have just added an extra command to the Spectrum!

I have found the following definitions very useful:

*key0 <enter> PRINT INVERSE 1; "FREE MEMORY:";65536-USR 7962

This will define the '8' key in graphics mode to display the number of bytes left to the user at any time.

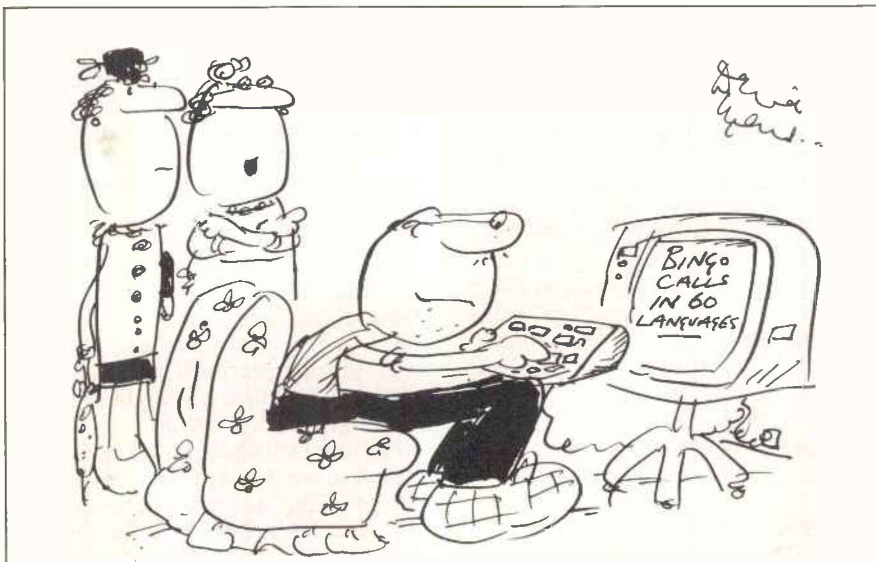
*key1 <enter> LOAD "": LIST <enter>

If you have an assembler on the Spectrum then you can assemble the mnemonics given and create your own commands.

For example:

*RENUMBER, *FIND or *REPLACE.

END



'My George has this tremendous thirst for knowledge'

TEACH YOURSELF LISP

Dick Pountain's 'Teach Yourself' series continues with a definition of new functions and examples of proper Lisp programs.

Lisp works on names, numbers and lists by applying functions to them; a function is applied by making it the first element of a list, the rest of which contains its arguments. Functions always return values (so far we have looked at CAR, CDR and CONS) but Lisp systems include many other functions; typical microcomputer versions will have between 60 and 100 built-in functions. You'll find a list of these in the supplied system manual, along with descriptions of what they do and how they treat their arguments. One function that's always included is OBLIST, which returns a list of all the objects Lisp knows about in the order in which they were created. It will list on the screen any names that you have created during the session and the names of all the built-in functions.

PLUS, DIFFERENCE and TIMES are always provided to do arithmetic (in some systems they can take more than two arguments so (PLUS 1 2 3 4) returns 10). Division is more variable between systems. No home computer implementation of Lisp that I know of has floating point arithmetic; most have signed 16-bit integer maths, which can cope with numbers between −32768 and 32767 (the notable exception is Microsoft's muLISP which, like most mainframe versions, has 'infinite' precision integer arithmetic so you can deal with any number whose representation will fit into free RAM). Most micro Lisps provide QUOTIENT and REMAINDER for integer division and some have DIVIDE which returns both quotient and remainder. Lisp is not geared to lots of number crunching: if that's what you need a good Basic will serve you better.

Another important group of functions perform tests. They return a value which is either True or False, just like =,<,> do in Basic. However, the representation of True or False in Lisp is not 1 or 0 as in most other languages: instead they have their own special names, T and NIL. These two words are built into the system and if you type them in at the keyboard they evaluate to themselves, just as a number does. It's important not to confuse NIL with arithmetic 0, though. It does represent nothing, but a different sort of nothing (no prizes for guessing that it represents the empty list (), as you'll see if you type in ()).

Typical tests include:

(NUMBERP X)	— is X a number?
(ATOM X)	— is X an atom?
(NULL X)	— is X NIL?
(ZEROP X)	— is X zero?
(EQUAL X Y)	— are X and Y the same?
(GREATERP X Y)	— is X numerically greater than Y?
(MEMBER X Y)	— is X a member of the list Y?

The P which often ends these names is one of the historic relics that litter Lisp, standing for 'predicate' (a question mark at the end of all test names would have been better but I don't think they had them in those days). You've probably realised by now that some of these tests are sensitive to the type of their arguments: for example, GREATERP must have numbers not lists. This is the price we pay for letting a name take values of any type but it's well worth it. Check how your system behaves if you give it the wrong types; some give error messages while others just return NIL. Try this:

```
*  (SETQ FRED 4)
*  (SETQ TOM '(1 2 3))
*  (GREATERP TOM FRED)
```

(Throughout this article I'm going to show in the examples exactly what you'd see on the screen. * is the prompt and Lisp's replies will appear on the next line at the left margin).

If all that Lisp could do were evaluate its built-in functions in this way, it would be a rather boring type of (integer only!) desk calculator. But, of course, we can define our own functions: defining functions *is* programming in Lisp. In order for our functions to do all the things that a Basic or Pascal program can (and more), they'll need to be more complex than the ones we've seen so far: they must be able to branch and loop and choose just as GOTO, FOR ... NEXT and IF do. But for now let's just settle for defining something simple.

The function that defines functions in Lisp has various names in different systems but it's usually one of DEFINE, DEF, DE or DEFUN (DEFine FUNction). I'll stick to DEFINE because it says what it does.

DEFINE takes three arguments, so: (DEFINE function-name (list of its arguments) (body of function)) where the 'body' of the function is just what you would type in if you wanted to do what the function is supposed to do. As an example let's define SQUARE to calculate the square of a number. To square nine, using what we know so far, we type:

```
*  (TIMES 9 9)
81
```

In our SQUARE function we want to replace the specific number nine with a variable argument, which we'll call NUM. So:

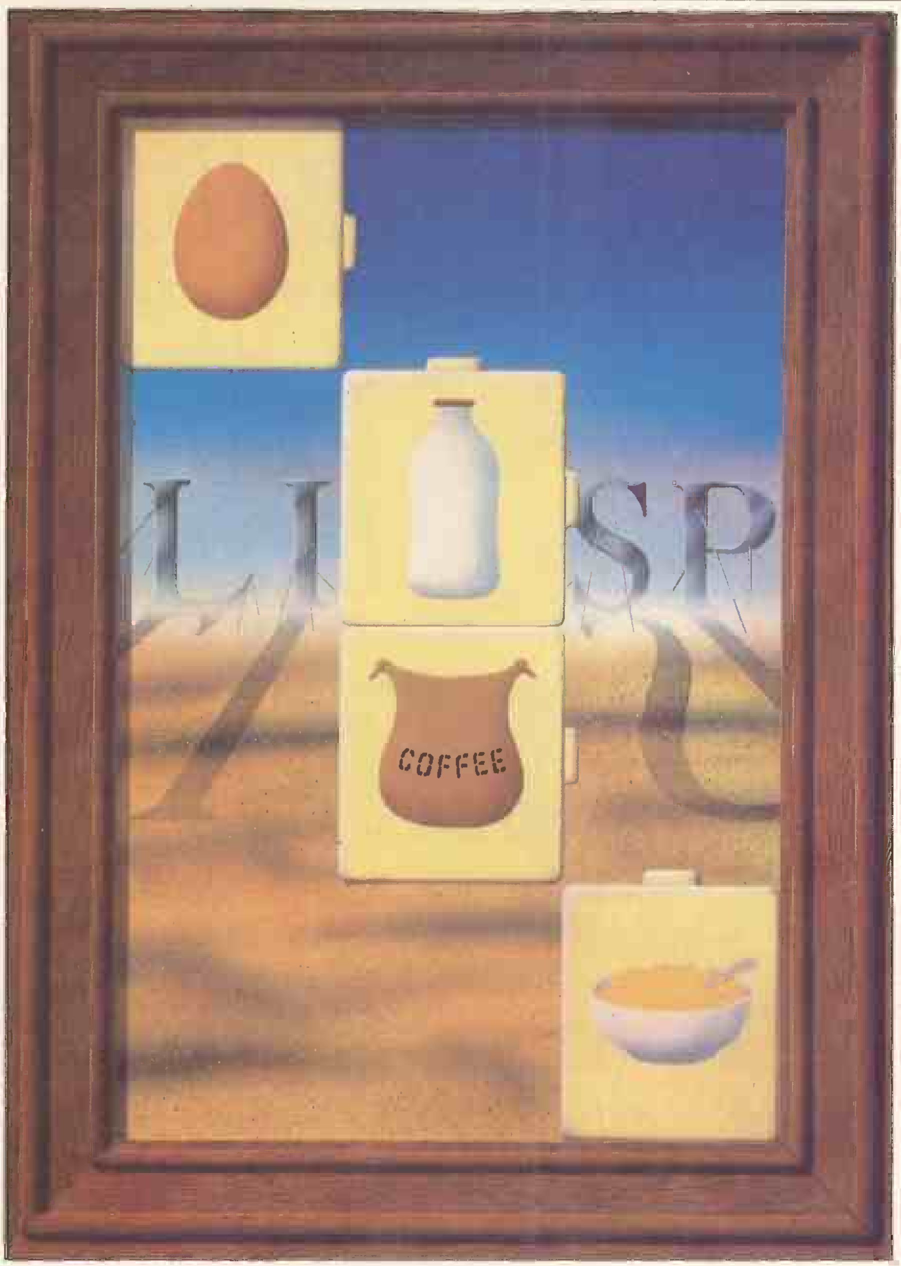
```
*  (DEFINE SQUARE (NUM)
   (TIMES NUM NUM) )
SQUARE
```

does the trick. Notice the value 'SQUARE' which Lisp returned. DEFINE is, after all, only another function and it must return a value, which is always the name of the function we've just defined. We use SQUARE just like any other function :

```
*  (SQUARE 8)
64
```

Two points are worthy of comment; the first is that we didn't need to use any quotes in the definition: DEFINE is one of that rare breed of functions that doesn't evaluate any of its arguments.

The second is that the variable which represents SQUARE's argument (namely NUM) is given to DEFINE as a list (that is, in brackets). This is nothing to do with the type of NUM (in this case it's a number not a list), but is the way



DEFINE wants its second argument and who are we to argue. The reason becomes obvious when you define a function which takes more than one argument.

People whose only programming language is Basic may not be comfortable with the fact that SQUARE's argument is called NUM when we define it, but we don't need to use NUM when we use it. For example, if we SETQ FRED to 4, then:

```
*   (SQUARE FRED)
16
```

NUM is a 'formal' parameter or argument (they're used in Pascal and many other languages too). It's there just as a place holder in the definition, to mean 'whatever value is given to SQUARE'. Whenever you call SQUARE, you can think of its argument (8 or FRED in the above examples) as being automatically decanted into NUM. This decanting process (called 'variable binding') is rather special in Lisp.

SQUARE is now just as good as any of the built-in Lisp functions; you'll see it on the OBLIST if you wish. There are no second-class citizens in Lisp (many of the built-in functions are defined in machine code, some in Lisp like SQUARE, but you can't tell the difference).

Let's define a function which takes the first element from each of two lists and tells us whether they're the same:

```
*   (DEFINE SAME-FIRST-ELEMENT?
     (LIST1 LIST2)
     (EQUAL (CAR LIST1) (CAR LIST2)) )
SAME-FIRST-ELEMENT?
```

We can use the function thus:

```
* (SAME-FIRST-ELEMENT? '(1 2 3)
    '(1 EGG 2 PIGS))
T
```

or:

```
* (SAME-FIRST-ELEMENT? '(1 2 3)
    '(A B C))
NIL
```

Note SAME-FIRST-ELEMENT? is a normal, respectable Lisp function and evaluates its arguments, hence the quotes before the lists. This is true of all functions created with DEFINE.

Note again that the brackets around (LIST1 LIST2) are there because it's a list of the formal arguments, not because LIST1 and LIST2 represent lists. Satisfy yourself that you understand why the brackets are as they are in (EQUAL (CAR LIST1) (CAR LIST2)). It's exactly what you'd type at the keyboard to do the test, assuming that LIST1 and LIST2 had been given values with SETQ.

Finally, note that Lisp doesn't mind a definition running over more than one line. When you hit RETURN Lisp won't accept the definition until all the brackets are balanced, which means that it's finished. Note also the extra spaces before the last bracket (which matches the one before DEFINE and ends the definition). This makes the structure of the EQUAL clause easier to see than if it had three right brackets at the end. If you're not to be driven batty by the brackets in Lisp (it's rumoured to stand for Lots of Irritating Single Parentheses) then pay attention to the layout of your definitions, breaking them at natural places onto a new line.

This raises a further point: how do you edit Lisp definitions? There is no simple answer. The Lisp interpreter normally allows only the use of the BACKSPACE/DELETE to undo things typed on the current line. Some home computer implementations (for example, on the BBC and Spectrum) might allow you to use the built-in editor which works for Basic programs. Otherwise a separate editing program is required and very often one, written in Lisp, will be supplied as a separate file which you can load. Lisp people tend to be spartan, almost monastic souls unspoiled by full-screen editors, so don't expect it to look like WordStar.

Now that we can define functions, all that's lacking in order to write real programs is some means of directing control flow.

This is a rather controversial area among Lisp people. The original 'pure' form of Lisp relied entirely on a function called COND (for 'CONDition') to alter the course of evaluation. Various other control structures have been tried, mostly modelled on those in more conventional languages: for example, LOOP or WHILE. I'll only consider a pure form of Lisp using COND here, partly because COND is both powerful and elegant once you grasp it but also because the newer constructs tend to vary from version to version.

COND is a function which chooses between a number of lists (called 'clauses') which make up its arguments. Each clause has two parts: the first element is a test expression which returns T or NIL (sometimes called a 'predicate'), and the rest can be any number of Lisp expressions :

```
(COND
   ( test1 expressions . . . .)
   ( test2 expressions . . . .)
   ( test3 expressions . . . .)
   . . . . . . . . . . . . . . . . . .
   ( testN expressions . . . .)   )
```

COND performs the tests one at a time starting from the top and when it finds one that isn't NIL, evaluates the

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PLANTRAC 1	Computerline	●		●	●
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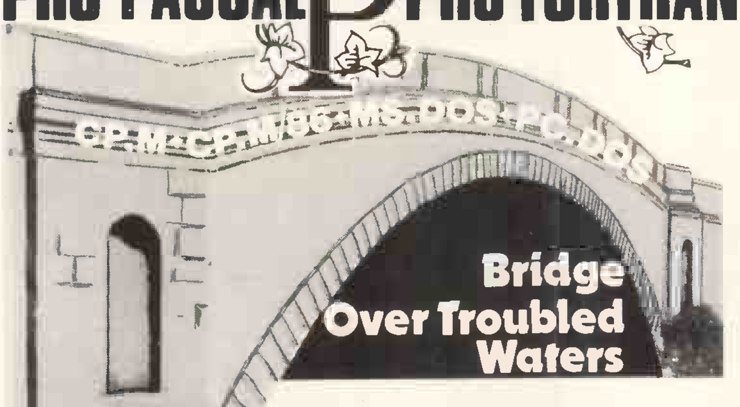

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expressions that follow it. The value of the *last* of these expressions is the value returned by COND. If all the tests yield NIL then COND just returns NIL.

It may help to understand COND better if we stop thinking in Lisp functional terms for a minute and pretend we're in Basic. Tracing control flow with your finger, as in a Basic program, COND works down the column of tests and when it finds a true one carries on across and out (Fig 1).

```
            (COND
NIL      →(test1             exp1 exp2)
NIL      →(test2             exp3  exp4   exp5)
  T      →(test3 →   exp6 → exp7) →   value of exp7
never  reached  (test4      exp8  exp9   exp10)  )
```

Fig 1 COND: tracing control flow

The tests don't have to evaluate to T — any value other than NIL will trigger COND. If you want to make sure that *something* always gets evaluated, then the last clause can simply have T as its test portion. If all the other tests fail, this last clause will always be evaluated. It wouldn't make sense to start any clause before the last with T, because the clauses below it could never be reached and would be redundant. The example in Fig 2 may help to clarify this.

```
(DEFINE LOOK-FOR-EGG (LIST)
  (COND
    (  (EQUAL  (CAR LIST)    'EGG)                      'FIRST!   )
    (  (EQUAL  (CAR(CDR LIST))    'EGG)                'SECOND!   )
    (  (EQUAL  (CAR(CDR(CDR LIST)))    'EGG)            'THIRD!   )
    (     T                                             'DUNNO!   )
  )
)
```

Fig 2 Function for the word 'EGG'

This preposterous function looks for the word 'EGG' in a list and tells you which position it's in, though it gives up after trying the first three! Artificial intelligence written very small indeed:

```
*(LOOK-FOR-EGG ' (DOG EGG FISH
   PIG))
SECOND!
```

You could read a COND like this as IF ... THEN ... IF ... THEN ... IF ... THEN ... OTHERWISE...., where the T clause is the otherwise part which is always executed by default.

Instead of the puny 'FIRST!, 'SECOND!, and so on, we could have any number of expressions doing processing of great complexity. Don't forget that only the value of the last such expression is returned; if there were more than one, the others could only be there for their side-effects as they can't return any value. For example, if we make this change :

```
(COND
  ( (EQUAL   (CAR   LIST)   'EGG)
  (SETQ EGGPOSN 1) 'FIRST! ) . . .
```

then the SETQ expression sets the variable EGGPOSN to one as a side-effect: that is, it contributes nothing to the value returned by LOOK-FOR-EGG, which remains FIRST! if this clause is chosen.

Don't be depressed by the sight of that grisly progression of CAR(CDR(CDRs (what if we wanted to search the first 100 places?). That is not a sensible way to do things in Lisp but we haven't yet discovered the trick to do it properly. A short term improvement would be to use CADR and CADDR, but what we really want is a means of repeating the application of CAR (or any other function) as many times as necessary. END

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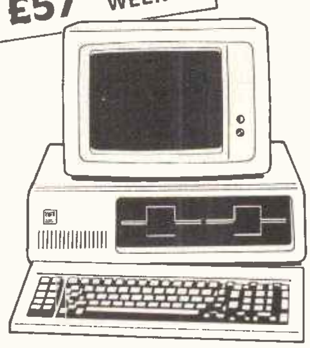

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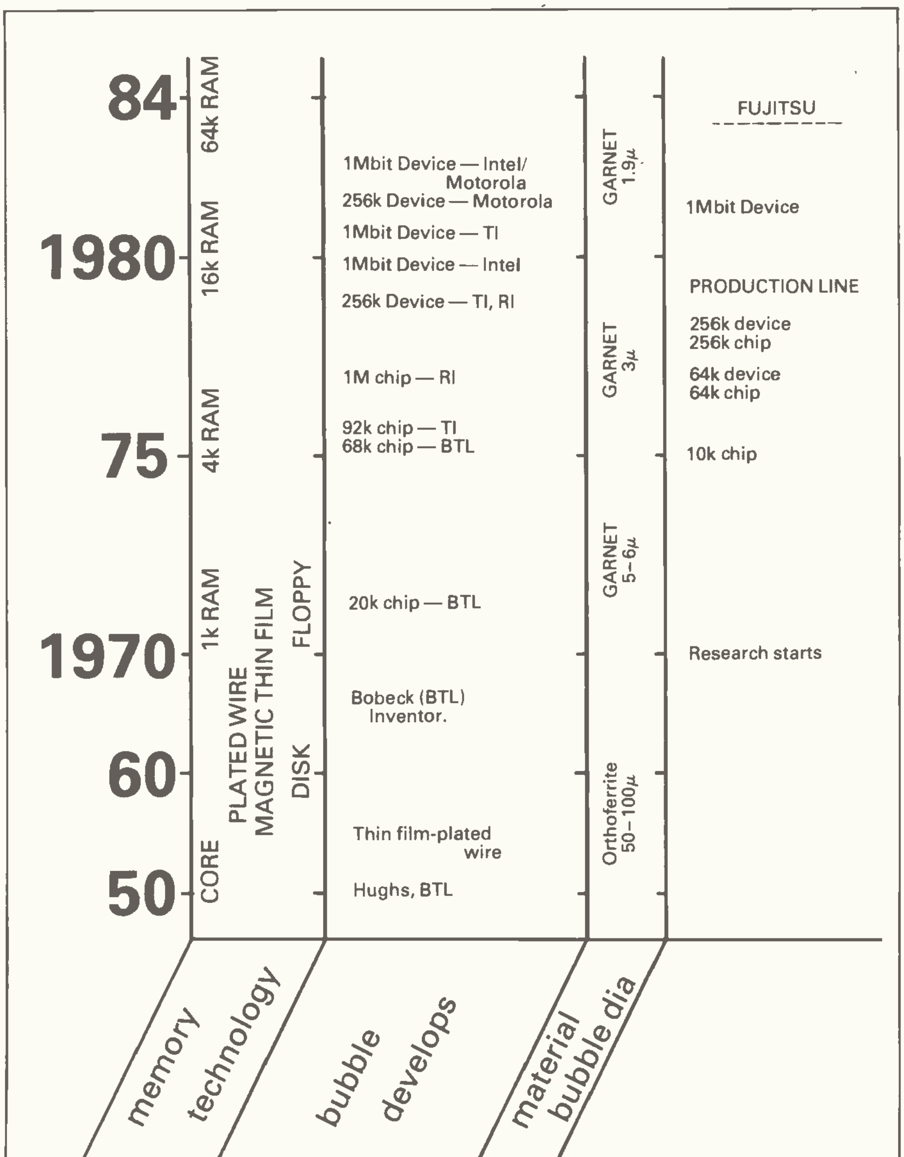
If the bubble bursts

One exciting data storage development has slipped quietly into the UK with a minimum of fuss. It's taken almost twenty years to get here and could signal the beginning of the end for disk drives. What is bubble memory and how does it work? Mike Mephan reveals all.

Memory is the name of the game, and the name of the memory is bubble. Fujitsu is first into the UK market with a one megabit magnetic bubble memory unit marketed by Immediate Business Systems at £690. Fujitsu also offers, though not in Europe, similar devices as alternatives to disk drives on its FM8 and FM16 micros.

In the US, a number of portables with bubble memory have appeared, such as the badly-named Portabubble from Teleram which weighs in at 10lb and has become standard word processor issue to reporters on the *New York Times*.

One of the reasons why magnetic bubble memory has taken so long to realise its full potential in the computer industry is that the technology is not easily explained in words of one syllable. The people who have been involved in its development over the past 20 years have tended to talk about bubble memory in terms which are not easily understood by the average electronics technician, and would be complete gobbledygook to the hobbyist.



Bubble memory history

Theory of magnetism

It is necessary to understand some of the theory of magnetism at this point.

The accepted difference between a ferromagnetic and a non-ferromagnetic substance is in their atomic structures. Unique to the ferromagnetic substance is the fact that at least one of the electrons of each of its atoms has a spin about the axis of the atom which is uncompensated by any other electron.

If two neighbouring atoms find themselves with their uncompensated electrons spinning in parallel, not only do they maintain that position, but begin a chain reaction of forcing atoms next to them to assume the same alignment. In this way, all the atoms in the substance have their unbiased electrons spinning in parallel very quickly and the substance is totally self-magnetised to saturation point.

However, the substance is of a crystalline nature and each crystal is divided into magnetic domains. While each domain is totally saturated magnetically, not all domains lie in the same magnetic direction.

In fact, nature being as clever as it is, the effect is of the magnetic forces of each individual domain of the crystal combining to give an overall minimum magnetic force as close to zero force as possible, so it can be seen that in ferromagnetic substances these forces exist as a natural state.

Not all these magnetic substances act in exactly the same way. Some are totally random in the way the magnetic domains lie, some have a directional preference. In addition, some have larger domains than others.

The materials used in the manufacture of bubble memories are iron oxide compounds described as rare earth garnets. By combining these materials in different proportions and by adding other non-ferromagnetic materials, the magnetic properties of the bubbles can be altered quite substantially.

The most important factors to be considered when choosing the right substance are the stability of the magnetic bubbles once formed, their size and the uniaxial magnetic properties of the substance.

If the substance is one which prefers its domains to lie along a single axis, in other words north and south but never east and west, it has a uniaxial magnetic anisotropy (which means it has different properties in different directions). By cutting through that material at right angles to its axis, you would see each of the domains in cross section. At that moment the domains would appear as long, unformed shapes (Fig 1).

'Magic'

The magic starts when an external magnetic field is applied to the overall cross section. Each domain shrinks in size, eventually taking on a uniform shape, and that's a bubble (Fig 2).

If the external magnetic field is increased the bubble continues to shrink, eventually collapsing; its magnetic direction becoming the same as the domain surrounding it. The magnetic force needed to form and maintain the bubble is quite critical.

Now we have two essential components of our bubble memory: the garnet material containing the magnetic domains; and the external magnetic forces to maintain the magnetic domains in their bubble form at all times.

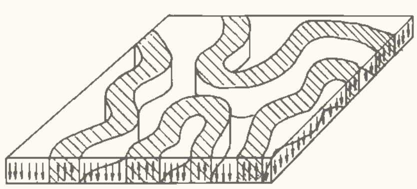


Fig 1 The ferromagnetic garnet is self-magnetised to saturation although the magnetic forces are arranged into domains of opposite polarity, cancelling any overall magnetic effect. It will remain like this until an external magnetic force is applied.

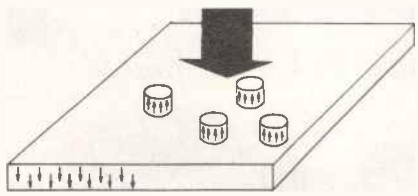


Fig 2 At a critical point, the external magnetic force will bring the shrinking domains to a point where they become cylindrical in shape; these are the bubbles.

If the magnetic force applied to the garnet were increased beyond this point, the bubbles would reach a state of collapse and take on the polarity of the surrounding domain.

Each bubble can be thought of as a tiny cylindrical bar magnet floating in a sea of opposing magnetism. While it is surrounded it can only remain at its point of creation; but it does want to get away so it takes only the slightest change in the direction of the surrounding magnetic bias to make the bubble scurry off in exactly the right direction.

This indicates that a third component is required to alter the direction of the magnetic field surrounding the bubbles. The component takes the form of a pair of field coils enveloping the garnet integrated circuit and the bias magnet; the windings of the coils are at right angles to one another.

Now that we know that bubbles are highly mobile elements in the structure, we're a whisker away from understanding exactly how they're used as a data storage medium. Three more components are needed to complete our elementary bubble memory chip: the first is a means of creating a bubble in exactly the right position in the garnet; second is a method of detecting the presence of a bubble; and third is the capability of organising the movement and structuring the organisation of bubbles which have been generated.

Once you have these components, it's not difficult to understand that a bubble can be created to represent a bit of data and moved down a line of storage elements until all the elements have been used up in a typical write operation, or shifted down the line past the detector element, vacating storage elements, in a read operation. Data consisting of a series of ones and zeros will be represented by creating a bubble for a 'one' and not creating a bubble for a 'zero'.

The storage elements are very simple iron alloy 'stepping stones' for the bubbles. The elements are deposited on the surface of the garnet chip and the bubbles hop underneath the stepping stones within the garnet. It's also important that no permanent magnetic field can remain in the stepping stones, so they are made from magnetically 'soft' material.

Simplicity

Organising the movement of bubbles is simplicity itself. By feeding alternating current through one of the field coils, it can be seen that an alternating magnetic force will be set up surrounding the garnet. If a similar current but 90 degrees out of phase with the first is sent to the second coil, another alternating magnetic force will surround the chip at right angles to the previous force. When both are working together, the result is the setting up of a rotating magnetic field. As the field rotates, the magnetic polarity of the specially shaped stepping stones is altered sequentially (Figs 3-7).

Unlike poles attract, so the bubble will move very quickly from its current position to the element displaying an opposite polarity to its own. Hopping

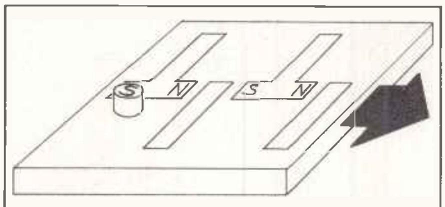


*Fig 3 **Movement of a bubble**: the large arrow indicates the current direction of the rotating field. Soft iron elements take on the magnetic polarity of the rotating magnetic field, while the bubble within the garnet acts like a tiny bar magnet with a constant polarity. The field in this position attracts the bubble to the nearest 'south'. T-bar elements illustrate the principle, but more efficient elements such as asymmetric chevrons are more commonly used in bubble memory chips.*

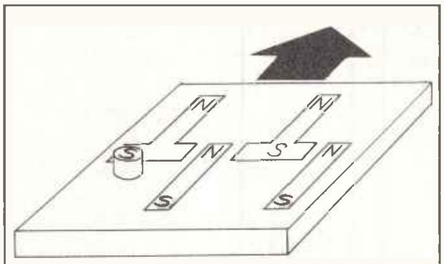


Fig 4 First change in polarity for the elements forces the bubble to move to the centre of the 'T' element.

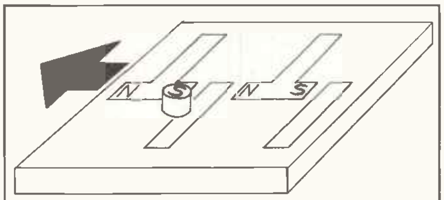


Fig 5 Another change and another hop for the bubble.

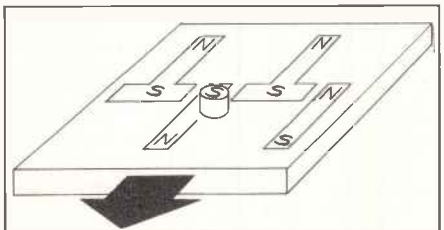


Fig 6 End of the first cycle brings it to the last stop in that element.

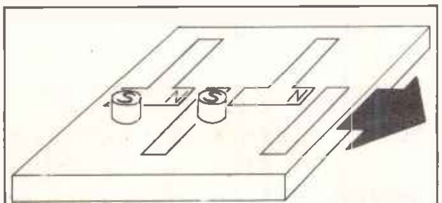


Fig 7 First move in the second cycle takes our first bubble to the second element, and another bubble moves into the first element position.

from stepping stone to stepping stone as the polarity of the elements change, the bubbles form a continuous stream of serial data.

If the current to the coils is stopped, so too is the movement of the bubbles. They remain static, safely stored by the field generated by the bias magnetic until the rotating field gets them on the move once more.

Log jams at the end of the line are easily avoided by shunting bubbles into a storage loop, where they happily hop around in a circle until the music stops (Fig 8).

In this simplified description we have a bubble being generated at the beginning of a line, moved down the line step by step and then detected at the line end. Some storage capability has been indicated by the 'loop' structure but, at present, once the bubble comes to the end of the line for detection it is destroyed and lost forever.

In order to ensure that data can be read more than once, it's necessary to add yet another component to the bubble chip — a replicator. Instead of reading the bubbles which were originally stored, replica bubbles are created and a branch made in the line of stepping stones.

The original bubbles will now happily continue their looping forever and a day, with replicas shooting off down the branch to the end of the line for detection (reading) and ultimate destruction.

A chip constructed in the fashion described here would be workable but impractical. Remember that if the device is to compete with other mass storage systems, it must be capable of holding tens of thousands of bits. If all these bits are to be read sequentially, read and write timing will be excessive.

If, for example, the frequency of the rotating drive field created by the bias coils is 50KHz, this is the bit shift rate. Reading the last bit entered into a 64k chip would occur 1.28 seconds after the write operation.

The solution is to have, instead of one very long loop, a number of much shorter loops, each being accessed at the same time. This is achieved by having an input track which, once full of bubble data, transfers its data in a parallel operation into a number of loops. If the 64k chip is organised as 128 loops of 512 bits, no single bit is, theoretically, further away from the detector than 512 bits. Access time in a read operation is reduced to 10 milliseconds compared with the previous time of over a second.

All these operations require very complicated and precise control signals, and a whole new family of bubble memory interface chips have been developed alongside bubble memories.

The circuitry needed to drive the bubble memory is fairly standard in electronic terms, but there are a few different processes to be controlled and synchronised.

The field coils, for example, have to be driven simultaneously to create a field rotation frequency of 50KHz with an error margin of one per cent. Ensuring that both stop and start together without the typical problem of 'ringing' is a feat in itself; to synchronise, read, write, replicate, swap and destroy signals, all of which have their own sequence and timing characteristics, has been a major achievement in electronic engineering.

Conclusion

The question still remains: have bubble memories missed the boat or will the totally solid state home computer be a reality in the future? My guess is that flexible magnetic media is already redundant technology, and that within a relatively short period of time the cost of bubble memories will plummet to a level which will make it comparable with a good floppy disk unit.

'Early bubble memory applications failed because too much was expected of the technology. Realism has replaced the initial naive optimism which was the cause of so many burned fingers . . . Confidence in bubble memories will rapidly gain momentum over the coming year or so and we'll see more mundane and accessible applications of the technology.'

The remaining manufacturers in the market have already made their commitment to the technology — millions have already been spent in getting it right; bubble memory must be the best researched and developed technology of the computer age. The early problems have been overcome by applying belt and braces safeguards to an unprecedented extent compared with other memory devices.

Early bubble memory applications failed because too much was expected of the technology. Realism has replaced the initial naive optimism which was the cause of so many burned fingers. Now there is a product available which actually does what the makers say it does.

Confidence in bubble memories will rapidly gain momentum over the coming year or so, and we'll see more mundane and accessible applications of the technology than the highly specialised military and scientific uses it's currently put to.

However, no matter how many specialised applications are found for bubble memory, there will never be enough to bring the price of the technology down to the mass manufacture prices of floppy disk systems. This will only be instigated by one of the big personal computer manufacturers — of the size of IBM or Apple — deciding to install bubble memories in their computers in preference to floppy disk drives. This will give chip manufacturers the confidence to bring their prices down. Once that happens, the downwards price spiral will begin and bubble memory will finally start to fulfil its promise.

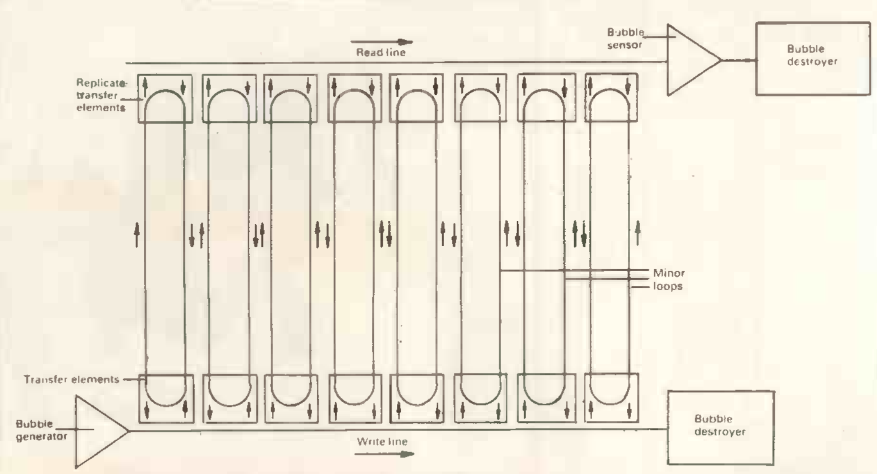


Fig 8 Bubble memory is organised into loops. When the write line is full, bubbles will be transferred to the loops in parallel where they will loop until needed for replication/read.

Thanks to Immediate Business Systems for permission to reproduce bubble memory drawings. END

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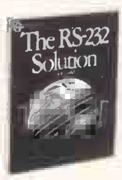

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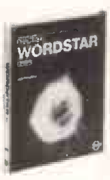

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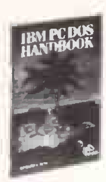

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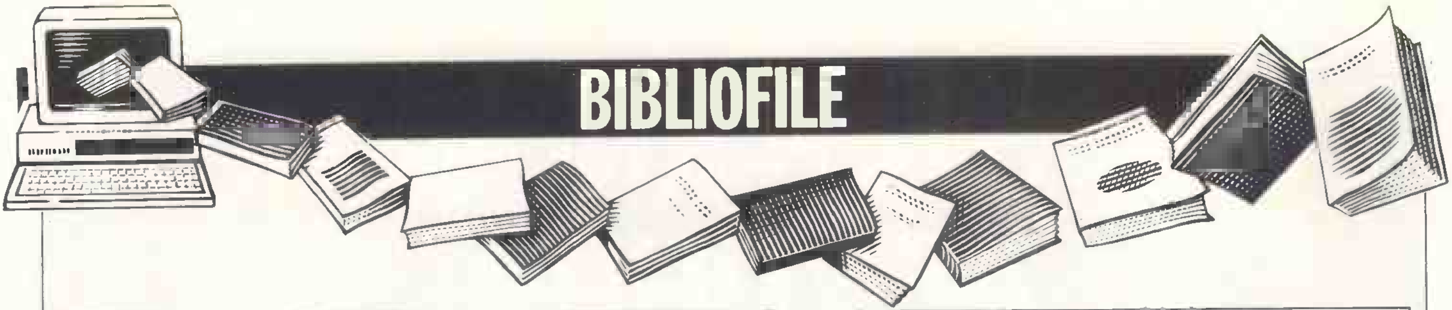


This month Linnet Evans bids farewell to PCW *with her pick-of-the-bunch from the IBM PC library. From owners' manuals to business software, she leaves no page unturned.*

IBM PC and XT Owner's Manual

Authors: Barbara Lee Chertok, Dov Rosenfeld & James H Stone
Publisher: Robert J Brady Co (distributed Prentice-Hall)
Price: £13.45 (paperback)

Over the last year the choice of titles pitched at certain popular home computers, the BBC for example, has been quite staggering. The one thing to be said here is that a number of field leaders have emerged and the great majority of books are home-grown, so there's something of a running order and mistakes aren't on the whole too expensive.

Take the wider and deeper market around the PC, push up prices to import level, substitute specialist bookshops for Smith's and Menzies — that's roughly how we stand in relation to XT ecstacy.

It's a measure of the current market, too, that while the magazines have been paying good attention to the lookalikes from Corona, Eagle *et al*, these have, as such, gone virtually unrecorded in the book world.

This last comment is a comment only, and not a criticism, of the content of the *IBM PC and XT Owner's Manual.* Subtitled 'A practical guide to operations', it's even more machine-specific than its title might suggest. Here, the three authors start with the premise that the official manuals are a pain in the butt, so the *Owner's Manual* is a shorter, smarter paraphrase of core information. Again, the target reader is the new owner who simply wants to get things done without too many gaffes.

Here, though, the bias is away from Basic — getting just a token coverage — and far more into hardware and operating software. One big spin-off is the opportunity to discuss possible configurations outside of the standard IBM offerings. While many books of this ilk confine themselves to PC-DOS, the *Manual* shows how to partition a hard disk for alternate operating systems. (It doesn't, however, stray beyond a basic definition of p-System and CP/M-86.) Discussion of differences between various releases of the mainline DOS is also to the fore, which could prove useful if you're adapting software or swapping machines. A chapter on communications and a compact but friendly glossary provide the tailpieces.

As with all good PC books, the *Owner's Manual* is written in a concise and calm style with a reasonably clear layout and the indubitable voice of experience. At the end of the day it's an eminently likeable book.

The IBM Personal Computer Handbook

Editor: Dzintar E Dravnieks
Publisher: Prism Press
Price: £11.95 (paperback), £16.95 (hardback)

Very heavily promoted on its launch earlier this year, *The IBM Personal Computer Handbook* sitting on the shelf looks like *War and Peace* alongside the average paperback. On checking, I was still quite surprised that it runs to well over 400 pages, since its arrangement takes the edge firmly off any sense of 'weightiness'.

The *Handbook* is very much what you care to make of it, although it's clearly intended by the publishers as a long-range reference book. The first part consists of 10 chapters, ranging from a general introduction to more or less need-specific chapters on areas like spreadsheeting, comms and games. In the best-regulated society there would perhaps be more common standards between the chapters and more cross-referencing, but then again we might miss out on the traits and whims of some of the individual writers. For the major business applications, a bunch of buzzwords and some ideas on kick-off questions are normally offered.

The second part is an extremely thorough dictionary of all manner of proprietary packages, ranging from general to trade-specific applications, from languages to programming utilities. Shadowing this is a section dealing with hardware bolt-ons, peripherals, periodicals, user groups, and so on. In each case, a brief factual description is given under the contact name.

Naturally this is all US-biased, and naturally you're not too chuffed. It does, however, give what was probably a wall-to-wall view of the full range of IBM and indie goodies at the time.

More importantly, the original directory is backed by a similar, albeit smaller, listing of UK supplies. This was furnished by *PC User* and, importantly, contains homegrown products which aren't in the US listings.

Another particularly relevant feature — others please note — is the inclusion of information on memory, OS and disk requirements which may, of course, vary widely. In the case of the operating system, while PC-DOS is predictably the front runner, CP/M-86 and p-System are also to hand if needed.

The IBM Personal Computer Handbook is a classic of its kind and will be bought by many libraries and individuals for its value as a reference book. It will also be read (if not bought) as a ginger-book, a big buzzbox of ideas. Even if you're torn between the two, at under £12 it's not that much more expensive than *War and Peace*.

IBM Displaywriter User's Guide

Author: Judy Crondahl
Publisher: Robert J Brady Co (distributed Prentice-Hall)
Price: £11.65 (spiralbound paperback)

Despite the officious title, the *IBM Displaywriter User's Guide* is no blue-stamped publication but very much an independent offering.

The *IBM Displaywriter* shares certain superficial characteristics with the PC. What it overtly doesn't share is the ready capacity to communicate (without an overhead of extra cards and disk drives) with its more popular cousin, or indeed any other bit of IBM kit. Instead it presents a staunchly self-contained face to the world with its Textpack and Recordpack functions; the latter being a dedicated word processor's database. To add insult to injury, at least one UK company is reported in a recent edition of *PC User* magazine as supplying its PC business applications software reconfigured for the Displaywriter including word processing. Big blue's small white elephant?

Judy Crondahl declines any such political or philosophical embroiling, preferring simply to show how the beast can work. Quite openly, she doesn't take time explaining 'how word processors work', or whatever, and it's probably best to have someone on call with at least general word processing/computer knowledge. With this proviso, the *User's Guide* makes a respectable self-teaching course for Textpack.

In the earlier chapters, the reader is taken through the basic typing, formatting and printing functions together with essential information on function keys. While the style is compact and eminently businesslike, it's not without its lighter moments. The system's stylised upright diskette unit, for example, is branded as 'the toaster'. A fair number of likely 'what if . . .' questions are picked up and answered squarely too, cross-referenced to other sections as necessary.

Central chapters cover the rather wider territory of housekeeping, system repatching and also the spelling checker. It might have been helpful to give more emphasis on the 'why' here, as well as the 'how', against which relatively complex and perhaps unfamiliar operations are clearly and confidently presented, which is two-thirds of any battle. As before, screen menus, prompts and working examples are shown.

The Reportpack section makes no pretence, quite rightly, at being comprehensive. Its nuts-and-bolts agenda should, however, map out the relevant avenues for both operator and manager, if indeed these are separate people.

Unlike the plethora of PC-based titles, the *IBM Displaywriter User's Guide* will have minimal competition. It's not a book for the totally unaided novice, but it certainly defines its aims and fulfils them very well.

A Guide to the Best Business Software for the IBM PC

Author: Richard C Dorf
Publisher: Addison-Wesley
Price: £12.95 (paperback)

When the fuss is over, it's a pure fact that a PC from IBM has to be the PC for many. Small businesses and solo operators in particular are often attracted equally by the range of software available and by the IBM marque.

This is very much the initiative behind *A Guide to the Best Business Software,* a very professional-looking offering from a prolific author. And the core of the book is indeed dedicated to thumbnail-plus reviews of proprietary software available for the small blue one. For better or worse, these are original scripts and not culled from magazines.

Prior to the grand slam *denouement*, there's a couple of chapters of introduction to microcomputers conceptually, and the PC in particular. Not the usual breezy tack so often deployed by our transatlantic cousins, but a leader clearly custom written for the real new generation of computer users — the octogenarians of Wyoming. Yes, I know that charges not merely of ageism but also of middle-Americanism may now be levelled against me, but it looks like the only explanation for Mr Dorf's groping, almost anachronistic pedantry at this stage.

The central chapters are each devoted to a particular application such as word processing, or a pair like the odd bedfellows of mailing lists and time management. In each case, there's some kind of generic introduction, sometimes with a cross-package comparison followed by a brief discussion of a selection of branded packages themselves.

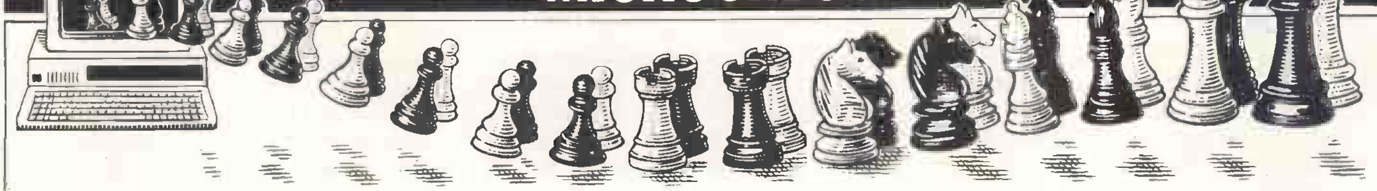
Some healthy UK developments are perforce omitted. While frustrating, that's less of a fault than the missed opportunities among the packages that are featured. Score charts are given for 'ease of use', 'documentation', 'reliability' (whatever that may be) and 'cost-effectiveness' (ditto).

Yet to be really helpful to either business or individual users, these, frankly, require more back-up text than is usually given. The inclusion of the odd comment on date of first release or best-seller status for example only underlines the omission of this data on other occasions.

One reason for a survey of this kind is surely the opportunity to separate the new and heavily-advertised sheep from the older, less advanced but perhaps sturdier goats.

Best Business Software cannot be dismissed out of hand, and certainly provides a more suitable intro than ploughing through dozens of magazines. Its more limited coverage and lack of distractions could equally make it a better choice in some circumstances than the marathon *IBM Personal Computer Handbook* reviewed alongside. However, its whole approach being that much slighter, the ball comes that much more swiftly back into the reader's court.

END



Private tuition

Teaching someone to play chess — unless you have the patience of an angel — is a good way of discovering your tolerance level. But teachers and beginners need fret no more: the Chess Tutor *for the 48k Spectrum may be the perfect antidote, as Tony Harrington discovered.*

It is astounding how slowly the human mind comes to terms with new concepts and rules. If your temperament is anything like mine, no matter how badly you play chess, you'll soon find a distinct edge in your voice as you point out for the umpteenth time the disastrous consequences of a novice's latest move! There are few things I find more irritating than seeing a beginner pick up a white bishop and deposit it on a black square.

Fortunately, provided the would-be-chess player has a Spectrum, there is no reason why any human being should have to waste valuable hours teaching another how to play the game. The *Chess Tutor* from Braveline (£9.95) will do it all for you.

Chess Tutor is an excellent program, well worth its weight in gold to anyone who wants to learn how to play chess. It is also, in my opinion, a great improvement on the self-teach method, where you sit down with an introductory book, chessboard and pieces. To start with, beginners find reading chess moves almost impossible. They confuse the addresses of squares and get into terrible muddles. A phrase like 'Qe3-b6' looks totally opaque and can kill off one's interest right at the start.

Chess Tutor cuts out the muddle by the simple device of displaying animated graphics. When it tells you about the rules governing knight moves, for example, it displays an animated knight, moving smoothly about the chessboard.

Aimed at the absolute beginner it takes nothing for granted. The program is cassette-based. But this is no disadvantage since all the information you require is displayed on the screen. *Chess Tutor* contains a surprisingly large amount of material which covers everything that the out-and-out beginner needs to know about playing chess — from how to move the pieces, to sophisticated tactical concepts like double checks and skewers.

The use of animated graphics combined with text is outstanding and demonstrates just how valuable computer-assisted learning can be in this area.

The main menu appears as follows when the program is loaded:

Introductory Course one:

1) **The board, starting play, pawns and knights**
2) **Bishops, rooks, queen, king**
3) **Castling exercises, check, checkmate and stalemate**
4) **Stalemate exercises, perpetual check, capture and pins**
5) **Forks, double attacks and skewers.**

Select a number. Which part do you want?
Enter 0 to stop

Chess Tutor is cunningly designed. The master routines, which handle things like the movement of sprites, the graphics display, loading routines and so on, are held in the 'master program routines'. Each of the options on the main menu is a separate set of routines on the tape and has to be loaded separately. If you have loaded Option 1 and want to move on to Option 3, the code for Option 3 would overwrite that for Option 1. In this way the limits of the Spectrum's 48k are overcome.

The sub-menu for Option 1 covers six options: the board, starting play, the pawn (basic), *en passant*, promotions, the knight. The technique for all *Chess Tutor's* lessons is the same. A green and white squared chessboard is displayed in the right-hand half of the screen, with enough space below it for five or six lines of text, plus more text in the left-hand half of the screen. This is used to display the record of moves, and for messages requesting user responses, like 'Press any key to continue', or 'Input a move'.

The first lesson starts with a point that beginners generally wouldn't consider. The chessboard always has to be positioned with a white square in the bottom right position. This is the only way that a board can be set up so that each player's queen is on the square of the appropriate colour (that is, white queen on a white square, black on black).

When it deals with the rules governing pawn movements, the graphics display is an invaluable teaching aid. To illustrate the two possible moves a pawn can make when it starts off, the 'd' pawn slides gracefully from d2 to d3, then from d2 to d4. The diagonal capture and the complexities of *en passant* pawn takes are all clearly demonstrated in the same fashion.

If there are definite advantages to a computerised, screen-based chess tutor, there is also one, fairly substantial, disadvantage — at least as far as a cassette-based program is concerned Jumping from one section to another is a good deal more complicated than flipping over the pages in a book.

Nevertheless, Braveline has done everything a programmer could do to make moving between sections a relatively painless operation. Selecting, say, Option 5 from the main menu, instead of Option 1 means that the program takes six minutes to load instead of two. This is because the program routines for Option 1 lie immediately after the master routines while Option 5 routines are at the end of the other side of the tape. But that's what you have to put up with when you use a sequential storage device.

Once you press '5' to indicate your selection, full instructions for finding and loading section five appear on the screen. Basically this involves no more than rewinding the tape, flipping the cassette and pressing PLAY on the recorder; and a message showing you the section code being received (section three, then section four, finally, section five) will appear.

Once section five has loaded there is a 30 second delay while the program merges with the master routines (this happens with each move to a new section) then the display for section five appears.

Within a sub-menu, all the options on that menu are accessible instantly without any further reloading. The concepts in section 5 are the staple ingredients of tactical play. As always, the most basic concepts are explained first of all. The 'fork' is illustrated by simple pawn forks, much used in beginner games, then goes on to more complex matters, like knight forks.

Narrative instructions and advice are excellent. For example, *Chess Tutor* reminds the beginner that pawn forks against pieces are always powerful, even if the pieces are defended, since the pawn's value is less than that of the pieces. It may not be the sort of stuff to keep seasoned chess players awake, but it is absolutely vital for the beginner.

One of the best things about the program is that many subtle little points emerge almost as by-products of the main point being demonstrated. The illustrative position for knight forks, for example, shows a black knight on c6, attacked by a white queen on e6, with a white rook on b3. *Chess Tutor* points out that 'The black knight is under attack, but it is black to move . . .' The graphics display then shows the knight sliding to d4 and forking the rook and queen.

This provides a vivid example not just of the fork, but of the cut-and-thrust that makes chess so rewarding. Defence has turned into attack in a single move. This is the sort of 'intuitive' lesson that beginners will find themselves picking up almost without realising while they work their way through the program.

At the end of every lesson a summary screen appears which restates the main points of the lesson. It is amazing how much text the program manages to accommodate. The summary for 'forks' alone contains eight separate points.

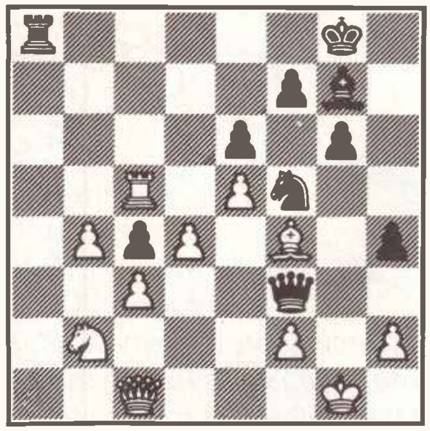
If beginners had memories like computers, and could apply their knowledge, a few hours spent alone with *Chess Tutor* would suffice to turn them into very good club players. Since they don't have, they won't. But they will learn how to play chess.

Beginners using *Chess Tutor* in conjunction with one of the handful of good chess programs for the Spectrum should find it an excellent way of getting into the game.

Games section

White: Cray Blitz. Black: David Levy. Notes by Dr John Nunn.

This month's game is another from the match between David Levy and Cray



Position after 30 Qh3-f3

Blitz. Last month I described how David beat the computer world champion 4-0 in convincing style, so let's go straight into the chess.

1 e2-e4 a7-a6
2 d2-d4 g7-96
3 Ng1-f3 Bf8-g7
4 Nb1-c3 b7-b5
5 Bf1-d3 Bc8-b7
6 0-0 d7-d6
7 Bc1-f4 e7-e6

(Black has adopted an unusual plan of development to take the computer out of its opening book, but this move is taking the unconventional approach a bit too far. 7 . . . Nb8-d7 was much safer.)

8 e4-e5

(White sees the chance to gain some space, but this sort of central thrust needs good piece support and is only effective after all the forces have been brought into play. 8 Rf1-el or 8 Qd1-d2 would have been better.)

8 . . . d6-d5?

(I'm sure David wouldn't have played this move against a human opponent! His aim is to keep the position as closed as possible to reduce the tactical possibilities, which are the machine's main strength. Objectively the move is bad because it blocks in the bishop at b7 behind a wall of pawns.)

9 b2-b4!

(If played by a human, this could only have been produced by a beginner or a grandmaster! Basically Black has the initiative on the queenside and White has the upper hand on the kingside. All the books tell you not to touch your pawns on the side where your opponent is attacking, but this position is a rare exception. Black's only counterplay will come from . . . Nb8-d7 followed by . . . c7-c5, and White, unhindered by the books, logically prevents . . . c7-c5.)

9 . . . Nb8-d7
10 Qd1-d2 Ng8-e7
11 a2-a4 c7-c6
12 a4xb5

(Undoing some of the benefits of the ninth move. 12 a4-a5 was the logical culmination of White's plan, completely blocking the queenside. Action could then only take place on the kingside, where circumstances greatly favour White.)

12 c6xb5
13 Bf4-h6 0-0
14 Bh6-g5?

(A completely pointless waste of time. White's last move quite correctly aimed to exchange Black's important defensive bishop, but at the last moment White pulls back. 14 Bh6xg7 Kg8xg7 15 Nc3-e2 Nd7-b6 16 h2-h4 Nb6-c4 17 Qd2-f4 would still have given White a dangerous attack.)

14 . . . Rf8-e8
15 Ra1-a3?

(This is awful. Black's knight at d7 is heading to c4 and when it arrives White shouldn't exchange it because a recapture by the pawn at d5 will turn the somnolent bishop at b7 into a powerhouse of activity along the long diagonal. The position of the rook at a3 sets up a self-fork when the knight arrives, forcing White to make the unpalatable exchange.)

15 . . . Nd7-b6
16 Nc3-d1 Nb6-c4
17 Bd3xc4 d5xc4
18 Nd1-b2 Qd8-c7
19 Rf1-a1 Re8-c8

(Threatening to win a piece by . . . c4-c3. White prevents this, but in doing so cuts the line of guard from a3 to f3, allowing Black to shatter White's king defences.)

20 c2-c3 Bb7xf3
21 g2xf3 Ne7-f5!
22 Ra3xa6 Ra8xa6
23 Ra1xa6 Qc7-b7
24 Ra6-a5 Qb7xf3
25 Ra5xb5 h7-h6

(Finally, David Levy has allowed some complications to start, but only when the outcome of the game has already been decided. White's defenceless king is far more important than his extra pawn.)

26 Bg5-f4 Qf3-h3

(26 . . . Nf5-h4 was tempting, but White's king could then flee the threatened mate by 27 Kg1-f1. Now, however, White's escape route is cut and . . . Nf5-h4 is a deadly threat.)

27 Bf4-g3 h6-h5
28 Rb5-c5 Rc8-a8
29 Qd2-c1?

(29 Rc5-a5 would have been a more resilient defence.)

29 . . . h5-h4
30 Bg3-f4 Qh3-f3

31 h2-h3

(Desperation, but there was no defence in any case. After 31 Rc5-a5, for example, Black could have won with the beautiful combination 31 . . . Ra8xa5 32 b4xa5 h4-h3 33 Kg1-f1 Bg7-h6! 34 Bf4xh6 Nf5-g3+! 35 h2xg3 h3-h2 followed by promotion and mate.)

31 . . . Qf3xh3
32 Rc5xc4 Qh3-f3

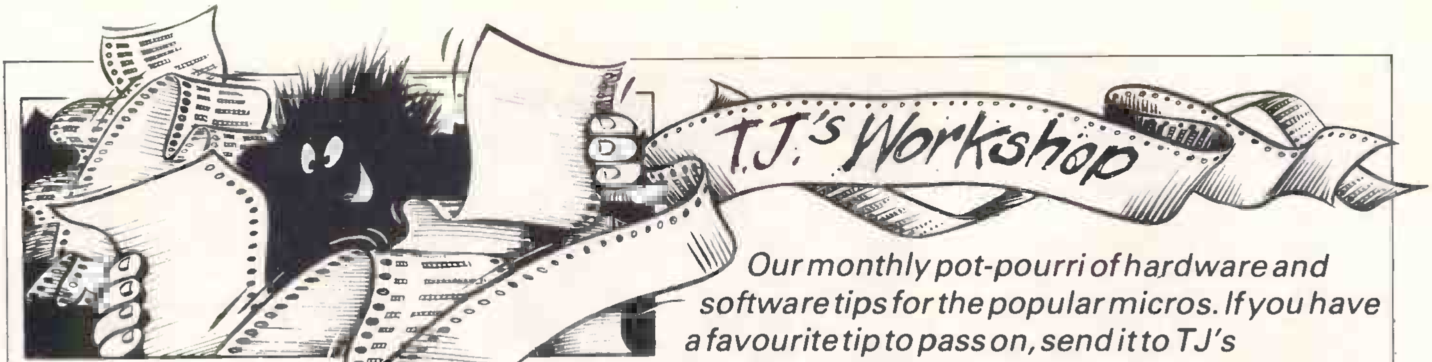
(Black returns, with all the original threats and more besides.)

33 Bf4-h2 h4-h3
34 Qc1-f1 Ra8-a1

(Deflecting the queen away from the defence of g2 and forcing mate.)

35 Nb2-d1 Ra1xd1
36 Resigns

END



Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to TJ's Workshop, PCW, 62 Oxford Street, London W1. Please keep your contributions concise. We will pay £5-£30 for any tips we publish. PCW can accept no responsibility for damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

SPECTRUM SCREENS

Here are two short machine code routines which will instantly store and recall a screen picture. They run on a 48k Spectrum.

```
10 clear 51680 : for n = 51681 to 51704 : read A : poke n, A : next n
20 Data 1,0,27,17,255,201, 33,0,64,237,176,201,1,0, 27,17,0,64,33,255,201,237, 176,201
30 clear 51656 : for n = 51657 to 51680 : read A : poke N, A : next N
40 Data 1,0,27,17,255,228, 33,0,64,237,176,201,1,0, 27,17,0,64,33,255,228,237, 176,201
```

The first one (lines 10-20) stores a screen at location 51711 and is operated by:

STORE: Randomise USR 51681
RECALL: Randomise USR 51693

The second one (lines 30-40) stores a screen at location 58623, and is operated by:

STORE: Randomise USR 51657
RECALL: Randomise USR 51669

Once stored a picture may be recalled as many times as you like. The two routines, plus the code for the screen pictures, use up all memory locations from 51656 upwards.

To save the machine code for the routines, simply type: SAVE "RECALLER" CODE 51656,50

The stored code for picture one is saved by: SAVE "PIC 1" CODE 51711, 6912

The second is saved by: SAVE "PIC 2" CODE 58623, 6912

A Normington-Smith

BBC SELF-LEARNING DATA ENTRY

The routine provides a method of in putting data with a minimum of typing by recognising words as the characters are typed. The rest of the word is then displayed on the input line and a gentle beep signals this. RETURN will cause the function to answer with the word on the data entry line. If the word is not the one required then the DELETE key can be used as normal.

The routine is most useful when the number of entered options is limited. It has been successfully used to input school subject names; for examples Physics and Maths. The maximum number that can be used is only limited by the degradation in response time. I have tested the routine with 100 known words and the response time is completely satisfactory. If many more words were needed then some simple tuning, for example, shortening all the variable names in the function, would speed up the response time.

The self-learning aspect of the routine is that any unrecognised words can be added to the list of known words simply by answering yes to a question. Thus no setting up or maintenance routines for known words are needed.

The routine works by storing known words in a matrix as shown in Fig 1. As characters are typed the value of line% and col% are updated to show the current position in the matrix. For example:

Input	line%	col%
B	2	1
I	2	2
O	2	3
L	3	4

After each character has been typed a check is made to see if the characters up to col% on line%+1 are the same as those on line%. If they are, then the word is not yet clear. As soon as they are not the same, the rest of the word is printed. In the example above BIOLOGY would appear.

line% \ col%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	A	R	T	"	"	"	"	"	"	"	"	"	"	"	"
2	B	I	O	C	H	E	M	I	S	T	R	Y	"	"	"
3	B	I	O	L	O	G	Y	"	"	"	"	"	"	"	"
4	B	O	T	A	N	Y	"	"	"	"	"	"	"	"	"
5	P	H	Y	S	I	C	S	"	"	"	"	"	"	"	"

Fig 1

DELETE is handled by keeping track of the previous value of line% in trace%(..) and stepping back to previous lines when necessary. Again in the example if the Y, G, O and L were deleted then line% and col% would end up as 2 and 3 respectively, so if 'C' were pressed then BIOCHEMISTRY would appear.

Known words are stored on a file which needs to be read in and written out each time a program using the routine is run. The procedures here do this.

Two major errors which can occur when using the routine in a program have been catered for: filling up the known words array; and not being able to extend the file on disk.

Although this routine was written on and for a disk system, cassette users can still use it by incorporating the known words in data statements instead of a file. Fig 2 does just this.

Note

(1) Padding out of the known words with dots must be left in for the routine to function correctly.

(2) The routine at present only accepts alphabetic characters and spaces; all lower case letters are converted to upper case. This could easily be altered to match the implementation of the routine.

```
10 subjectmax%=50
20 DIM trace%(16),subject$(50)
30 FOR 1%=1 TO subjectmax%:subject$(1%)=STRING$(15,""):NEXT
40 READ subjects%
50 FOR 1%=1 TO subjects%
60   READ A$
70   IF LEN A$<15 THEN subject$(1%)=A$+STRING$(15-LEN A$,".")
     ELSE subject$(1%)=A$
80   NEXT
90 DATA 8, "ALGEBRA","BIOCHEMISTRY",
        "BIOLOGY","BOTANY","CHEMISTRY",
```

Fig 2 "ECONOMICS","PHILOSOPHY", "PHYSICS"

Paul Nix

```
10 REM** Self learning input routine.  **
20 REM** Author: Paul Nix              **
30 REM** Date: 16.6.84                 **
40
50 REM ------------------ Demonstration Program ---------------------------
60 MODE7
70 PROCreadsubjects
80 ONERRORGOTO120
90 REPEAT:A$=FNgetsubject(0,10)
100   PRINTTAB(0,20)A$
110   UNTILFALSE
120 IFERR=17 THENPROCwritesubjects:END
130 REPORT:PRINT" at line ";ERL
140 END
150 REM ------------------------------------------------------------------
160
170
180 DEF FNgetsubject(screencolumn%,screenline%)
190 LOCAL C%,I%,C$,A$,B$,start%, OSBYTE
200 OSBYTE=&FFF4
210 PRINTTAB(screencolumn%,screenline%);STRING$(15,".");
220 PRINTTAB(screencolumn%,screenline%);
230 FOR I%=1 TO 15:trace%(I%)=0:NEXT
240 line%=1:col%=1:char%=0
250 newword%=0:CC$=""
260 REPEAT
270   C%=GET
280   IF C%=127 THEN PROCdelete:GOTO 480
290   IF C%=13 THEN PRINT:GOTO 480
300   IF char%=15 THEN 480
310   IF C%=32 THEN 340
320   IF C%<65 OR C%<97 AND C%>90 OR C%>122 THEN 480
330   C%=C% AND &DF
340   char%=char%+1
350   trace%(char%)=line%
360   C$=CHR$C%:PRINTC$;
370   CC$=CC$+C$
380   newword%=1
390   line%=line%-1
400   REM Check CC$ against list of subjects
410   REPEAT
420     line%=line%+1
430     UNTIL LEFT$(subject$(line%),col%)>=CC$
440   REM Check if a match was found
450   IF LEFT$(subject$(line%),col%)<>CC$ THEN col%=col%+1:GOTO 480
460   REM Check if match is unique and print the subject if it is.
470   IF LEFT$(subject$(line%),col%)<>LEFT$(subject$(line%+1),col%) THEN PROCp
rintword ELSE col%=col%+1
480   UNTIL C%=13 : REM only exit when RETURN is pressed
490 A$="":A%=135 : REM read input from screen using OSBYTE
500 FOR I%=screencolumn% TO screencolumn%+14
510   VDU31,I%,screenline%:A$=A$+CHR$((USR(OSBYTE) AND &FFFF)DIV&100)
520   NEXT
530 REM store input up to first dot.
540 B$=LEFT$(A$,INSTR(A$+".",".")-1)
550 IF newword%=0 THEN=B$
560 I%=0 : REM check against list of words to ensure no duplication.
570 REPEAT
580   I%=I%+1
590   UNTIL A$<=subject$(I%)
600 IF A$=subject$(I%) THEN=B$ : REM already in the list
610 VDU28,0,24,39,22 : REM window for messages
620 CLS
630 IF subjects%<subjectmax%-1 THEN 660
640 PROCnosplit("No more subjects can be added at present. Please exit the pro
gram and restart. Press SPACE to continue.")
650 REPEAT UNTIL GET=32:CLS:VDU26:=B$
660 PROCnosplit("Do you wish to add "+B$+" to the list of subjects (Y/N)?")
670 I%=GET:PRINTCHR$I%
680 IF CHR$(I% AND &DF)<>"Y" THEN CLS:VDU26:GOTO 210 : REM ask for input again
690 PRINT'SPC10;"Please wait"
700 subject$(subjects%+2)=A$
710 subjects%=subjects%+1
720 PROCsort(subjects%)
730 CLS:VDU26
740 =B$
750
760
770
780 DEF PROCprintword
790 LOCALI%
800 I%=INSTR(subject$(line%)+".",".")-1
810 PRINTMID$(subject$(line%),col%+1,I%-col%);
820 col%=I%+1
830 SOUND 1,-12,20,2
840 newword%=0
850 ENDPROC
860
870
880
890 DEF PROCdelete
900 newword%=1
910 IF char%=0 THEN ENDPROC
920 VDU8,46,8 : REM cursor left, dot, cursor left
930 IF col%>char%+1 THEN col%=col%-1:ENDPROC
940 REM step back to previous position
950 CC$=LEFT$(CC$,LENCC$-1)
960 line%=trace%(char%)
970 char%=char%-1:col%=char%+1
980 ENDPROC
990
1000
1010
1020 DEF PROCsort(end%)
1030 LOCAL I%,J%,T$
1040 FOR I%=1 TO end%
1050   IF subject$(I%+1)>subject$(I%) THEN 1110
1060   J%=I%+1
1070   REPEAT
1080     T$=subject$(J%):subject$(J%)=subject$(J%-1):subject$(J%-1)=T$
1090     J%=J%-1
1100     UNTIL J%=1 OR subject$(J%-1)<subject$(J%)
1110   NEXT
1120 ENDPROC
1130
1140
1150
1160 DEF PROCnosplit(A$)
1170 LOCAL L%
1180 L%=LEN(A$)
1190 IF L%+COUNT<40:PRINTA$;:ENDPROC
1200 REPEAT
1210   REPEAT
1220     REPEAT
1230       L%=L%-1
1240       UNTIL L%<1 OR MID$(A$,L%,1)=" "
1250     UNTIL L%+COUNT<=40
1260   PRINTLEFT$(A$,L%-1)
1270   A$=RIGHT$(A$,LEN(A$)-L%)
1280   L%=LEN(A$)
1290   UNTIL L%<40
1300 PRINTRIGHT$(A$,L%);
1310 ENDPROC
1320
1330
1340
1350 DEF PROCreadsubjects
1360 LOCAL chan
1370 DIM trace%(16)
1380 chan=OPENIN("D.SUBJECT")
1390 IF chan<>0 THEN 1430
1400 subjects%=0:subjectmax%=50
1410 DIM subject$(50)
1420 GOTO 1470
1430 INPUT#chan,subjects%
1440 subjectmax%=subjects%+20
1450 DIM subject$(subjects%+20)
1460 FOR I%=1 TO subjects%:INPUT#chan,subject$(I%):NEXT
1470 FOR I%=subjects%+1 TO subjectmax%:subject$(I%)=STRING$(15,"|"):NEXT
1480 CLOSE#chan
1490 ENDPROC
1500
1510
1520
1530 DEF PROCwritesubjects
1540 LOCAL chan
1550 ON ERROR GOTO 1670
1560 chan=OPENOUT("D.SUBJECT")
1570 PRINT#chan,subjects%
1580 FOR I%=1 TO subjects%:PRINT#chan,subject$(I%):NEXT
1590 CLOSE#chan
1600 IF ERR=191 THEN END : REM File has been saved but cannot continue
1610 ON ERROR OFF
1620 ENDPROC
1630
1640 REM-- Error processing for "Can't Extend".          --
1650 REM-- This works on Watford but may not on other DFS --
1660
1670 IF ERR<>191 THEN REPORT:PRINT" at line ";ERL:END
1680 PROCnosplit("FILE BEING EXTENDED- PROGRAM WILL THEN TERMINATE"):PRINT
1690 CLOSE#0
1700 *DELETE D.SUBJECT
1710 GOTO 1550
>
```

TORCHLIGHT ON PERFECT WRITER

If you have invested in the BBC/Torch ZDP/Perfect Software package and have had difficulty in sorting out the discrepancies between Perfect Writer documentation and performance, here is some helpful information.

Delete Commands: Contary to the Perfect Writer manual, the 'Delete' key (or CTRL-D) erases only the current character, and ESC-D erases only forwards to the end of the current word (the next word if the cursor is at a space). To get the much more useful backwards-delete you must use CTRL-H (for the previous character) and ESC-H (for the previous word).

Additional Commands: Hidden away in Appendix C of the manual you will find some other useful commands not mentioned elsewhere. But beware of those which claim to return 'Unknown command': some of them have unpleasant side-effects.

Function Keys: Fig 1 offers a file, BEGIN.SUB, called from key f9 (set by Torch to return 'BEGIN'). This will set up the BBC's function keys for the most useful commands. It uses the BBC's cursor-control keys for larger movements through the text; but if you set these remember to reset them with *FX4,0 if you return to Basic before switching off. Using SHIFT with keys f0-f9 will, in addition, give you the commands listed by Torch in its own installation documentation (see the right-hand column in Fig 1).

There are two further annoying discrepancies which you will need to know about. When naming a file for formatting you *must* provide the full file name complete with extension (not optionally, as claimed in the manual on pages 70 & 77). Anglicised spellings in the manual must be ignored as the program only understands American English (so you'll have to use CENTER, not CENTRE); and that goes for Pefect Speller as well.

Printer Configuration: If you do not have one of Perfect Writer's recommended printers, this can be a nightmare unless you follow the configuration program's advice to start from its 'Vanilla' definition and change one item at a time, printing out a test file after each change in order to see what its effect has been. Fig 2 lists a set of values that will work for the Epson FX-80 in normal, elite and proportional formats. If you need to alter any of the values (for instance, to allow for a different paper size) change one at a time, and see what happens.

If anyone has managed to persuade the FX-80 to produce a multi-national character set from a Perfect Writer file, using French and German accents in a normal print mode, I should be very glad to hear about it!

Daniel Leech-Wilkinson

```
'BEGIN.SUB'          Action                      With SHIFT

*Key 0 !H            Delete previous character   Return to menu
*Key 1 ![B           Backward word               HELP menu
*Key 2 !B            Backward character          Previous screen
*Key 3 !F            Forward character           Next screen
*Key 4 ![F           Forward word                Refresh screen
*Key 5 @I(           Open italics                Save file
*Key 6 @B(           Open boldface               Read file
*Key 7 !P            Previous line               Write file
*Key 8 !N            Next line                   List buffers
*Key 9 menu !M       Calls PW from CP/M          Switch buffers
*fx 5,1
*fx 4,2
*Key 11 ![!W         Continue saving
*Key 12 ![A          Beginning of sentence
*Key 13 ![E          End of sentence
*Key 14 ![N          End of paragraph
*Key 15 ![P          Beginning of paragraph
```

Fig 1 Torch file to set function keys, COPY and cursor keys for Perfect Writer commands

```
 1. 20955 (8.3 ins.)
 2. 30480 (12 ins.)
 3. 254 (10-pitch)      212 (12-pitch)      235 (proportional)
 4. 423 (6 per in.)
 5. 254                 212                 21
 6. 423                                     53
 7. N                                       Y
 8. (omitted)                               0[see * below]
 9. N
10. 0
11. 1
12. Y
13. Y
14. N
15. 1
16. N
17. (omitted)
18.                     ESC M               ESC p CTRL-A
19.                     ESC P               ESC p
20. CTRL-M CTRL-J
21. ESC G
22. ESC H
23. ESC 4
24. ESC 5
```

*Width Table 0 has to be reset to the values given in the FX-80 manual, pp. 3-105 — 3-106, taking 1/2 dot as 21.17 micas. For example, SPACE = 254, ! = 106, " = 169, etc.

Note: CTRL codes have to be preceded by CTRL-Q.

Fig 2 Perfect Writer FX-80 configuration values

SPECTRUM UPPER SCREEN INPUT

This machine code subroutine has been devised to allow input in the upper part of the screen. The machine code is entered into RAM, saved to tape and activated by running the Basic program in listing 1 (48k machine) or listing 2 (16k machine). Once the machine code has been POKEd into RAM (lines 10-80) and activated, by modifying two of the system variables (lines 100 and 110), input can be taken from the upper part of the screen by using the data stream 2.

For example: INPUT #2;AT5,5;"ENTER A WORD ";A$

Input may be carried out in exactly the same way in the lower part of the screen. While entering a line, errors and omissions may be corrected using the delete horizontal cursor keys.

When programming for input in the upper part of the screen a number of points require consideration:

a) When the input is completed the print position moves to the position immediately after the input.
b) When using "AT" the parameters relate to the upper part of the screen.
c) Print items and input are not cleared from the screen.
d) During input the lower part of the screen is cleared continuously.
e) Should the input extend into the lower part of the screen the display does not scroll and the program terminates with an "OUT OF SCREEN" error message.
f) Whenever the machine code is entered or loaded into RAM, the subroutine requires activating before input can be carried out.

The program works by substituting a call to a machine code subroutine into the input stream of channel 2 in place of the call to an error routine. This input stream does not require opening because it is one of the streams that are permanently open.

To explain in detail how the program works it is necessary to examine how input is carried out in the lower part of the screen. The input command uses the EDITOR routine in the ROM to build up the input line in an input buffer. Each time the EDITOR requires a character it calls the KEY INPUT routine (at 10A8) indirectly, through the system variables. If a character is available, the KEY INPUT routine prints out the input line including the new character inserting the cursor in the correct position and then returns the character to the EDITOR routine. Printing the input line is carried out in the lower part of the screen which clears each time a key is pressed. This is why the addition of characters to an input line gets slower as the line is entered.

The subroutine has been inserted as an interface between the EDITOR routine and the KEY INPUT routine utilising the indirect call. It routes all printing to the upper part of the screen, keeps the printing tidy and, where necessary, updates the system variables.

Each time the EDITOR requires a character it calls the subroutine. The first part of the subroutine stores away the current upper screen print position and then, if a character is expected, calls the KEY INPUT routine alternatively. If an attribute control code is expected it calls the KEY NEXT routine (at 110D). Once the KEY INPUT routine has been executed, the second part of the subroutine is entered. The print position is restored and a check is made to see if a key has been pressed. If it has not, the system variables are modified to ensure that the cursor continues to show on the screen. The subroutine then prints out the buffer, substitutes a space for the cursor and checks to see whether the screen is full. If it is, an error message is generated. The character returned by the KEY INPUT routine is then examined to see if it is an 'enter', a 'delete' or an attribute control character, for example, FLASH, INK. If it is an 'enter' character, the print position is moved to just after the input and a return is made to the EDITOR. If it is a 'delete' character, a check is made to ensure that a CHR$(6) separated from a deleted colour control character has not occurred, then the buffer is printed out with an additional space to cover up any remaining characters. Attribute control characters set a flag to warn the subroutine to expect an attribute code next time the subroutine is called. A return is then made to the EDITOR.

This subroutine adds a useful extension to the Spectrum input command which only requires 200 bytes of machine code. This facility would have required far less space had it been programmed into the ROM and it is surprising that it was not included.

Richard Parrot

```
10 CLEAR 65176
11 DATA 245,229, 42
12 DATA 132, 92, 34,  6,255
13 DATA  42,136, 92, 34,  8
14 DATA 255,225, 58, 72,255
15 DATA 254,  1, 40,  6,241
```

```
 16 DATA 205,168, 16, 24, 12
 17 DATA 241,205, 13, 17,245
 18 DATA  62,  0, 50, 72,255
 19 DATA 241,201,229,213,197
 20 DATA 245,205, 74,255, 56
 21 DATA   2, 40, 62, 62,  1
 22 DATA  50, 73,255,205, 51
 23 DATA 255,205, 68,255, 58
 24 DATA 136, 92,254,  1, 32
 25 DATA   9, 58,137, 92,254
 26 DATA   3, 32,  2,207,  4
 27 DATA 241,245,254, 13, 40
 28 DATA  20,205, 74,255,254
 29 DATA  12, 40, 41,254, 16
 30 DATA  56,  9,254, 22, 48
 31 DATA   5, 62,  1, 50, 72
 32 DATA 255,241,193,209,225
 33 DATA 201,  0,  0,  0,  0
 34 DATA  58, 73,255,254,  0
 35 DATA  40,240, 33, 60, 92
 36 DATA 203,222, 62,  0, 50
 37 DATA  73,255, 24,228, 42
 38 DATA  91, 92, 43,126,254
 39 DATA   6, 32,  2, 54,  0
 40 DATA 205, 51,255,205, 68
 41 DATA 255,205, 74,255, 24
 42 DATA 206,237, 91, 97, 92
 43 DATA  42, 99, 92,167,237
 44 DATA  82, 43, 68, 77,205
 45 DATA  60, 32,201, 62, 32
 46 DATA 215,201,  0,  1, 42
 47 DATA   6,255, 34,132, 92
 48 DATA  42,  8,255, 34,136
 49 DATA  92,201
 50 FOR I=65177 TO 65366
 60 READ J
 70 POKE I,J
 80 NEXT I
 90 SAVE "input"CODE 65177,190
100 POKE 23741,153
110 POKE 23742,254
```

Listing 1 48k input

```
 10 CLEAR 32408
 11 DATA 245,229, 42
 12 DATA 132, 92, 34,  6,127
 13 DATA  42,136, 92, 34,  8
 14 DATA 127,225, 58, 72,127
 15 DATA 254,  1, 40,  6,241
 16 DATA 205,168, 16, 24, 12
 17 DATA 241,205, 13, 17,245
 18 DATA  62,  0, 50, 72,127
 19 DATA 241,201,229,213,197
 20 DATA 245,205, 74,127, 56
 21 DATA   2, 40, 62, 62,  1
 22 DATA  50, 73,127,205, 51
 23 DATA 127,205, 68,127, 58
 24 DATA 136, 92,254,  1, 32
 25 DATA   9, 58,137, 92,254
 26 DATA   3, 32,  2,207,  4
 27 DATA 241,245,254, 13, 40
 28 DATA  20,205, 74,127,254
 29 DATA  12, 40, 41,254, 16
 30 DATA  56,  9,254, 22, 48
 31 DATA   5, 62,  1, 50, 72
 32 DATA 127,241,193,209,225
 33 DATA 201,  0,  0,  0,  0
 34 DATA  58, 73,127,254,  0
 35 DATA  40,240, 33, 60, 92
 36 DATA 203,222, 62,  0, 50
 37 DATA  73,127, 24,228, 42
 38 DATA  91, 92, 43,126,254
 39 DATA   6, 32,  2, 54,  0
 40 DATA 205, 51,127,205, 68
 41 DATA 127,205, 74,127, 24
 42 DATA 206,237, 91, 97, 92
 43 DATA  42, 99, 92,167,237
 44 DATA  82, 43, 68, 77,205
 45 DATA  60, 32,201, 62, 32
 46 DATA 215,201,  0,  1, 42
 47 DATA   6,127, 34,132, 92
 48 DATA  42,  8,127, 34,136
 49 DATA  92,201
 50 FOR I=32409 TO 32598
 60 READ J
 70 POKE I,J
 80 NEXT I
 90 SAVE "input"CODE 32409,190
100 POKE 23741,153
110 POKE 23742,126
```

Listing 2 16k input

MACHINE CODE MUSIC

Since no mention is made in the Oric manual of how to access the sound chip, I have worked out how to get into the EPROM routines which carry out the Basic sound commands, thus enabling sounds to be produced from within the machine code programs.

SHOOT, ZAP and EXPLODE can be produced with a JSR to &F415, &F41B and &F418 respectively, and a PING may be produced with LDA &07 and JSR &F57B (equivalent to PRINT CHR£(7)).

SOUND, MUSIC and PLAY take arguments and, therefore, need slightly more code. Arguments are stored as ordinary two-byte integers in locations &2E1 to &2E8. &2E1/2 should contain the tone channel(s) selected for each command, &2E3/4 should contain the period for the SOUND command, the octave for MUSIC or the noise channel(s) selected for PLAY, location &2E5/6 contains the volume for SOUND, the note for MUSIC or the envelope for PLAY and &2E7/8 is the volume for MUSIC or the envelope period for PLAY. After setting up the arguments, making sure that the hi-bytes are zero where necessary, the commands may be carried out with a JSR to &F41E, &F424 or &F421 for SOUND, MUSIC or PLAY respectively.

(Readers who are unsure about using this in machine code straight away may like to experiment with DOKEs and a CALL before incorporating it into a machine code program.)

AJ Edgington

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

Looking for a cure

The Welsh Drug Information Centre has the following computer equipment:

—North Star Horizon, quad density
—20Mbyte hard disks
—ADM 36 VDU—Lear Siegler Inc
—Qume Sprint printer

In early 1983, we purchased dBaseII from Benchmark Computer Systems Ltd, Street, Somerset (which also supplied the hardware). Although both the company and ourselves have tried to install dBaseII onto the micro, we have been relatively unsuccessful and are only able to make limited use of the software. I would be grateful, therefore, if you could help.

The major problem appears to be the install procedure: 'Enter commands that will clear the screen and place cursor in upper left corner.' According to instructions in our VDU manual, there *are* commands for home cursor and erase to end of screen. The problem is that if we have the 'home cursor' command first, followed by the 'erase command', the screen clears; but when records are displayed, some fields are missing from a record, even though data has been entered in. If the commands are reversed then the records are displayed, but the screen does not clear.

In order for us to get any sort of proper record display, the VDU has to be in VT52 mode, where there does not seem to be an escape sequence for 'clear screen' rather than 'erase from cursor position'. In the ANSI mode there is a 'clear screen' command, but any attempt to run dBaseII in this mode results in a jumbled up screen which is unusable.

At present, the only way we can use the system is by manually clearing the screen using several carriage returns before we try to append data or edit records. If we do not, the records are laid on top of whatever is already on the screen.

As you will appreciate, this is a real waste of time and inhibits us from using what would be really useful software in our line of work.

I hope you will be able to offer some guidance.
Mike Spencer, principal pharmacist, WDIC

Installing systems for different terminals is always a tricky problem — even more so when trying to solve the problem from a distance.

It looks as if you were on the right track when you entered 'home cursor' followed by 'erase'; this would have taken the cursor to the top left of the screen and then erased the whole screen. The problem is that it looks like the erase command left the cursor at the bottom of the screen, which would be the cause of your partial display problems.

The best we can suggest is that you try 'home cursor' followed by 'erase' followed by another 'home cursor'. This should make sure that the cursor ends up back at the top left of the screen after the erase operation.

Your dealer should be able to cope with problems like this. If you are unhappy with your dealer, Ashton Tate is keen to hear from you, so why not drop the company a line.

In search of high-quality print

I have had a Commodore 64 for nearly six months and would like to expand my system to include a printer. The problem is that I have seen some of the Commodore printers, but they don't seem to meet my needs.

My question is: are there any other printers available for the 64, or am I restricted to Commodore's own breed?
Susan Lloyd, London N4

The Alphacom 81 printer reviewed on page 144 is one alternative to consider. It costs about £150 and is a high-speed, 80-column thermal printer. It may, however, be unsuitable for your needs as its print quality tends to be poor.

The answer is probably to invest in a Centronics interface which will allow you to use any number of printers: for example, the popular Epson range.

The interface may cost you anything up to £45 from a starting price of about £25. The reason for the price difference is the medium on which the printer driver program is supplied (this is a machine code program which ensures that what you want to print appears as you would like it on the paper). The cheaper interfaces invariably have a tape-based program, which would be incredibly slow to load in every time you wanted to use your printer. Slightly faster is a disk-based program, but by far the most practical — and most expensive — are the ROM-based programs that are integrated into the interface itself.

Incidentally, you should be prepared to pay between £300-400 for your printer.

No time for leisure

I have a Sharp MZ-80K and used it to solve the June *PCW* Leisure Lines problem. Using the program listed below, I had the computer examine every integer between 100000 and 999999 to see if the product of the first half of the number and the second half all squared equalled the original number.

In order to reassure myself that the computer was indeed performing, I had it printing the original number, the squared product and the error between the two numbers whenever the error was less than 50.

An interesting result followed: even though the error should have been an integer, it was not calculated as such for the majority of occasions. The first 14 'answers' are also listed in Fig 1. Can anybody explain why I got the results I did?
AJ Flewitt, Bushey Heath, Herts

Program

```
10 FOR X=100000 TO 999999
20 W$=STR$ (X)
30 D$=RIGHT$(W$,3)
40 E$=LEFT$(W$,3)
50 D=VAL     (D$)
60 E=VAL     (E$)
70 IF ABS(X-((D+E)^2)<50
   THEN PRINT X,(D+E)^2,
   ABS(X-((D+E)^2))
80 IF X<>((D+E)^2) THEN 100
90 PRINT "ONE ANSWER IS",X
100 NEXT X
```

108221	108241	19.999939
110222	110224	1.9999695
112223	112225	1.9998474
114224	114244	20.000214
123228	123201	26.999878
133232	133225	7.0007935
148237	148225	11.99939
155239	155236	3.0004883
159240	159201	39.000366
163241	163216	25.00061
167242	167281	38.999451
172243	172225	18.000916
177244	177241	3.000061
189246	189225	21
etc	etc	etc

Fig 1 Answers (see 'No time for leisure')

Your problem is typical of many which plague programmers, and whose solution is so obvious that it's difficult to see. I painfully checked the logic, and found it correct except that you have used the ABS function instead of INT.

The ABS function is merely used to strip numbers of their minus signs: for example, ABS(−2.143) returns the number 2.143. The function you should have used is INT, which returns the integer part of a number. INT(2.143) would return the answer 2.

Help! — sharp answer needed

After several frustrating hours trying to load a newly received Basicode-2 translation program into my Sharp MZ-80A, I am left with three alternatives:
(1) Keep the tape as a Christmas present for someone I don't like.
(2) Eat it.
(3) Write a begging letter for help.

Having decided against option (2), and as option (1) is still a long way off, I settled for the final choice, which, I

hasten to add, immediately left me blissfully confident that salvation is at hand.

Without further ado I present my problem.

I LOAD Basic 5510 in the normal way, and then attempt to LOAD Basicode-2. After a few seconds of tape loading, I get a screen message 'Found BASC2-5510A' immediately followed by error message 18 (writing statement issued to the Basic control area).

The only way I can progress from this position is, after LOADing Sharp Basic, to switch to MONitor and then LOAD the Basicode-2. I now get a longer tape load, ending with a return to the screen of the standard Sharp message that Basic is loaded, except that now only 30,456 bytes are available (so a little less than 2k has been consumed by Basicode from the 32,492 bytes normally indicated).

However, transferring the tape to my hi-fi indicates that not all the code has been read, only about half.

Entering LIST has no effect, but entering LOAD/2 displays each line of the Basicode subroutine section, lines 10-1000, one at a time until the 'Ready' message appears. The Basicode subroutines may now be LISTed in the normal way.

However, Basicode programs will not LOAD, and if I return to MONitor and enter the cold start address J1200, I am returned to my 30,456 bytes and cannot erase the partial Basicode program which now seems to have overwritten the Sharp Basic. Needless to say, NEW will not erase the Basicode either. The only option is to switch off and start again.

Broadcasting Support Services cannot offer advice on this matter, although it is exchanging the tape for me. Neither can the Sharp User Group I belong to.

I am keen to get Basicode running on my MZ-80A as I feel that the concept behind it is a step forward for home computing.

While I appreciate that to maximise on any computer's facilities programs implies that programs must be written in the Basic of the target machine, to have available a common language must be a great advantage.

Trevor R Escott, Mill Hill, London NW7

As with many questions of this type, you're so close to finding the full answer but just lack that final piece of information. To run Basicode on the MZ-80A, all you have to do is:

1 Load in the Basic.
2 Type MON (cr) to enter the monitor.
3 Load in Basicode-2.
4 Typing LOAD/B loads Basicode into user memory (LOAD/2 loads only the Basicode subroutines).

You should have no further trouble from here on.

This information was kindly supplied by Frank Butterfield, who also provided the following details which allows the MZ-700 to also use Basicode.

At the moment, Basicode is not available for the Sharp MZ-700. Using the following Basic program, it's possible to use MZ-80A Basic SA-5510 and Basicode BASC-5510A on the Sharp MZ-700.

First load Sharp SA5510 Basic, then return to ROM monitor by typing MON (CR). Now load Basicode BASC2-5510A.

When Basicode has loaded and the computer has returned to Basic, enter and run the following program:

```
10 FOR K = 1 TO 15
20 READ A,B
30 POKE A,B
40 NEXT
50 END
100 DATA 20804,36,20813,36,
         21044,159,21066,
         5,21276,159
110 DATA 21389,97,21391,97,
         21406,90,21438,43,
         21454,25
120 DATA 21472,45,21485,45,
         21498,45,21511,37,
         21735,62
```

If you wish to save the altered Basicode program, return to ROM monitor and enter:
S505C5850505C (CR)
Filename BASIC2-MZ-700 (CR)

European features

I am using an Epson QX-10 as a word processor (with Perfect Writer) for a research project which involves the use of several European languages. One of the attractions of the QX-10 is that it has the ability to function in eight keyboards (including Danish).

However, neither by switching the pins inside the printer nor by programming the computer to use another keyboard am I able to achieve the flexibility I require to make proper use of this facility.

I find it impossible to view on the screen or print out text containing vocabulary from several languages. It's as if manufacturers never considered that this might be desirable or necessary. For academic work in the humanities it is essential (for example, for listing documents in different languages or for bibliographies), and general writers also need to include foreign place names and proper names, and anglicised foreign words. On my screen, and perhaps in *PCW*, it is impossible for a Herr Müller to meet a Mlle Hélène in La Coruña, let alone feast on pâté and crêpes washed down with Löwenbrau.

It seems to me, as a newcomer to the world of microcomputers, that if manufacturers wish to exploit the full potential of software for writers, they should make more effort to understand and establish the latter's requirements.

I do not know whether to be disappointed or relieved that after all this technological breakthrough, I still have to use my trusty black biro to do the work that the computer cannot do!

Dr Janet Hartley, School of Slavonic and East European Studies, University of London

Perhaps we can throw a little light on your problems. You don't mention which printer you're using, so we'll cross our fingers and hope it's an Epson (MX, RX, FX, or even LQ-1500). The QX-10 can only be configured for one language at a time using the CONFIG program; however, Appendix K in the *Operations Manual* shows the keyboard layout for all the character sets. Thus, providing a change of international character set in the form of a printer control code is possible within Perfect Writer. The appropriate key for the required language can be pressed on the keyboard, and the character seen on the screen will be the one with the same ASCII control code for the language selected under CONFIG. After all, it's the final printer output which really matters and not what is produced on the screen.

Now to Perfect Writer. On pages 303-338 of the manual are instructions for installing this program for your printer. There is an option for the Epson, but this will only produce the codes for an MX-80 F/T Type 1. You can also configure it for any other printer by answering a set of questions. Page 318 shows how this program can set up Perfect Writer for an MX-80 F/T Type 3, which has a number of additional features such as bit image and italics mode.

The Epson international character set printer control code is ESC R. ESC R+n = CHR$(27);CHR$(82);CHR$(n), since the ASCII code for ESC is 27 and for R is 82.

The letter 'n' can take values 0-7, which represent the US, France, Germany, England, Denmark, Sweden, Italy and Spain respectively. These codes are all available on the MX printers.

Like many word processors (including WordStar), the installation program for Pefect Writer allows features such as bold, underlining, superscript and subscript to be set up for a particular printer. Perfect Writer and WordStar do not allow special code sequences to be inserted in the program, so enabling the full features of our printers to be utilised, unless the command is well hidden in the Perfect Writer Manual (2nd Edition 1983) or the program has been upgraded.

It is for this reason that Epson recommends Peachtext (and indeed bundle it with the QX-10). Using the 'out' command of Peachtext, any control sequence can be sent to employ any feature of the printer.

We sympathise with your problem. It is extremely difficult for a first-time buyer to know the features required from a word processor/printer combination without carrying out a great deal of research beforehand. But if a buyer writes down a specification and a dealer sells him software, the customer is entitled to his money back if the software and the system does not meet the purpose.

The above information was kindly supplied by Esther Bayer at Epson who's asked us to point out that both she and John Franklin are always available on Technical Support to answer customers' technical queries. The address to write to is Dorland House, 388 High Rd, Wembley, Middlesex.

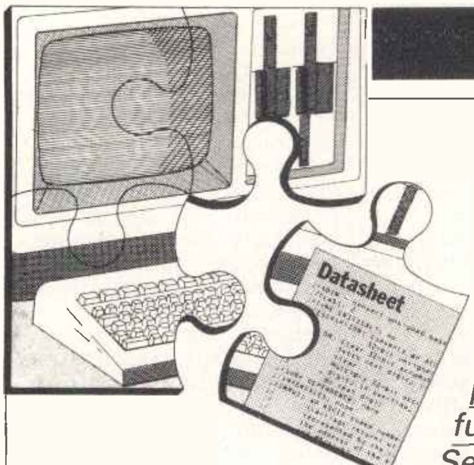
Secrets of the Genie

Please could you provide a list of the locations where the Basic command words are stored in the memory of the Genie I computer, and the registers which are involved in these operations.

Frank Percival, Godalming, Surrey

According to Ronald Degg, one of our Genie I experts, you are heading into deep water where a guide would be useful.

He suggests that you look in your local Tandy shop for a TRS 80 Level II assembly language book, which will help you as you delve into the 12k of memory where these commands are stored. END



SUBSET

David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Sub Set, PCW, 62 Oxford Street, London W1A 2HG.

SUB SET SYSTEM

From this month Sub Set is broadening its scope to include routines written to interact with specific computer systems. And there's documentation to prove it.

Also from this month, Sub Set will be given occasional extra space for passing on all that information *you* have painstakingly discovered about your computer — how, and where Basic stores its variables, how to get into the system routines, which areas of memory are safest for assembling your code, and so on.

For the first of these system pages Sverrir Karlsson of Kopavgi, Iceland, shows how to make BBC assembler programs easier to read.

NEW DOCUMENTATION

The time-honoured Sub Set Datasheets have a new look to them. This is to highlight the system implementation. The description now has four main parts.
(a) A general definition which should help in converting the routine for use on other systems or in other machine codes.
(b) Details of the system for which the routine is written.
(c) The actual operation details of the routine, specific to the way it is written.
(d) Classification to show those situations in which the routine can (marked with '*') and cannot (marked with '–') be safely used. Class 1 routines are entirely safe.

The 'Time critical' section was so rarely used that it has been dropped. That, and any other special considerations, can be included in 'Job'.

'Errors' is a new section to point out any problems you might have in using the routine — what could happen if you don't validate input before calling it, and so on. 'RAM use' is for any workspace or storage other than on stack. The 6502 page zero pseudo-registers MO to MF can be included here instead of in 'Reg use'.

'Discreet' routines don't change any variable except to pass useful information from the routine. 'Robust' routines don't crash or produce unflagged erroneous results on invalid input, being interrupted, or whatever.

COLOURS OF THE SPECTRUM

The displayed characters and graphics on the screen of the ZX Spectrum are more complex than those of the TRS-80. Every pixel is either 'paper' (background) or 'ink' (foreground). Each character position is a matrix of 8 × 8 dots whose ink and paper colours are controlled by a byte in an 'attribute file'. The dot pattern displayed or the colours used can each be separately changed.

INKPAP, written by BJ Lowry of Hornchurch, changes the displayed colours on the full screen. It also sets the system variable which controls the colours of any further printing. The actual pattern of dots is not disturbed.

DATASHEET

```
:===========================================================
:= INKPAP   Global Ink and Paper change.
:===========================================================
:JOB        To change the foreground and background colours
:           of all current screen locations and the system
:           attribute variable.
:ACTION     Calculate attribute values from input values.
:           For each byte in attribute file:
:             [ store new attribute ].
:           Store new attribute to system variable.
:-----------------------------------------------------------
:CPU        Z80.
:HARDWARE   Written for ZX-Spectrum.
:SOFTWARE   Local subroutine use:
:           CALC - Combine colour codes in one byte.
:           CHANGE - Store new value to attribute file.
:-----------------------------------------------------------
:INPUT      E = Ink code (0 - 7). D = Paper code (0 - 7).
:OUTPUT     E = paper and ink colour attributes. D = 0.
:           All bytes in attribute file and attribute
:           variable contain new attributes.
:ERRORS     Input E (ink) > 7 will affect paper colours.
:REG USE    DE
:STACK USE  10
:RAM USE    None.
:LENGTH     51
:CYCLES     Not given.
:-----------------------------------------------------------
:CLASS 2    -discreet  *interruptable  *promable
:-**---     -reentrant  -relocatable  -robust
:===========================================================
:
ATTRP  EQU  23693        :Permanent colour system variable.
ATTRF  EQU  22528        :Start of attribute file.
ATTRE  EQU  5BH          :Hi-byte of attribute file + 1.
:
INKPAP PUSH AF           :Save flags                  F5
       PUSH BC           :and registers               C5
       PUSH HL           :used in INKPAP.             E5
       CALL CALC         :Get new attribute byte.     CD lo hi
       CALL CHANGE       :Change all attribute file.  CD lo hi
       LD   A,E          :Also store new attribute    7B
       LD   (ATTRP),A    :in system variable for      32 8D 5C
       POP  HL           :permanency. Restore         E1
       POP  BC           :registers                   C1
       POP  AF           :and flags.                  F1
       RET               :Return to calling program.  C9
:
:...Subroutine to combine paper and ink attr. in one byte.
CALC   LD   A,0          :Clear new attribute in A.   3E 00
       LD   BC,0         :Clear counter.              01 00 00
LOOP   INC  C            :Increment counter.          0C
       ADD  A,D          :Get paper colour in bits    82
       PUSH AF           :3, 4 & 5 of A by adding     F5
       LD   A,C          :eight times into A.         79
       CP   8            :Test if 8 additions done,   FE 08
       JR   NZ,NOTOUT    :continuing if not,          20 06
       POP  AF           :else get paper back and     F1
       ADD  A,E          :add in ink to bits 0, 1     83
       LD   E,A          :and 2. Store in E and       5F
       LD   D,0          :clear D.                    16 00
       RET               :Return to INKPAP.           C9
NOTOUT POP  AF           :Recover partial attribute   F1
       JR   LOOP         :and loop until complete.    18 EF
:
:...Subroutine to store attr. in all attribute file.
CHANGE LD   HL,ATTRF-1   :Index attribute file.       21 FF 57
CLOOP  INC  HL           :Point to next byte.         23
       LD   A,H          :Test if point gone past     7C
       CP   ATTRE        :last attribute byte and     FE 5B
       RET  Z            :return to INKPAP if so,     C8
       LD   A,E          :else get attribute          7B
```

```
        LD    (HL),A      ;into file byte and          77
        JR    CLOOP       ;repeat until all changed.   18 F7
;===============================================================
```

INVERTING PIXEL GRAPHICS

The TRS-80 and Video Genie use a graphics system based on a sequence of 64 characters. These can be used to display any combination of pixels in a 3 × 2 matrix in each character position. Text and graphics can be mixed.

SGREV from Tom Ithell of Alveley in Shropshire will go through screen RAM and invert each pixel, leaving the text unaltered. The only ASCII character it does affect is 20H which is inverted to a fully lit graphics character. SGREV should be easily converted for use on any computer with a similar, binary sequence, pixel graphics set.

DATASHEET

```
;===============================================================
;= SGREV     Screen Graphics Reversal.
;===============================================================
;JOB         To reverse (invert) monochrome graphics pixels
;            displayed on screen.
;ACTION      For each character in screen memory:
;              [ Convert text spaces to graphics spaces.
;                IF not graphics char THEN skip
;                ELSE char = lastchar - (char - firstchar) ]
;---------------------------------------------------------------
;CPU         Z80
;HARDWARE    Written for TRS-80 models I/III or Video Genie.
;SOFTWARE    None.
;---------------------------------------------------------------
;INPUT       None.
;OUTPUT      None.
;ERRORS      Re-reversal of completed part if re-entered.
;            Text spaces irreversibly changed to graphics.
;REG USE     None.
;STACK USE   8
;RAM USE     None.
;LENGTH      44
;CYCLES      Not given.
;---------------------------------------------------------------
;CLASS 2     *discreet  *interruptable  *promable
;***-*-      -reentrant  *relocatable  -robust
;===============================================================
;
SPACE  EQU  32         ;ASCII space.
PIXLIT EQU  96         ;Graphics space minus text space.
PIXL1  EQU  128        ;Lowest graphics code (graphic space).
PIXL64 EQU  191        ;Highest graphics code (inv. space).
PIXL65 EQU  192        ;Graphics + 1.
SCREEN EQU  1024       ;No. of screen bytes.
VIDEO  EQU  15360      ;Video RAM start address.
;
SGREV  PUSH AF         ;Save flags                  F5
       PUSH BC         ;and registers               C5
       PUSH DE         ;used in                     D5
       PUSH HL         ;SGREV.                      E5
       LD   BC,SCREEN  ;Get screen byte count       01 00 04
       LD   HL,VIDEO   ;and start address.          21 00 3C
;
AGAIN  LD   A,(HL)     ;Get next byte and           7E
       CP   SPACE      ;test for ASCII space, skip  FE 20
       JR   NZ,GRAFIX  ;to graphics test if not,    20 02
       ADD  A,PIXLIT   ;else make it graphics space. C6 60
;
GRAFIX CP   PIXL1      ;If byte < first graphics    FE 80
       JR   C,NEXT     ;then no reversal.           38 0C
       CP   PIXL65     ;If byte > last graphics     FE C0
       JR   NC,NEXT    ;then no reversal.           30 08
;
       LD   E,PIXL1    ;Get char position in        1E 80
       SUB  E          ;graphics set,               93
       LD   E,A        ;(char - firstchar) in E.    5F
       LD   A,PIXL64   ;Reverse position,           3E BF
       SUB  E          ;lastchar - position in A    93
       LD   (HL),A     ;then back to screen RAM.    77
;
NEXT   INC  HL         ;Index next screen byte.     23
       DEC  BC         ;Repeat for                  0B
       LD   A,B        ;all bytes                   78
       OR   C          ;in                          B1
       JR   NZ,AGAIN   ;screen RAM.                 20 E3
;
       POP  HL         ;Restore                     E1
       POP  DE         ;registers                   D1
       POP  BC         ;and                         C1
       POP  AF         ;flags.                      F1
       RET             ;Return to calling program.  C9
;===============================================================
```

LEGIBLE LISTINGS

BBC Basic is a very powerful tool and the more so since 6502 assembly language programs and subroutines can be embedded in the Basic program. Variables assigned in the Basic can be used in the assembler and, as in Basic, the assembler supports multi-statement lines.

The only problem with this wealth of facilities is that of readability. The Beeb doesn't go in for normal assembler formatting.

Rather than help you find your way through a routine, comments tend to obscure as in Listing 1 of LSTFMT, a patch by Sverrir Karlsson for the BBC print routine WRCH. LSTFMT formats progress to normal assembler fields. Listing 2 is the result of LSTFMT acting on itself.

Type the program in as it appears in Listing 1. Run it and then type in LIST01 — the list option to print a space after each line number. Before LISTing press function key 1 to format, function key 0 to list normally in List Option 1 or the BREAK key (*KEY 10) to list without spaces (Option 0).

The string in *KEY1 loads the address of LSTFMT into the OSWRCH vector. *KEY0 replaces the OSWRCH address. *FX 6,10 stops LF (line feed) being sent to the printer since most printers do this automatically on carriage return.

Several words of warning: Sverrir has found out that the locations &D00 and &D01 are set to &FF on machine reset, hence the origin at &D02. If you have a DFS disk system you will have to assemble LSTFMT higher in memory since LOMEN is moved up from &E00 to &1900. Finally, don't try to edit your programs in the formatted mode — LSTFMT is strictly a one way process.

DATASHEET

```
 10REM ~ "LSTFMT" - FORMATTED ASSEMBLER LISTING
 20*FX 6,10
 30*KEY 10 !N OLD!M
 40*KEY0"?&20E=&A4:?&20F=&E0!M"
 50*KEY1"?&20E=&02:?&20F=&0D:!&70=0!M"
 60REM ~ VECTOR PRINT ROUTINE WRCH
 70OSWRCH=?&20E+?&20F*256
 80REM ~ SYSTEM READ OF CURSOR POSITION
 90OSBYTE=&FFF4:csrpos=&86
100REM ~ SET UP PAGE ZERO USE
110asmfl=&70:cmtfl=&71:lblfl=&72:litfl=&73:tabst=&74:tempA=&75
120REM ~ NAME FORMATTING CHARACTERS
130asmin=&5B:asmout=&5D:colon=&3A:quotes=&22:carret=&0D:lnfeed=&0A
140space=&20:label=&2E:commnt=&5C
150REM ~ FIELD TAB SETTINGS
160coltab=4:lbltab=6:mnmtab=14:cmntab=28:lwidth=59
170FOR I=0 TO 2 STEP 2
180P%=&D02
190[OPT I
200STA tempA \Save value in zero page
210PHP:TXA:PHA:TYA:PHA \Save registers and
220LDX tempA \get input value in X for tests.
230TXA:SEC:SBC #carret:BNE qtest \Test for line end.
240STA cmtfl:STA lblfl:STA litfl \Clear comment, label & literal flags.
250BEQ bexit \Hop to exit.
260.qtest CPX #quotes:BNE lftest \Test for literal start/end.
270LDA litfl:EOR #1:STA litfl \Toggle literal flag on/off.
280DEX:BNE width \Hop to line-end test.
290.lftest LDA litfl:BNE width \No formatting if flag on.
300CPX #colon:BNE asstst \Test statement as new line.
310STA cmtfl:STA lblfl \Clear flags
320JSR lfeed \Go to new line.
330LDY #coltab:JSR tabout \Tab to colon position.
340TXA:JSR OSWRCH \Print colon,
350LDA #space:STA tempA:BNE exit \then a space on exit.
360.asstst CPX #asmin:BNE asetst \Test for assembler start.
370INC asmfl:BNE width \Flag on and go to line-end test.
380.asetst CPX #asmout:BNE aftst \Test for assembler end.
390DEC asmfl:BEQ width \Flag off and go to line-end test.
400.aftst LDA asmfl:BEQ width \BASIC if flag off - no format.
410LDA cmtfl:BNE width \Inside a comment - carry on.
420CPX #commnt:BNE lbftst \Test for comment start.
430INC cmtfl:LDA #cmntab:JSR pos \Comment flag on and test print position.
440BCC exit:BEQ exit:TAY:JSR tabout \Tab to comment field if needed.
450.bexit BEQ exit \Also "stepping stone to 'exit'.
460.lbftst LDA lblfl:BEQ lbtest \Test if inside a label.
470CPX #space:BNE exit \Print if not end of label,
480DEC lblfl:BEQ exit \else flag off and print space.
490.lbtest CPX #label:BNE lintst \Test for label start.
500INC lblfl:BNE exit \Flag on and exit to print "."
510.lintst CPX #space:BEQ exit \Print space on exit.
520CPX #&30:BCC anmtst:CPX #&3A:BCC exit \Digits ok - probably line number.
530.anmtst LDA #anmtab:JSR pos:BCC exit:BEQ exit \Exit if in anemonic,
540TAY:JSR tabout:BEQ exit \else tab to anemonic field.
550.width LDA #lwidth:JSR pos:BCS exit \Okay if not at line-end
560JSR lfeed \else next line and
570LDA cmtfl:BEQ lblpos \skip if not in a comment
580LDY #cmntab:JSR tabout \else tab up to comment position and
590LDA #commnt:JSR OSWRCH:INY:BNE exit \write new comment symbol.
600.lblpos LDY #lbltab:JSR tabout \Else tab to label field.
610.exit PLA:TAY:PLA:TAX:PLP \Restore registers and
620LDA tempA:JMP OSWRCH \exit through character print routine.
630.tabout LDA #space:JSR OSWRCH:DEY:BNE tabout:RTS
640.lfeed LDA #carret:JSR OSWRCH \Using OSNEWL would send CHR$ 13 and 10
```

Listing 1

```
650LDA #lnfeed:JSR OSWRCH \through LSTFMT and overwrite
660RTS \the character stored in tempA.
670.pos PHA:LDA #csrpos:JSR OSBYTE \Read text cursor position.
680STX tabst:LDX tempA:PLA \store it and recover registers
690SEC:SBC tabst:RTS \get position difference and return.
700]
710NEXT
```

DATASHEET

```
10 REM ~ "LSTFMT" - FORMATTED ASSEMBLER LISTING
20 *FX 6,10
30 *KEY 10 |N OLD|M
40 *KEY0"?&20E=&A4:?&20F=&E0|M"
50 *KEY1"?&20E=&02:?&20F=&0D:!&70=0|M"
60 REM ~ VECTOR PRINT ROUTINE WRCH
70 OSWRCH=?&20E+?&20F*256
80 REM ~ SYSTEM READ OF CURSOR POSITION
90 OSBYTE=&FFF4
 : csrpos=&86
100 REM ~ SET UP PAGE ZERO USE
110 asmfl=&70
 : cmtfl=&71
 : lblfl=&72
 : litfl=&73
 : tabst=&74
 : tempA=&75
120 REM ~ NAME FORMATTING CHARACTERS
130 asmin=&5B
 : asmout=&5D
 : colon=&3A
 : quotes=&22
 : carret=&0D
 : lnfeed=&0A
140 space=&20
 : label=&2E
 : commnt=&5C
150 REM ~ FIELD TAB SETTINGS
160 coltab=4
 : lbltab=6
 : mnmtab=14
 : cmntab=28
 : lwidth=59
170 FOR I=0 TO 2 STEP 2
180 P%=&D02
190 [        OPT I
200          STA tempA      \Save value in zero page
210          PHP
 :           TXA
 :           PHA
 :           TYA
 :           PHA            \Save registers and
220          LDX tempA      \get input value in X for tests.
                            \
230          TXA
 :           SEC
 :           SBC #carret
 :           BNE qtest      \Test for line end.
240          STA cmtfl
 :           STA lblfl
 :           STA litfl      \Clear comment, label & literal
                            \flags.
250          BEQ bexit      \Hop to exit.
260 .qtest   CPX #quotes
 :           BNE lftest     \Test for literal start/end.
270          LDA litfl
 :           EOR #1
 :           STA litfl      \Toggle literal flag on/off.
280          DEX
 :           BNE width      \Hop to line-end test.
290 .lftest  LDA litfl
 :           BNE width      \No formatting if flag on.
300          CPX #colon
 :           BNE asstst     \Test statement as new line.
310          STA cmtfl
 :           STA lblfl      \Clear flags
320          JSR lfeed      \Go to new line.
330          LDY #coltab
 :           JSR tabout     \Tab to colon position.
340          TXA
 :           JSR OSWRCH     \Print colon,
350          LDA #space
 :           STA tempA
 :           BNE exit       \then a space on exit.
360 .asstst  CPX #asmin
 :           BNE asetst     \Test for assembler start.
370          INC asmfl
 :           BNE width      \Flag on and go to line-end test
                            \.
380 .asetst  CPX #asmout
 :           BNE aftst      \Test for assembler end.
390          DEC asmfl
 :           BEQ width      \Flag off and go to line-end tes
                            \t.
400 .aftst   LDA asmfl
 :           BEQ width      \BASIC if flag off - no format.
410          LDA cmtfl
 :           BNE width      \Inside a comment - carry on.
420          CPX #commnt
 :           BNE lbftst     \Test for comment start.
430          INC cmtfl
 :           LDA #cmntab
 :           JSR pos        \Comment flag on and test print
                            \position.
440          BCC exit
 :           BEQ exit
 :           TAY
 :           JSR tabout     \Tab to comment field if needed.
                            \
450 .bexit   BEQ exit       \Also "stepping stone to 'exit'.
                            \
460 .lbftst  LDA lblfl
 :           BEQ lbtest     \Test if inside a label.
470          CPX #space
 :           BNE exit       \Print if not end of label,
480          DEC lblfl
 :           BEQ exit       \else flag off and print space.
490 .lbtest  CPX #label
 :           BNE lintst     \Test for label start.
500          INC lblfl
 :           BNE exit       \Flag on and exit to print "."
510 .lintst  CPX #space
 :           BEQ exit       \Print space on exit.
520          CPX #&30
 :           BCC mnmtst
 :           CPX #&3A
 :           BCC exit       \Digits ok - probably line numbe
                            \r.
530 .mnmtst  LDA #mnmtab
 :           JSR pos
 :           BCC exit
 :           BEQ exit       \Exit if in mnemonic,
540          TAY
 :           JSR tabout
 :           BEQ exit       \else tab to mnemonic field.
550 .width   LDA #lwidth
 :           JSR pos
 :           BCS exit       \Okay if not at line-end
560          JSR lfeed      \else next line and
570          LDA cmtfl
 :           BEQ lblpos     \skip if not in a comment
580          LDY #cmntab
 :           JSR tabout     \else tab up to comment position
                            \ and
590          LDA #commnt
 :           JSR OSWRCH
 :           INY
 :           BNE exit       \write new comment symbol.
600 .lblpos  LDY #lbltab
 :           JSR tabout     \Else tab to label field.
610 .exit    PLA
 :           TAY
 :           PLA
 :           TAX
 :           PLP            \Restore registers and
620          LDA tempA
 :           JMP OSWRCH     \exit through character print ro
                            \utine.
630 .tabout  LDA #space
 :           JSR OSWRCH
 :           DEY
 :           BNE tabout
 :           RTS
640 .lfeed   LDA #carret
 :           JSR OSWRCH     \Using OSNEWL would send CHR$ 13
                            \ and 10
650          LDA #lnfeed
 :           JSR OSWRCH     \through LSTFMT and overwrite
660          RTS            \the character stored in tempA.
670 .pos     PHA
 :           LDA #csrpos
 :           JSR OSBYTE     \Read text cursor position.
680          STX tabst
 :           LDX tempA
 :           PLA            \store it and recover registers
690          SEC
 :           SBC tabst
 :           RTS            \get position difference and ret
                            \urn.
700 ]
710 NEXT
```

Listing 2

TRANSACTION FILE

● SUPERIOR TELETYPE, ASR 33, RS232, £50. Unit with two 8in floppy drives, £50. Sharp PC1211 pocker computer + cassette interface, £30. TRS 80 RAM + disk expansion circuit boards, (needs finishing), £40. Tel: 01-4510520.

● COMMODORE 8032SK computer. 3040 disk drive with useful software, £750 ono. Commodore 8027 daisy wheel printer, £300 ono. "Jaws" 64K memory S100 board, £85. All excellent condition. Tel: 01-4510520.

● LUCAS NASCOM boards, 64K RAM, £95. AVC video card, £95. Lucas EDC disc controller, £75. All boards unused. Tel: (0234) 852942 (day) or (0234) 857491 (eve).

● APPLE IIE. 64k, disk drive, Kaga monitor, joystick, software, books, included. All hardly used and in mint condition. Only six months old. Boxed, £900. Tel: Southampton 584487 (eves).

● TORCH Z80 2nd processor upgrade for BBC micro. Complete with OS chip and softwear. Unused, (requires any 80T disc drive). Offers to: (031) 3460591.

● DRAGON. 32k for sale. Perfect working order. Many books, light pen etc. In original box, bargain at £50. 2 Grange End, Smallfield, Surrey. Tel: Smallfield (034284) 2595.

● ORIC-1 48k, and Seikosha GP80A printer. Spare paper, ribbon, books, software and articles. Includes attache case, £250. Tel: Gosport 520204 weekends or SAE 43 Milford Court, Gale Moor Avenue, Gosport PO12 2TN.

● ATARI 800 48k. 810 disk drive, 850 interface unit, 1010 cassette, with assembler, communications, extended Basic cartridges, various games. All as new £600 ono. Tel: Newbury (0635) 42436 (after 7pm).

● TANDY TRS80 Model one. Level two. 32k Expansion interface, high resolution graphics, matrix printer, VDU, cassette, plus all cables, etc. £550 ono. Tel: Bagshot (0276) 74458 (eves).

● WANTED, back issues PCW vol 1.1 until vol 5.8 and PC(UK) vol 1.1 until vol 5.12 issues, complete and in mint condition, not bound. Make offer to Walter Quatannens Melkwezerstr 39 B-3350 Linter, Belgium.

● SPECTRUM, 48k. Interface 1, microdrive, Prism Micronet modem, printer, sound generator, joystick, cassette recorder, loads of programs on cartridge and cassette, books, magazines, worth over £700. Bargain at £480. Tel: 01-3736303. Noon.

● SUPERBRAIN II QD64 twin disc drive giving 1.5MB; plus Epson 100 FT printer; plus DBase II complete business system. As new. All manuals. £1,400 ono. Tel: John Denholm, Leamington Spa 0926 313695.

● TRS-80 Model 2, 64k, 80 × 24 VDU, 8in disk drive, 115 VAC only TRSDOS, Basic-80, business software, manuals, acoustic coupler (Bell 103A), £500. Tel: (0624) 824380.

● BBC Model-B + disc interface. Latest model, new, boxed and guaranteed. Includes 57 quality-games and new BBC-books. Best offer of around £400 secures sale. Tel: 01-7203353 Now! London-area. An unrepeatable offer.

● COMPLETE COMPUTER/word processor system. Video Genie 48k. Lower case, sound, Aculab floppy tape unit, green screen monitor, Seikosha printer, plus software: Scripsit, Xbas, Jumbo, £400, might split. Tel: Wolverhampton 341333.

● BBC MICRO MODEL B (32k). Includes all leads, manuals and welcome tape, £200 ono. Also cassette unit for BBC, £10 ono. Tel: Bradford (0274) 43973 (after 6pm, ask for Jonathan).

● APPLE IIe. 2 disk drives, controller, 80 col, monitor III, stand, boxes, disks, manuals and other books. All for £1,000. Tel: (0244) 43665 (eve).

● TRS-80 Model 1 Level II, 48k. With expansion interface, RS232, VDU, ICL termi-printer, 100k disk drive, cassette recorder and software manuals etc, £449 ono. Willing to separate. Tel: (04626) 4184.

● WANTED FOR CBM 8032, spreadsheet, word processor programs. No games. McCann, 28 Maxwellton Street. Tel: Paisley 041-6371718.

● VIDEO GENIE, floppy disk interface wanted. Also disk drives. Must be in good condition. Tel: Leicester (0533) 825517.

● NASCOM 2, with 4Mhz 48k RAM B board, cased with power supply. Nas-Sys m assembler, disassembler, full documentation, club magazines and books. Excellent condition, £180 ono. Tel: Leigh (0942) 677244.

● SHARP 48k MZ80A. Computer incl. printer interface, many Basics, Pascal, Forth, many books and user club notes. All for £395. Tel: (021)-7049201.

● ENGINEER WANTS APPLE IIe, minimum 64k, 2 × FDM, VDU, printer. Unused swap items. Villiers Honda Robin Petrol engines, £600. Radio spares, components, £1,500. Hydraulics kits, Westwood tractor. Tel: 074-981 2392 (eves, for list).

● TRS-80 Mark 1, Level 2. 48k expansion interface, 2 disc drives, monitor and software. Fully operational at £400 ono. Must sell quickly. Tel: Stan on Batley 478469. Will split if needed.

● TANDY MODEL 100, 32k RAM, CGP115 printer, stats package books, manuals, etc, £650. Torch Z80 card, software, manuals, etc, £225. Target Plannercalc for Torch, £40. Tel: 0204 694265 (Bolton).

● TRS-80. 48k expansion interface, monitor, 3 double density disk drives and software. Will split. £350 ono for quick sale. Tel: 01-9977578.

● OSBORNE. DD/80 col, Wordstar, Mailmerge, Disk-Doctor, Supercalc, Supersort, Cardbox, Datastar, Milestone Mail/List, Footnote Typing—Tutor, £950. Home use under warranty. Tel: Rayner on 01-6723728.

● MOUNTAIN COMPUTER MUSIC SYSTEM for Apple II. Perfect condition, original packing, £135. Also Z80 card with CP/M, Cobol, Fortran, and Pilot compilers with manuals, £170. Tel: 01-527 2350 ext 52/54 (Mr Bhatti, office hours).

● TANDY DMP100 matrix printer. Boxed, as new with cable and box of paper, £145. Videx 80 col card for Apple II. As new and boxed, £80. Tel: 01-5272350 ext 52/54 (Mr Bhatti, office hours).

● HP-41C with Maths Pac, £80 ono. Tel: 0892 44607.

● NEWBRAIN AD. Manuals, demo tapes, and software, £170. Sanyo green monitor 12in, £75 or £220 the lot. Delivery negotiable. Tel: Fischer on Worcs (0905) 620098.

● TRS-80 I L-232k, + 15A teleprinter + interface + monitor + tape recorder + over £1,000 software. Over 215 programs, many games, utilities:—Edtasm, Scripsit, Invaders etc + books, manuals. Complete system, £550 ono. Tel: Birmingham (021) 7482405. Wascem.

● SHARP MZ80B, 64k, Twin disk drive, P6 matrix printer. Also software, Word-Star, Calcstar, CP/M 2.2, and FDOS, £910. Tel: Corsham 714589 (Wiltshire), 24-hour answer machine.

● SWEET P PLOTTER, Apple business graphics, almost new, £400. Microsoft softcard manuals never used, £180. Accelerator card for II Plus, £150. Last one Apple II, £70. Tel: 0277 228885 (eves).

● TRS80 LEVEL 2 16k, 32k expansion interface, CTR80, CGP115 colour graphic printer, utility ROMS, £200. TRS80/VG software from £1.50. Tel: A. Young on 01-669 5830 (after 6pm).

● APPLE II SOFTWARE. Less than half price! Over 60 games, utilities, word processors, assemblers, books, etc. Digitek 16k ramcard, £40. All with original documentation. Tel: Guildford (0483) 69975 (after 6pm).

● ATARI 822. 40COPS thermal printer. Nearly new, all leads, paper and manuals. Tel: (0702) 365150 (days) or (0702) 610325 (eves).

● NEWBRAIN AD. 32k, with psu and tape recorder, £150. Tel: Kegworth 3465.

● NEWBRAIN A. 32k, including psu, manual and leads, £140 ono. Tel: 01-5503166 (after 10.30pm or weekends).

● OSBORNE I. Double density 80 cols, CP/M, CBasic, M Basic, Wordstar, Mailmerge, Supercalc, plus blank discs, £800 ono, still under warranty. Tel: Uxbridge 38230 ext 2298 (day) or 38543 (eves). Mark, Flat 59.

● TANDY DMP100 dot matrix printer. Ideal for home computer, £160. TRS-80 model 1 series 1 editor assembler, £15. Richard Partington, 184 Kitchen Lane, Ashmore Park, Wednesfield WV11 2HZ. Tel: (0902) 739509 (after 6pm).

● SHARP MZ80B, Twin disks, software includes CP/M, Wordstar, Calcstar, Datastar, CBasic. Also Centronics printer interface, £1,000 (inc. VAT) ono. Tel: (021) 233 3988 or (021) 351 4137.

● 80 BVS/NASBVS compatible video card GM812 IVC and also GM811 CPV card. Both as new, will separate, £180 ono. Tel: Potters Bar (0707) 42065 (after 7pm).

● COMMODORE 700 256k, full keyboard, full screen. As new, cost £1,195, updated to latest spec, £500. Part exchange considered. Tel: 0564 824128.

● NEWBRAIN MODEL A. 32k, includes power supply, leads, manual, padded cover etc. Hardly used. Quick sale, £180 ono. Tel: 01-9414687 or (0202) 709344.

● SANYO MBC555. Twin 160k drives, high resolution colour monitor, Brother HR15 daisywheel printer, Wordstar, Mailmerge, Spellstar, Calcstar, Infostar, Basic. New with ten months guarantee and full documentation, £1,850. Tel: (0264) 54696.

● APPLE VISICALC. As new (with manual), £80. 16k RAM/language card, £30, (or will sell together for £100). Also Visicalc applications book, £5. Tel: Milton Keynes (0908) 317435.

● TRS-80 MODEL 1 Level 2, 16k. With monitor, UHF mod, cassette leads, software and manuals, £175 ono. Tel: Fullwood Codsall 4543.

● TANDY TRS-80 Model-1. Enthusiast apprehensively changing to QL. Offers, ultra reliable Tandy hardware, programs, books, disks, accessories etc. Too much to list here. Tel: Amersham (02403) 3829 (eves, for details).

● NASCOM 2 48k. Cased, Nas-Dis, Nas-Pen, Zeap, Nas-Debug, Sargon, Chess, Nas-Sys3. All in ROM. Full documentation, all manuals, magazines, for quick sale, £150. Tel: Colchester 841293.

● WANTED. Casio FX602 programmable calculator. Must be good condition. All prices considered. Tel: Dunstable 603907.

● APRICOT original monitor. Hardly used, as new, only £125. Delivered free, save £70, have spare monitor. For home use. Tel: Leyland (07744) 23221 (after 7.30pm) or Chorley 78531 (during day).

● JUPITER, Forth computer, interfaced inside monitor with multirail power supply, ASC11 interface with non-working matching keyboard. All circuits supplied, plus more. Reasonable offer. Tel: (03752) 5934 Tilbury, Essex (after 6pm).

● LOTUS 123 software package for IBM-PC, £275. Tel: 01-9946365.

● BBC 32k 'A'. Runs all software. Partly upgraded, excellent condition, hardly used. Includes all leads, some software, games, educational, etc. O.S1.2 several manuals, word processor, cassette lead, only £299. Tel: 01-4401635.

● SHARP MZ80K. Built in monitor, cassette player, languages, games, utilities, books, mags, etc. Or swap for Atari 800. Details, tel: Tamworth (0827) 872554.

● BBC MODEL B. Boxed with manual, light pen, joysticks, 15 programs including Hunchback, Philosophers, Quest, 3D Bomb Alley, Flight Simulator. All original. Will sell for £440. Tel: 01-868 8536 (eves and weekends).

● OSBORNE 1. Excellent condition, CP/M, Wordstar, Mailmerge, Supercalc, MBasic & CBasic, TV adaptor, 10 diskettes, comprehensive manual, £750. Tel: Upminster (04022) 23886.

● WANTED. Any Apple computer. Must be less than £200. Also disk drive. Please contant Babls after 5pm to 9pm. Tel: 01-4558854.

● BUSINESS SYSTEM super Apple. Basis 108 dual processors 128k, twin Apple drives, monitor, Mannesman Tally MT180L printer, plus £1,500 worth software. Rolls-Royce quality machine. Tel: Chandra on 01-3486401 or 01-739 8856.

● LYNX 48k. For sale, still in box. Hardly used, all leads/manuals included. Bargain price, £145. Write to: Ian Paton, 39 Yates Street, Dingle, Liverpool L8 6RD.

● VIDEO GENIE, 16k. With inbuilt cassette recorder. Perfect condition, some softwear and books, £100. Contact Piers Shepperson, 264 Lee High Road, London SE13 5PL. Tel: 01-8524183.

● IBM PC Business Spec, brand new, unused, unwanted, award with FX80 printer. will sell at good discount to list price. References supplied. Call Mike on 01-483 0369.

● Teletype 43 printer. No reasonable offer refused. Tel: Medway (0634) 54553.

● Sharp MZ80K (48k)+Apollo w.p. +Easidata+toolkit+Zen assembler. All manuals and instructions £240. Garner, 90 Sunny Bank Road, Bury. Tel: 061 766 8971.

● Apple compatible ITT 2020, 48k, disk drive, Hitachi monitor, RS232 serial interface, loads of software including Visicalc, Visidex, Visiplot, Visitrend, £350, will split. Texas Omni 800 printer, offers invited. Tel: 021 351 7129.

● HP-16C 'computer scientist' calculator. Programmable, hex binary decimal octal calculations. As new, manual £45 ono. Trutwein, Tel: Bracknell 483244 ext 120 10.30am-5.00pm. Mondays-Thursdays inclusive. 10.30am-2.00pm Fridays.

● Newbrain A TRS-80, cassette recorder, manuals leads and software, including word processor and database, £150. Tel: 061 980 6675.

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photo-copy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to Personal Computer World. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send form to: Transaction File PCW, 62 Oxford Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

ACC NEWS

Your caring, sharing Co-op is interested in more than your custom: it also offers advice on computer clubs. Rupert Steele keeps you up to date on club news.

Mr Keith Goldie-Morrison has written to explain the aim of FIG — the UK Forth Interest Group. A slightly unusual national user group in that it is aimed at a language, rather than a machine, it reminds me of the 'bad' old days of mainframes and minis with machine independence, where you could (in theory) take a program written for one machine and run it unchanged on another. With micros this is largely impossible (particularly with the cheap home machines). The group promotes its own implementation of the language 'not so much a language as a complete tool kit for managing a computer'.

FIG Forth documentation, listings and club magazine are available to members for £7 in addition to the £7pa membership fee. For more details, write to Keith (enclosing an sae) at Bradden Old Rectory, Towcester, Northants, NN12 8ED.

The Co-operative Society is running a number of computer clubs throughout the country. ROYCOM in Woolwich, London is run by John Mileham. The club also has contacts with Computer-Town UK!. Write to ROYCOM, Education Dept, RACS, Ltd, 147 Powis Street, Woolwich, London, SE18 6JN.

Many thanks to Richard Lown, secretary of the Colchester Sinclair User Group, for sending me a copy of his club's first newsletter. It includes two reviews, one of software (Psion's 'Scrabble') and one of hardware ('The Contact Lens' — a lens claimed to improve the visibility of the ZX81 keyboard). It also contains some local news, including the address of a new computer shop, and some 'diary dates' for computer club members. Since the club holds meetings as well, it looks most interesting. Contact Colchester Sinclair User Group, c/o 102 Prettygate Road, Colchester on Colchester 561066.

Attention NewBrain users! There is a competition in NewBrain User Groups (you may recall I mentioned INgroup some months ago). Now we have NewBrain Users Group, GFG Microsystems, 36 Armitage Way, Cambridge CB4 2UE. Try them both and choose. Also of interest may be the Dutch NewBrain User Group, which has sent me a detailed letter in which it asks if anybody is running an amateur user group. The group is also collecting names of people who would like to join a *really independent* NewBrain User Group. Anyone interested should send £1 to cover costs, with their name, address, phone number, main areas of interest, languages used, and so on. Any surplus money will be donated to the first *really independent* NewBrain User Group with over 200 members. Write to Rob van Albada, secretary, NewBrain Gebruikersgroep, Talmasstraat 20, 1073 JX Amsterdam, Netherlands, for the information.

Mr Norman Wright writes to tell me of the ROMney Marsh Computer Club. This was set up as a result of a Further Education course on computer programming; in which the participants got together and decided to carry on as a computer club. Contact Norman on (0679) 62603 or write to him at 73 Queens Road, Littlestone, Kent.

And a change of address. The new secretary for the Queen's Crescent Computer Club is Roberto Campana of 1d Lady Somerset Road, London, NW5. You can also contact the club through Joan Walton at the Queen's Crescent Library, London NW5 or call (working hours) (01) 485 4551/1312.

Most new clubs are affiliating to the Association, in order to take advantage of the public liability insurance scheme (under which all affiliated clubs get *free* public liability insurance cover to the tune of half a million pounds per incident — write to me for written details). We hope soon to be announcing a scheme for covering computer equipment belonging to clubs, or members' equipment at, or in transit to, meetings, against accidental damage or loss (including theft). This will be available to affiliated clubs for a small extra fee.

By the time this is printed, the scheme should be operational, so why not drop us a line to find out the details?

Remember that the Association belongs to its member clubs: it's up to you to state in what direction you would like the Association to move. The Association aims to build up a large and committed membership of local computer clubs to take an interest in what is going on in the ACC, and in improving the services available to affiliated clubs. I see a growing number of small national user groups for the less popular or discontinued machines, or those whose manufacturers have gone bankrupt.

I think it unlikely that any further large national user groups will be formed: the mass market machines have sufficient users that they can support a fully commercial dedicated magazine. But I do not think we should, as amateur computer users, try to oppose the trend. The most democratic way for people to choose what they want is by their choice of purchase.

Remember, if you would like a mention here, or if you would like information about the ACC and its activities, write to: Rupert Steele, 17 Lawrie Park Crescent, London, SE26 6HH or call (01) 370 0601.

CTUK

Interested in setting up a Computer Town? Why not write for guidelines.

If you're new to computers, and would like some help and support from more experienced hobbyists, then Computer Towns are a good place to start. And if there is no Computer Town near you, why not start one of your own? All you need are a few interested people, a place to meet and a notice to advertise the meetings. A set of guidelines to assist people setting up Computer Towns is available by sending an A4 sae to *PCW*.

COMPUTER TOWN UK! CONTACTS

Chris Woodford
31 Hopley Road
Anslow
Burton-on-Trent
Staffordshire

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

Peter J Kiff
2 Ranelagh Grove
St Peter's in Thanet
Broadstairs
Kent CT10 2TE

John Byfield
Moonrakers
The Rutts
Bushey Heath
Herts WD2 1LH

Peter Earthy
46 High Street
Church Stretton
Shropshire SY6 6BX

Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 0RT

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

JO Dale
12 Poplar Road
Newtown
Powys SY16 2QS

Ray Skinner
22 Colsterdale Close
High Grange
Billingham
Cleveland

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Peter Herring
Ordnance Road Library
Ordnance Road
Enfield
Middx

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear NE8 1TL

B J Candy
9 Oakwood Drive
Gloucester Gl3 3JF

Mike Sones
Gayton Library
Gayton Road
Harrow
Middx

John Barton
Ashford Main Library
Church Road
Ashford
Kent

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

Robin Bradbeer
Polytechnic of
North London
Holloway Road
London N7

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

John Mileham
RACS
147 Powis Street
London SE18 6JN

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

J G Batch
Central Library
Clapham Road
Lowestoft NR32 1DR

Brian Taylor
22 Millbrook
Leybourne
Nr Maidstone
Kent ME19 5QJ

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne

E N Ryan
15 Queens Square
Eastwood
Nottingham NG16 3BJ

Derek Knight or
Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Patrick Colley
52 Queensway
Caversham Park
Village
Reading
Berks RG4 0SI

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Chris Cooper
110 Church Road
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J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle
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Philip Joy
130 Rush Green Road
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R Shipton
17 Woodlands Avenue
Eastcote
Ruislip
Middx

Paul Maddison
Gardenways
Chilworth
Southampton SO1 7JH

Roger Shears
181 Woodmill Lane
Bitterne Park
Southampton SO2 4PY

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Mike Perry, Steve
Collas or Dave Lee
The Library
Ealing Road
Wembley
Middx HA0 4BR

Alan Potten
14 Foxmede
Rivenhall End
Witham
Essex

Alan Sutcliffe
4 Binfield Road
Wokingham
Berks RG11 1SL

Peter Stone or
P Strangman
Computing and Maths
Dept
The Polytechnic
Wulfruna Street
WV1 1LY

Tony Cartmell
54 Foregate Street
Worcester WR1 1DX

Martin Haugh
Hayes Library
Golden Crescent
Hayes
Middx

R L Saunders
14 St Nicholas Mount
Hemel Hempstead
Herts

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

WRITING FOR PCW

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

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

We accept articles on ACT Sirius 1 (CP/M-86 or MS-DOS) single-sided. In an emergency we can accept stuff over the phone by modem using BSTAM at 300 baud but as we can only do this during office hours (10am to 6pm) it's not exactly a cheap way of getting your article to us! We can also accept material by Telecom Gold. Please note that if you want to send your article in this way, it should be as an ASCII file rather than as a 'work file' for any one type of word processor — that is, use your word processor to print the text to disk instead of to paper.

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

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

Once you've sent off your article or proposal, please don't hassle us for a decision. We receive far more submissions than we can ever use and it takes us a while to sort through them, acknowledge receipt and give an opinion one way or the other.

Please be sure to tell us if you've sent the article to another magazine — it would be very awkward indeed if the same article were to appear simultaneously in two publications! Frankly, we're more likely to accept something which has been offered exclusively to us.

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

BENCHMARKS

A listing of the Benchmarks used when evaluating micros is given below. An explanation can be found in the December '83 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130

160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 220
170 FOR L=1 TO 5
180 NEXT L
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190NEXT L
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)


170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Manchester	(University) Electron & BBC Micro User Show. Contact: Database Publications, (061) 456 8383	31 Aug-2 Sept
London	(Royal Horticultural Hall) Board Computer & Role-Playing Adventure Games Exbn. Contact: Games Workshop Ltd, (01) 965 3713	2-4 Sept
London	(Olympia) Video Software & Computer Games Show. Contact: Link House Magazines, (01) 686 2599	2-4 Sept
London	(Olympia 2) IBM System User Show. Contact: EMAP, (01) 837 3699	3-5 Sept
Glasgow	(Anderston Centre) Computer & Software Exbn. Contact: Trade Exbns Scotland, (0764) 4204	11-13 Sept
Manchester	(Belle Vue) Information & Technology & Office Automation Exbn. Contact: BED Exbns Ltd, (01) 647 1001	18-20 Sept
London	(Olympia 2) Personal Computer World Show. Contact: Montbuild Ltd, (01) 486 1951	19-23 Sept
Brighton	(Brighton Centre) Computers In Communications & Control Exbn. Contact: Institute of Electrical Engineers, (01) 240 1871	26-28 Sept

PROGRAM FILE

The search is on for a new programs editor and until such a person is installed, I (Tony Hetherington) am in control. Consequently there may be some disruption in processing and acknowledging program submissions so please bear with us.

To help us deal with incoming programs, PCW would appreciate adherence to the following guidelines. Programs should be submitted on cassette or disk and be accompanied by full documentation and a readable listing. Listings should not be more than 80 columns wide. As a matter of policy we will not be printing listings on Sinclair paper as reproduction is not good enough. However do please still include a listing as it's an easy guide to the length of the program. Any Spectrum programs selected for publishing will be reprinted in the office. Commodore 64 owners should use the 'Brackets' program printed in the June issue to make undecipherable control codes understandable.

Programs should, of course, be original and not like one we received recently — a beautiful copy of a program printed in a book; the only difference being the name in the copyright statement.

This month we've a wide selection of programs for a variety of machines. Program of the Month is the excellent SP-Easel by John Palmer, inspired by the Easel program supplied with the QL. Knowing Sinclair owners, it would be no surprise if John has started a fashion of emulating the QL's facilities on the Spectrum.

Another serious application is an equation-solving database for the BBC, but on the lighter side there's a scramble variant for the BBC called Astrorun and an original game called Honeypot for the Commodore 64.

Finally, a selection of useful utilities include a disk-based menu selector for Atari owners and a machine code assembler for the VIC 20, Commodore 64 and PET, which has been written in Basic.

Games

Scientific/mathematic

Business

Toolkit/utilities

Educational/Computer Aided Learning

Program of the month
Spectrum SP-Easel
by John Palmer

'SP-Easel' is a business graphics program inspired by the QL program of the same name. It allows the user to enter up to three sets of data with up to 12 items in each, and represent that data by bar graph, line graph or pie chart.

The bar and line graphs allow you to graph the sets of data individually or in any combination. With the bar graph, the third data number entered is drawn by a line due to the Spectrum's limiting display. Depending on how the data overlaps, the best results may be obtained by entering the data in a different order. The pie chart gives you the option to have a segment highlighted by pulling that slice away from the pie (see diagrams with listing).

All input is formatted on the screen as it's typed; the DELETE key is operational on all input and CAPS LOCK on the General Format option. A yellow background on input ensures that the user does not lose track of what he's inputting, and ENTER should be pressed when an item has been typed. The General Format year option allows the data to be labelled by months and asks for the starting month number: that is, '1' gives January to December.

The listing contains some short machine code routines in lines 8000 to 8195. The first of these draws the bars on the bar graph, as this would take far too long in Basic. The second draws the lines and is a virtual copy of the ROM routine, except that it allows a step to be added so that dotted lines can be drawn. The final routine shifts the numbers on the x axis right four pixels so that they line up neatly with the graph.

The remaining code makes up the January to December labels as there is insufficient room on the screen for normal characters to be used. The listing contains a checksum to detect errors in the machine code entries, but readers are advised to save the program before running to avoid a program crash.

When the program runs successfully, the waiting while the machine code is POKEd in can be avoided by changing line 10 to LOAD" "CODE, deleting lines 8000 to 8195 and then saving the program with:
SAVE "SP-EASEL" LINE 10: SAVE "Easel MC" CODE 60000, 460.

Note: The two dashes and dot at the end of line 50 are user-defined graphics and are created by substituting graphics A B C in that order.

```
  10 GO SUB 8000
  20 LET n=0: LET month=0
  30 LET t$="Title": LET s$="": LET x$="x axis": LET y$="y axis"
  40 POKE 23658,0: FOR f=USR "a" TO USR "c"+7: POKE f,0: NEXT f
  50 POKE USR "a"+4,255: POKE USR "b"+4,204: POKE USR "c"+4,240: LET k$="——-"
  60 DIM m$(2,24): LET m$(1)="1 2 3 4 5 6 7 8 9 101112"
  70 LET m$(2)="abcdefgheijkjlmnopqrstuv"
  80 DIM b$(7,32): LET b$(2)="Enter name of data (max 7 chars)": LET b$(3)="Ente
r data or press 'E' to exit ": LET b$(4)="    Enter required number(s)"
  90 LET b$(5)="              Enter number": LET b$(6)="          Enter new data": LE
T b$(7)="COMMANDS:M=Menu:P=Print:R=Repeat"
 100 LET z$=b$(1): PAPER 0: INK 7: BORDER 0
 110 LET n$=m$(1): GO TO 1000
 500 REM ************************
 501 REM menu
 502 REM ************************
 510 CLS : PRINT TAB 11; PAPER 6; INK 0;" SP-EASEL "
 520 PRINT AT 4,4;"1) Initial input of data";AT 6,4;"2) Add/Amend/Display data";
AT 8,4;"3) General format";AT 10,4;"4) Bar graph";AT 12,4;"5) Line graph";AT 14,
4;"6) Pie chart"
 530 PRINT )1;AT 1,0; PAPER 2;"           ENTER OPTION
 540 IF INKEY$="1" THEN  GO TO 1000
 550 IF INKEY$="2" THEN  GO TO 2000
 560 IF INKEY$="3" THEN  GO TO 3000
 570 IF INKEY$="4" THEN  GO TO 4000
 580 IF INKEY$="5" THEN  GO TO 5000
 590 IF INKEY$="6" THEN  GO TO 6000
 600 GO TO 540
1000 REM ************************
1001 REM initial input
1002 REM ************************
1010 CLS : IF n=0 THEN  GO TO 1050
1020 PRINT AT 12,12; FLASH 1;"WARNING": PRINT '" Existing data will be lost by
 entering this option.          Do you wish to continue? (y/n)"
1030 IF INKEY$="n" THEN  GO TO 500
1040 IF INKEY$<>"y" THEN  GO TO 1030
1050 DIM a$(3,7): DIM d(12,3): DIM l(3): LET g=0: DIM e(3)
1060 CLS : PRINT TAB 10; PAPER 6; INK 0;"INPUT OF DATA"
1070 FOR f=1 TO 12: PRINT AT 6+f,0;f;")": NEXT f
1080 LET g=g+1: GO SUB 9000
1090 IF g=3 THEN  GO TO 1130
1100 PRINT )1;AT 0,0; PAPER 2;"  Do you wish to enter anymore           data? (y
/n)    "
1110 PAUSE 0: IF INKEY$="y" THEN  GO TO 1080
1120 IF INKEY$<>"n" THEN  GO TO 1110
1130 PRINT )1;AT 0,0;z$; PAPER 2;"     PRESS ANY KEY FOR MENU     "
1140 LET n=g: PAUSE 0: GO TO 500
2000 REM ************************
2001 REM display/amend
2002 REM ************************
2010 CLS : PRINT TAB 5; PAPER 6; INK 0;"DISPLAY/AMEND/ADD DATA"
2020 PRINT AT 2,16-LEN t$/2;t$
2030 FOR f=1 TO 12: PRINT AT 6+f,0;f;")": NEXT f
2040 FOR g=1 TO n: PRINT AT 4,g*8+5;g;")";AT 5,g*8+7-l(g);a$(g): FOR f=1 TO e(g)
: LET a=LEN STR$ d(f,g)
2050 PRINT AT 6+f,g*8+7-a;d(f,g): NEXT f: NEXT g
2060 PRINT )1;AT 0,0; PAPER 2;"COMMANDS:  M=Menu   D=Amend DataA=Add data P=Prin
t  N=Amend Name"
2070 PAUSE 0: LET i$=INKEY$
2080 IF i$="m" THEN  GO TO 500
2090 IF i$="d" THEN  GO TO 2200
2100 IF i$="a" THEN  GO TO 2300
2110 IF i$="p" THEN  COPY
2120 IF i$="n" THEN  GO TO 2400
2130 GO TO 2070
2200 PRINT )1;AT 0,0;z$;z$: IF n=1 THEN  LET g=1: LET a=16: GO TO 2230
2210 PRINT AT 20,0;"column number "
2220 GO SUB 9840: LET g=VAL d$: LET a=0
2230 PRINT AT 20,16-a;"Row number ": LET c$=b$(5)
2240 LET col=29-a: GO SUB 9850: LET f=VAL d$: IF f<1 OR f>12 THEN  GO SUB 9990:
GO TO 2240
2260 PRINT AT 20,0;z$
2270 GO SUB 9820: LET d(f,g)=VAL d$
2296 IF f>e(g) THEN  LET e(g)=f
2297 GO TO 2060
2300 IF n<3 THEN  LET n=n+1: LET g=n: GO TO 2350
2310 PRINT AT 20,0;"Column number ": GO SUB 9840: LET g=VAL d$: PRINT AT 20,0;z$
2320 PRINT )1;AT 0,0; PAPER 2;" Data '";g;"' will be overwritten.   Do you wish
to continue? (y/n) "
2330 IF INKEY$="n" THEN  GO TO 2060
2340 IF INKEY$<>"y" THEN  GO TO 2330
2350 FOR f=1 TO 12: LET d(f,g)=0: PRINT AT f+6,g*8;z$( TO 7): NEXT f: GO SUB 900
0: GO TO 2060
2400 PRINT )1;AT 0,0;z$;z$
2410 IF n=1 THEN  LET g=1: GO TO 2440
2420 PRINT AT 20,0;"column number "
2430 GO SUB 9840: LET g=VAL d$: PRINT AT 20,0;z$
2450 GO SUB 9830: LET a$(g)=d$: LET l(g)=LEN d$: GO TO 2060
3000 REM ************************
3001 REM format
3002 REM ************************
3010 CLS : PRINT TAB 9; PAPER 6; INK 0;"GENERAL FORMAT"
3020 PRINT  INK 4;AT 2,0;"1) Main title:": PRINT 't$
3030 PRINT  INK 4;AT 6,0;"2) Sub-title:": PRINT 's$
3040 PRINT  INK 4;AT 10,0;"3) Label for x axis:": PRINT 'x$
```

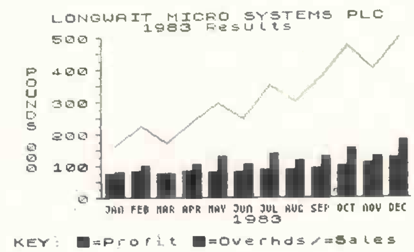
PROGRAM FILE

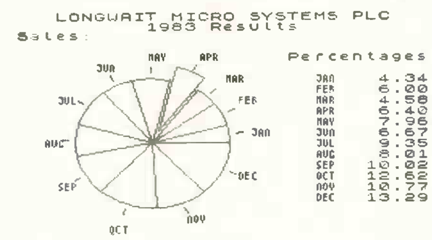
```
3050 PRINT  INK 4;AT 14,0;"4) Label for y axis:": PRINT 'y$
3060 PRINT  INK 4;AT 18,0;"5) Year option: ";
3070 IF month<>0 THEN  PRINT "Yes"
3080 IF month=0 THEN  PRINT "No"
3090 PRINT  INK 4;AT 20,3;"Start month: ";: PRINT month
3100 PRINT )1; PAPER 2;AT 0,0;" Press number and enter details      'M' to retur
n to Menu       "
3110 PAUSE 0: POKE 23658,0
3120 IF INKEY$="1" THEN  LET f=4: LET g=31: GO SUB 3300: LET t$=d$
3130 IF INKEY$="2" THEN  LET f=8: LET g=31: GO SUB 3300: LET s$=d$
3140 IF INKEY$="3" THEN  LET f=12: LET g=24: GO SUB 3300: LET x$=d$
3150 IF INKEY$="4" THEN  LET f=16: LET g=14: GO SUB 3300: LET y$=d$
3160 IF INKEY$="5" THEN  GO SUB 3200
3170 IF INKEY$="m" THEN  GO TO 500
3180 GO TO 3100
3200 PRINT )1;AT 0,0;z$; PAPER 2;"  Year option required? (y/n)   "
3210 POKE 23658,0: PAUSE 0: IF INKEY$="n" THEN  LET month=0: LET n$=m$(1): PRINT
 AT 18,16;"No ";AT 20,16;"0 ": RETURN
3220 IF INKEY$<>"y" THEN  GO TO 3200
3230 PRINT AT 18,16;"Yes"
3240 LET c$="  Enter starting month number   ": LET col=18: GO SUB 9850: LET mon
th=VAL d$: IF month<1 OR month>12 THEN  GO SUB 9990: GO TO 3240
3250 LET n$=m$(2,(month-1)*2+1 TO )+m$(2, TO (month-1)*2)
3260 RETURN
3300 PRINT )1;AT 0,0;z$;z$
3310 PRINT  PAPER 6;AT f,0;z$( TO g): LET d$=""
3320 PRINT AT f,LEN d$; PAPER 2; FLASH 1;CHR$ (76-(9 AND PEEK 23658=8)): PAUSE 0
: LET i$=INKEY$: LET i=CODE i$
3330 IF i=6 THEN  POKE 23658,ABS (PEEK 23658-8): GO TO 3320
3340 IF i=13 THEN  GO TO 3400
3350 IF i=12 AND d$<>"" THEN  PRINT AT f,LEN d$; PAPER 6;" ": LET d$=d$( TO LEN
d$-1): GO TO 3390
3360 IF LEN d$=g THEN  GO TO 3320
3370 IF i<31 OR i>127 THEN  GO SUB 9990: GO TO 3320
3380 LET d$=d$+i$
3390 PRINT AT f,0; PAPER 6; INK 0;d$: GO TO 3320
3400 PRINT AT f,LEN d$;" ";AT f,0; OVER 1; PAPER 0; INK 7;z$( TO g+1)
3410 RETURN
4000 REM ***********************
4001 REM bar graph
4002 REM ***********************
4010 IF n=1 THEN  LET d$="1": GO TO 4060
4020 CLS : PRINT TAB 11; PAPER 6; INK 0;"BAR GRAPH"
4030 PRINT AT 5,0;"Which data?"
4040 FOR f=1 TO n: PRINT AT 6+f,2;f;") ";a$(f): NEXT f
4050 PRINT AT 18,0;"Data to be graphed": GO SUB 9860
4060 GO SUB 9100
4070 LET f=VAL d$(1): IF LEN d$=1 THEN  LET g=f: GO SUB 9200: GO TO 4090
4080 LET g=VAL d$(2): GO SUB 9200: GO SUB 9500: LET f=g
4090 GO SUB 9500: RANDOMIZE USR 60000: IF LEN d$<>3 THEN  GO TO 4120
4100 LET g=VAL d$(3): FOR f=1 TO e(g)-1: PLOT  INK 8;48+f*16,36+py+d(f,g)*sc: DR
AW  INK 8; OVER 1;16,(d(f+1,g)-d(f,g))*sc: NEXT f
4110 PRINT  PAPER 1;"/=";a$(g)
4120 PRINT )1; PAPER 2;AT 1,0;b$(7)
4130 IF INKEY$="m" THEN  GO TO 500
4140 IF INKEY$="p" THEN  COPY
4150 IF INKEY$="r" THEN  GO TO 4000
4160 GO TO 4130
5000 REM ***********************
5001 REM line graph
5002 REM ***********************
5010 IF n=1 THEN  LET d$="1": GO TO 5060
5020 CLS : PRINT TAB 11; PAPER 6; INK 0;"LINE GRAPH"
5030 PRINT AT 5,0;"Which data?"
5040 FOR f=1 TO n: PRINT AT 6+f,2;f;") ";a$(f): NEXT f
5050 PRINT AT 18,0;"Data to be graphed": GO SUB 9860
5060 GO SUB 9100: GO SUB 9300
5070 FOR a=1 TO LEN d$: LET g=VAL d$(a): GO SUB 9600: NEXT a
5080 PRINT )1; PAPER 2;AT 1,0;b$(7)
5090 IF INKEY$="m" THEN  GO TO 500
5100 IF INKEY$="p" THEN  COPY
5110 IF INKEY$="r" THEN  GO TO 5000
5120 GO TO 5090
6000 REM ***********************
6001 REM pie chart
6002 REM ***********************
6010 IF n=1 THEN  LET g=n: GO TO 6060
6020 CLS : PRINT TAB 11; PAPER 6; INK 0;"PIE CHART"
6030 PRINT AT 5,0;"Which data?"
6040 FOR f=1 TO n: PRINT AT 6+f,2;f;") ";a$(f): NEXT f
6050 PRINT AT 20,0;"Chart of data": GO SUB 9840: LET g=VAL d$
6060 IF e(g)=1 THEN  LET h=0: GO TO 6110
6070 PRINT )1;AT 0,0; PAPER 2;"  Do you want a segment of the       pie highligh
ted? (y/n)     "
6080 PAUSE 0: IF INKEY$="n" THEN  LET h=0: GO TO 6110
6090 IF INKEY$<>"y" THEN  GO TO 6080
6100 PRINT AT 20,0;"Segment number ": LET c$=" Enter number to be highlighted ":
 LET col=17: GO SUB 9850: LET h=VAL d$: IF h<1 OR h>e(g) THEN  GO SUB 9990: GO T
O 6100
6110 LET t=0: LET a=0: LET c=100: LET r=0: FOR f=1 TO e(g): LET t=t+ABS d(f,g):
NEXT f
6120 CLS : PRINT TAB 16-LEN t$/2;t$;AT 1,16-LEN s$/2;s$;AT 2,0;a$(g, TO l(g));":
";AT 4,21;"Percentages"
6130 FOR f=1 TO e(g): PLOT 84,76: LET p=ABS d(f,g)/t: LET r1=r+p*PI: LET r=r+p*2
*PI: DRAW 48*COS r,48*SIN r
6140 IF h=f THEN  PLOT 84+10*COS r1,76+10*SIN r1: DRAW 48*COS r,48*SIN r
6150 LET hi=0: DRAW 48*(COS a-COS r),48*(SIN a-SIN r),-p*2*PI: IF e(g)=1 THEN  C
IRCLE 84,76,48
6160 IF h=f THEN  DRAW -48*COS a,-48*SIN a: LET hi=1
6170 LET p1=INT (p*1e4+.5)/100: LET q$=STR$ (INT (100*(p1-INT p1)+.5)/100)+"0"
6180 LET p$=STR$ INT p1: LET q$=("."+q$ AND q$(1 TO 2)="00")+(q$ AND q$(1)=".")+
(q$(2 TO ) AND q$(1 TO 2)="0.")
6190 PRINT AT 5+f,29-LEN p$;p$+q$( TO 3)
6200 IF p<0.025 AND h<>f THEN  PRINT  INK 4;AT 5+f,22;"*";AT 19,24;"* = not";AT
20,24;"labelled";AT 21,24;"on chart"
6210 IF month<>0 THEN  POKE 23606,116: POKE 23607,232
6220 PRINT AT 5+f,23;n$(f*2-1 TO f*2)
6230 IF p<0.025 AND f<>h THEN  GO TO 6260
6240 PLOT 84+(hi*8+52)*COS r1,76+(hi*8+52)*SIN r1: DRAW 4*COS r1,4*SIN r1
6250 PRINT  OVER 1; INK 4;AT 12-(8+hi)*SIN r1,10+(8+hi)*COS r1;n$(f*2-1 TO f*2)
6260 LET a=r: POKE 23606,0: POKE 23607,60: NEXT f
6270 PRINT )1;AT 1,0; PAPER 2;b$(7)
6280 IF INKEY$="m" THEN  GO TO 500
6290 IF INKEY$="p" THEN  COPY
6300 IF INKEY$="r" THEN  GO TO 6000
6310 GO TO 6280
8000 REM ***********************
8001 REM poke code
8002 REM ***********************
8005 CLS : PRINT "PLEASE WAIT - POKING M. CODE": PRINT
8010 LET c=0: LET m=60000
```

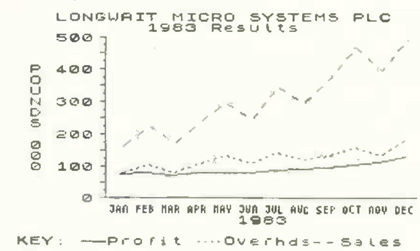
```
8015 FOR l=0 TO 9: READ a$
8020 FOR s=1 TO LEN a$ STEP 2
8025 LET a=CODE a$(s): LET b=CODE a$(s+1)
8030 LET c=c+b+a
8035 IF a>96 THEN  LET a=a-39
8040 IF b>96 THEN  LET b=b-39
8045 LET a=a-48: LET b=b-48
8050 POKE m,a*16+b
8055 LET m=m+1
8060 NEXT s
8065 READ chksum
8070 PRINT l*10+8100: IF c<>chksum THEN  PRINT "Error at line ";l*10+8100: STOP
8075 LET c=0: NEXT l
8080 RETURN
8100 DATA "1126533e3f2148ea01001813d5c5e508af0846f578cb7f2809ed4447083c081418071
5a72003041833ebf1f577e57ce6"
8105 DATA 6132
8110 DATA "18cb2fcb2fcb2fc65867d51146ea7b815f1ad177e108a72029087c3d672fe607200a7
dd6206f38047cc60867f110cce1"
8115 DATA 6564
8120 DATA "23c1cb4028050d3e3f18033efc0cd1109ac9087c3c67e60720e27dc6206f38dc7cd60
86718d6070408d9e5d93ae7ea6f"
8125 DATA 6571
8130 DATA "cb276722e7ea01101711010179b8300669d5af5f18056841d5160060781f853803bc3
807944fd9c1c518044fd5d9c12a"
8135 DATA 6079
8140 DATA "7d5c78844779854fcd34ebd97910dfd1d9e1d9c9ed437d5ccdaa2247043e010f10fd4
7e5f52ae7ea3ae6eaa720017c3d"
8145 DATA 6925
8150 DATA "32e6eabd3806f1e17eb077c9f1e1c92157500609c5e506087e23ed670f0f0f0f2b772
410f3e1c12b2b10e9c9"
8155 DATA 5996
8160 DATA "00390a0a0b2a12000010a8a8a8a8a800003b223b2222230000b028b02828b00000293
a2a2b2a2a000030a8a8b0a8a800"
8165 DATA 5960
8170 DATA "00132a2a3b2a2a000030a8a8302828000028a8a890909000003a0a0a0a2a11000090a
8a8a8a8280000a0a0a0a0a03800"
8175 DATA 5915
8180 DATA "00122a2a3a2a29000090a8a0a0a83800001b2223120a330000b028a83020a00000112
a2a2a2a110000b8101010109000"
8185 DATA 5627
8190 DATA "00112a2a2a2a29000028a8a8a890100000332a2b2a2a3300009820a020209800"
8195 DATA 3786
9000 REM ************************
9001 REM data input
9002 REM ************************
9010 LET f=0: PRINT AT 4,g*8+5;g;")"
9030 GO SUB 9830
9040 LET l(g)=LEN d$: LET a$(g)=d$
9050 GO SUB 9810
9060 IF i=end OR i=end+32 THEN  GO TO 9080
9070 LET f=f+1: LET d(f,g)=VAL d$: IF f<12 THEN  GO TO 9045
9080 LET e(g)=f: RETURN
9100 REM ************************
9101 REM scale
9102 REM ************************
9110 CLS : PRINT AT 10,10;"PLEASE WAIT";AT 12,9;"SCALING DATA"
9120 LET s=0: LET s5=2: LET m=1: LET dl=0: FOR a=1 TO LEN d$: LET g=VAL d$(a): I
F e(g)>dl THEN  LET dl=e(g)
9130 FOR f=1 TO e(g): LET k=0: LET b=ABS d(f,g)
9140 IF b>10 THEN  LET b=b/10: LET k=k+1: GO TO 9140
9150 IF k>s THEN  LET s=k: LET s5=2
9160 IF SGN d(f,g)=-1 THEN  LET m=.5
9170 NEXT f: FOR f=1 TO e(g): LET b=ABS d(f,g)/10^s
9180 IF b>5 THEN  LET s5=1
9190 NEXT f: NEXT a: LET sc=12*m*s5/10^s: RETURN
9200 REM ************************
9201 REM poke bar data
9202 REM ************************
9210 POKE 59974,f*2: POKE 59975,g*2
9220 FOR a=1 TO 12: POKE a*2+59974,d(a,f)*sc: POKE a*2+59975,d(a,g)*sc: NEXT a
9300 REM ************************
9301 REM draw graph
9302 REM ************************
9310 CLS : PRINT TAB 16-LEN t$/2;t$;AT 1,16-LEN s$/2;s$
9320 PLOT 55,36: DRAW 0,120: IF m=1 THEN  PLOT 52,36: LET py=0: POKE 60001,38: P
OKE 60002,83
9330 IF m=.5 THEN  PLOT 52,97: LET py=61: POKE 60001,38: POKE 60002,78
9340 DRAW 195,0: LET x=36: FOR y=6 TO 114 STEP 12: PLOT 54,x+y: DRAW 1,0
9350 IF m=.5 AND y=54 THEN  LET x=x+1
9360 PLOT 52,x+y+6: DRAW 3,0: NEXT y: PLOT 52,36: DRAW 3,0
9370 LET a=10^s: IF s>2 THEN  LET a=1: PRINT AT 20,0; INK 4;"x";10^s: LET s=0
9380 INK 4: FOR y=0 TO 10 STEP 2: LET x=a*(10-y+2*y*(m-1))/s5: PRINT AT 2+1.5*y,
6-LEN STR$ x;x: NEXT y
9390 IF month<>0 THEN  POKE 23606,116: POKE 23607,232: PRINT AT 18,7;n$( TO dl*2
): POKE 23606,0: POKE 23607,60
9400 IF month=0 THEN  PRINT AT 18,7;n$( TO dl*2): RANDOMIZE USR 60255
9410 PRINT AT 19,19-LEN x$/2;x$
9420 FOR y=1 TO LEN y$: PRINT AT 9-LEN y$/2+y,4-s-1/m;y$(y): NEXT y
9430 INK 7: PRINT AT 21,0; PAPER 1;z$;AT 21,0;"KEY: ";
9440 RETURN
9500 REM ************************
9501 REM key
9502 REM ************************
9510 LET i=f*2
9520 PRINT  PAPER 1; INK i;"■"; INK 7;"=";a$(f);
9530 RETURN
9600 REM ************************
9601 REM draw line
9602 REM ************************
9610 POKE 60135,g*2-2: POKE 60134,0: PLOT 63+g,36+py+d(1,g)*sc
9620 FOR f=1 TO e(g)-1: LET y=d(f+1,g)-d(f,g): POKE 60152,ABS y*sc: POKE 60155,S
GN y
9630 RANDOMIZE USR 60137: NEXT f
9640 PRINT  PAPER 1;k$(g);k$(g);a$(g);
9650 RETURN
9800 REM ************************
9801 REM keyboard input
9802 REM ************************
9810 LET line=f+7: LET col=g*8+7: LET len=7: LET end=69: LET max=57: LET min=45:
 LET excep=47: LET c$=b$(3): GO TO 9880
9820 LET line=f+6: LET col=g*8+7: LET len=7: LET end=256: LET max=57: LET min=45
: LET excep=47: LET c$=b$(6): GO TO 9880
9830 LET line=5: LET col=g*8+7: LET len=7: LET end=256: LET max=127: LET min=31:
 LET excep=0: LET c$=b$(2): GO TO 9880
9840 LET line=20: LET col=15: LET len=1: LET end=256: LET max=CODE STR$ n: LET m
in=49: LET excep=0: LET c$=b$(5): GO TO 9880
9850 LET line=20: LET len=2: LET end=256: LET max=57: LET min=48: LET excep=0: G
O TO 9880
9860 LET line=18: LET col=22: LET len=n: LET end=256: LET max=CODE STR$ n: LET m
in=49: LET excep=0: LET c$=b$(4): GO TO 9880
9880 PRINT AT line,col-len; PAPER 6;z$( TO len): LET d$=""
```

PROGRAM FILE

```
9890 PRINT )1;AT 0,0;z$; PAPER 2;c$
9900 PAUSE 0: LET i$=INKEY$: LET i=CODE i$
9910 IF i=12 AND d$<>"" THEN  PRINT AT line,col-LEN d$; PAPER 6;" ": LET d$=d$(
TO LEN d$-1): GO TO 9970
9920 IF i=13 AND d$<>"" THEN  GO TO 9980
9930 IF LEN d$=len THEN  GO SUB 9990: GO TO 9890
9940 IF i=end OR i=end+32 AND d$="" THEN  GO TO 9980
9950 IF i<min OR i>max OR i=excep THEN  GO SUB 9990: GO TO 9890
9960 LET d$=d$+i$
9970 PRINT AT line,col-LEN d$; PAPER 6; INK 0;d$: GO TO 9900
9980 PRINT  OVER 1;AT line,col-len;z$( TO len): RETURN
9989 REM ***********************
9990: PRINT )1; PAPER 2;AT 0,0;"       **INVALID ENTRY**               PLEASE R
E-ENTER           ": BEEP .3,10: PAUSE 75
9995 PRINT )1;AT 0,0;z$;z$: RETURN
```







Atari Autorun

by Steven Green

This useful disk-based utility produces an autorun menu from which machine code and Basic programs can be loaded, using only the SELECT and START keys.

Program one should be typed in and saved to disk as SAVE"D:MENU".

The second program can then be typed in and RUN. After running this program you should select DOS, option K — Binary Save to Disk. In answer to the prompt SAVE-GIVE FILE, START, END, (INIT, RUN) type AUTORUN.SYS, 0600,0686,0600. This sequence creates an autorun file which will run the menu program each time the drive is booted.

The menu will now load Basic and machine code programs (with the extender .OBJ) without the need to call DOS. The required program is selected using the SELECT key and loaded at a press of the START key.

It's also possible to delete, lock, unlock and rename files from the menu with use of CTRL and D, L, U and R keys respectively. Pressing the 2 key will produce a menu of the contents of drive two, and pressing D will call DOS.

```
PROGRAM 1, MENU
1 REM . S.P.GREEN 6A, WRYTHE LANE,CARS
HALTON,SURREY,SM5 2RN. TEL.737 2001 EX
.57
30000 DIM FA$(17),FB$(28),A$(16),C$(39
):FOR I=1 TO 39:C$(I,I)=" ":NEXT I:FB$
="D1:"
30005 POKE 580,1:CONSOL=53279:NAME=301
60:LINE=30170:KEY=764:V=3:H=0:R=0:K=0
```

```
30010 GRAPHICS 0:POKE 709,32:POKE 710,
40:POKE 712,40:POKE 82,2:POKE 65,0:POK
E KEY,255
30015 ? "}}":POSITION 13,0:? "  DISK
MENU   DRIVE ";FB$(2,2):? :?
30016 REM "}}"=ESC CTRL 2  ESC CTRL CL
EAR
30020 IF FB$(2,2)="1" THEN OPEN #1,6,0
,"D1:*.*"
30022 IF FB$(2,2)="2" THEN OPEN #1,6,0
,"D2:*.*"
30025 TRAP 30060:IF R=40 THEN 30070
30030 INPUT #1,FA$:IF FA$(5,8)="FREE"
THEN POSITION 12,1:? FA$;:POSITION H,V
:GOTO 30060
30033 IF FA$(3,5)="DOS" OR FA$(3,5)="D
UP" OR FA$(3,6)="MENU" OR FA$(3,9)="AU
TORUN" THEN 30025
30035 ? FA$(1,1);:FOR I=3 TO 10:IF FA$
(I,I)<>" " THEN ? FA$(I,I);:NEXT I
30040 IF FA$(11,11)<>" " THEN ? ".";:?
 FA$(11,13);:FOR I=I TO (LEN(FA$)-6):?
 " ";:NEXT I:? FA$(15,17):GOTO 30050
30045 FOR I=I TO LEN(FA$)-2:? " ";:NEX
T I:? FA$(15,17)
30050 R=R+1:IF R>19 THEN POKE 85,22:PO
KE 84,R-17
30055 GOTO 30025
30060 K=1:CLOSE #1:GOTO 30070
30070 TRAP 30180:POKE 752,0:POSITION 1
,23:? "PRESS SELECT OR START  (D=DOS)
     ";
30075 FOR LOOP=0 TO 0 STEP 0:IF V>22 A
ND H=0 THEN H=20:V=3
30080 IF R>19 THEN IF V>=R-17 AND H=20
 THEN V=3:H=0
30085 IF R<=19 THEN IF V>=R+3 THEN V=3
:H=0
30090 POSITION H,V:? " ";:IF PEEK(CONS
OL)=5 THEN V=V+1:FOR I=1 TO 50:NEXT I
30095 IF PEEK(CONSOL)=6 THEN GOSUB NAM
E:GOTO 30140
30100 IF PEEK(CONSOL)=3 AND R=40 THEN
FOR I=2 TO 22:POSITION 0,I:? C$:NEXT I
:R=0:POSITION 2,3:GOTO 30025
30110 IF PEEK(KEY)=186 THEN GOSUB NAME
:A$="Deleating => ":P=8:GOSUB LINE:XIO
 33,#1,0,0,FB$:GOTO 30005
30115 IF PEEK(KEY)=128 THEN GOSUB NAME
:A$="Locking => ":P=8:GOSUB LINE:XIO 3
5,#1,0,0,FB$:GOTO 30005
30120 IF PEEK(KEY)=139 THEN GOSUB NAME
:A$="Unlocking => ":P=8:GOSUB LINE:XIO
 36,#1,0,0,FB$:GOTO 30005
30125 IF PEEK(KEY)=168 THEN GOSUB NAME
:A$="New name for=>":P=0:GOSUB LINE:GO
SUB 30175:XIO 32,#1,0,0,FB$:GOTO 30005
30126 IF PEEK(KEY)=31 THEN FB$="D1:":P
OSITION 34,0:? FB$(2,2):GOTO 30005
30127 IF PEEK(KEY)=30 THEN FB$="D2:":P
OSITION 34,0:? FB$(2,2):GOTO 30005
```

PROGRAM FILE

```
30128 IF PEEK(KEY)=58 THEN POKE KEY,25
5:DOS
30129 POKE KEY,255
30130 NEXT LOOP
30140 IF FB$(4,4)=" " THEN 30005
30145 FOR I=4 TO LEN(FB$):FB$(I,I)=CHR
$(ASC(FB$(I,I))+128):NEXT I
30150 POSITION 0,23:? "Loading ";FB$(4
,LEN(FB$));:FOR I=LEN(FB$) TO 15:? " "
;:NEXT I:? "Please stand by..";:POSITI
ON H,V
30155 FOR I=4 TO LEN(FB$):FB$(I,I)=CHR
$(ASC(FB$(I,I))-128):NEXT I
30156 IF FB$(LEN(FB$)-2,LEN(FB$))="OBJ
" THEN 30200
30157 IF FB$(LEN(FB$)-2,LEN(FB$))="ENT
" THEN ENTER FB$
30158 RUN FB$
30160 FOR H=H+3 TO H+14:LOCATE H,V,X:I
F X<>32 THEN FB$(LEN(FB$)+1)=CHR$(X):N
EXT H
30165 POSITION H,V:PUT #6,X:RETURN
30170 POKE 752,1:POSITION 0,23:? C$;:P
OSITION P,23:? A$;FB$(4,LEN(FB$));:POK
E KEY,255:FOR I=1 TO 500:NEXT I:RETURN

30175 ? "}";:INPUT A$:? "}":FB$(LEN(FB
$)+1)=",":FB$(LEN(FB$)+1)=A$:RETURN
30176 REM "}"=ESC CTRL 2, "}"=ESC CTRL
 CLEAR
30180 POKE 752,1:? "}}":POSITION 17,10
:? "SORRY! ":POSITION 5,12:? "UNABLE T
O FOLLOW INSTRUCTIONS..."
30181 REM "}}"=ESC CTRL CLEAR ESC CTRL
 2
30185 POSITION 2,14:? "PLEASE CHECK  D
RIVES AND/OR FILESPECS   THEN   PRESS
 OPTION  FOR MENU."
30190 IF PEEK(CONSOL)<>3 THEN 30190
30195 RUN
30200 FOR A=1536 TO 1717:READ B:POKE A
,B:NEXT A
30210 DATA 162,16,32,173,6,134,207,104
,104,157,69,3,104,157,68,3,169,4,157,7
4,3,169,3,157,66
30220 DATA 3,32,86,228,16,3,76,166,6,1
69,203,157,68,3,169,0,157,69,3,169,2,1
57,72,3,169
30230 DATA 0,157,73,3,169,7,157,66,3,3
2,86,228,16,6,192,136,240,92,208,96,16
9,255,197,203,208
30240 DATA 4,197,204,240,210,169,205,1
57,68,3,169,0,157,69,3,32,86,228,16,2,
48,69,165,207,240
30250 DATA 14,165,203,141,224,2,165,20
4,141,225,2,169,0,133,207,165,203,157,
68,3,165,204,157,69,3
30260 DATA 165,205,56,229,203,157,72,3
,165,206,229,204,157,73,3,254,72,3,208
,3,254,73,3,32,86
```

```
30270 DATA 228,16,137,192,3,240,133,76
,166,6,32,173,6,108,224,2,152,133,212,
169,0,133,213,169,12
30280 DATA 157,66,3,32,86,228,96
30290 LO=USR(1536,ADR(FB$))
30300 GOTO 30180

PROGRAM 2, AUTORUN MENU
100 FOR N=1536 TO 1670
110 READ X:POKE N,X:NEXT N
120 END
10000 DATA 162,0,189,26,3,201,69,240,5
,232,232,232,208,244,232,142,105,6,189
,26
10010 DATA 3,133,205,169,107,157,26,3,
232,189,26,3,133,206,169,6,157,26,3,16
0
10020 DATA 0,162,16,177,205,153,107,6,
200,202,208,247,169,67,141,111,6,169,6
,141
10030 DATA 112,6,169,11,141,106,6,96,1
72,106,6,240,9,185,123,6,206,106,6,160
10040 DATA 1,96,138,72,174,105,6,165,2
05,157,26,3,232,165,206,157,26,3,104,1
70
10050 DATA 169,155,160,1,96,7,0,251,24
3,51,246,67,6,163,246,51,246,60,246,76
10060 DATA 228,243,249,0,34,85,78,69,7
7,58,68,34,78,85,82
```

Commodore 64 Basic assembler

by N Thomas

The intention when writing this program in Basic was to have a fully-working 'Basic' assembler with which to write a machine code version following the same methods and philosophy. In this way, all the principles to be used have been tested in the Basic program, and also, when eventually the assembler source is completed, it will be possible to amend the machine code very swiftly using the latest version of the program as the software (in Commodore tradition!) will be upward-compatible.

The program should be suitable for use with the VIC 20 and Pet computers, merely by changing line 5640. The value of 43 is the zero page location of start of Basic pointer on the 64 and should be changed to the relevant number for the computer used.

The outline method used in the program is as follows. The assembler source code is written as though it were Basic code — that is, with each line having its own line number. Start of code is signified by a square bracket, [, followed by the initial assembly address and then by an optional storage address (for assembly into free memory for subsequent transfer into the 'running' memory after completion of the assembly process). End of the source is signified by an optional close bracket,]. The source code can be located anywhere, but from line 6000 on is obviously most suitable.

The assembler uses standard 6502 mnemonics and addressing mode conventions, and also includes the most useful pseudo-op codes. These are :

*=N	Moves assembly to location 'N'.
=+N	Moves assembly on by 'N' bytes.
.DAT	Stores the integer value 'N' in one byte if N<256, and in two bytes (lo-hi) if N>255.
.TXT 'ABC'	Stores the ASCII codes for the text between the single quotes in the order in which it appears.

So-called 'variables' and labels are dealt with in a manner slightly different from most assemblers. Variables are assigned by superseding the variable name by a colon, for example:

120 :VARIAB=$FFD2 :COMMENT.

Note that the colon must be the first character on the line. Labels are more unusual in that they appear as the last word on the line and include a trailing colon, for example:

130 LDA (POINT),Y ;COMMENT-LOOP:

The main reason for having the label as the last word on the line is for improved formatting of the source.

The main principle used to convert mnemonics and operands into the relevant machine code is as follows:

MN$() Contains the 56 different mnemonics plus the two extra mnemonics .DAT and TXT.

MN%() AND MD%() Contain the corresponding fundamental op-codes and the number (from one to eight) of the relevant addressing method used by any particular op-code respectively.

MD$() Contains eight strings (plus one error string) corresponding to the eight possible addressing methods. As there are different addressing modes (immediate, accumulator, and so on), each string is 13 characters long with each character supplying the number divided by four which must be logically 'OR'ED to the fundamental op-code to give the final full code.

Thus, taking the following as an example:

200 LDA #$0D ;COMMENT

Subroutine 2100 searches for "LDA"
This results in MN=32
The fundamental code = MN%(32) = 161 ($A1)
The addressing method = MD%(32) = 1
Therefore, MD$(1)="231EE045E76EE"
Next, subroutine 2300 calculates the addressing mode used based on the operand "#$0D" and returns a value of 1
Extracting character 1 from MD$(1) gives 2
The final op-code = ($A1) or (2*4) = $A9
The total length of the instruction is extracted from IL$ which is in terms of the 13 addressing modes

If the operand is a variable or label, the source is searched for a variable of the same name and, if found, the variable is evaluated. If it's not found, then it's assumed to be a label and this is evaluated on the final pass of the assembler.

The length of the instruction is stored in the end-of-line byte of the line of source (normally zero). When the final assembly pass is calculating the label addresses, it sums these values so that no recalculation is necessary. Finally, on completion of the assembly (or on an error) the source code end-of-line bytes are reset back to zero.

It should be noted that if the assembly is halted for any reason, this tidying-up process should be forced by typing GOTO 3910.

The program as it stands can be rather slow at assembling long source files with many labels. The process can quite easily be speeded up by replacing the label search routine by equivalent machine code. The example source appended to the program shows a possible method of searching for the start of the source and this operates virtually instantaneously.

```
0 ::::::GOTO110:::BASIC ASSEMBLER::::
1 ::::::::::::::::::N. THOMAS  1984::::::
2 ------------------------------------
3 :
4 :
5 :
100 --SPECIAL FUNCTIONS--
110 DEF FNA(X)=9*INT((X-48)/16)+X-INT(X/16)*16
120 DEF FNB(X)=X+48-7*(X>9 AND X<16)
130 DEF FNC(X)=PEEK(X)+256*PEEK(X+1)
140 :
150 PRINT"               BASIC ASSEMBLER"
160 PRINT:GOTO 5710
190 :
200 :
1000 --GET--
1010 E=1:IF PT+Y+2=FNC(PT) THEN RETURN
1020 Y=Y+1:C=PEEK(PT+Y):C$=CHR$(C)
1030 IF C$=":" OR C$=";" THEN E=2:RETURN
1040 IF C>127 THENC$=KW$(C AND 127)
1050 E=0:RETURN
1060 .
1100 --WORD--
1110 WD$=""
1120 GOSUB 1010:IF E<>0 THEN RETURN
1130 IF C=32 THEN 1150
1140 WD$=WD$+C$:GOTO 1120
1150 IF C=32 THEN GOSUB 1010:GOTO 1150
1160 Y=Y-1:RETURN
1170 .
1200 --HEX--
1210 K$="":IF K>255 THEN RETURN
1220 K1=INT(K/16)
1230 K$=CHR$(FNB(K1))
1240 K1=K-K1*16
1250 K$=K$+CHR$(FNB(K1))
1260 RETURN
1270 .
1300 --DOUBLE-HEX--
1310 K=INT(A/256)
```

```
1320 GOSUB 1210:N$=K$
1330 K=A-256*K
1340 GOSUB 1210:N$=N$+K$
1350 RETURN
1360 .
1400 --PRINTLINE--
1410 P$=RIGHT$("     "+STR$(FNC(PT+2)),5)
1420 L=0:GOSUB 1810:RETURN
1430 .
1500 --PRINT-AND-STORE--
1510 GOSUB 1210:P$=K$
1520 :
1530 IF LB>127 THEN LF=LF+1
1540 IF LF>1 THEN P$="**"
1550 GOSUB 1810
1560 POKE S,K  :REM --STORE--
1570 A=A+1:S=S+1
1580 RETURN
1590 .
1600 --END--
1610 E=1
1620 IF FNC(FNC(PT))=0 THEN E=2
1630 IF PEEK(FNC(PT)+4)=ASC("J")THEN E=2
1640 RETURN
1650 .
1700 --PRINT-ADDRESS--
1710 GOSUB 1310
1720 P$=" "+N$:GOSUB 1810
1730 L=L+6:RETURN
1740 .
1800 --PRINT--
1810 L=L+LEN(P$)
1820 PRINT P$;
1830 IF DV<>0 THEN PRINT#DV,P$;
1840 RETURN
1850 .
1900 --NUMBER--
1910 N=0
1920 IF LEFT$(N$,1)="$" THEN 1960
1930 IF LEFT$(N$,1)="%" THEN 2000
1940 IF LEFT$(N$,1)="'" THEN 2040
1950 N=VAL(N$):RETURN
1960 N$=RIGHT$(Z$+MID$(N$,2),4)
1970 FOR I=1 TO 4
1980 N=N+16^(I-1)*FNA(ASC(MID$(N$,5-I,1)))
1990 NEXT:RETURN
2000 N$=RIGHT$(Z$+MID$(N$,2),8)
22010 FOR I=1 TO 8
2020 N=N+(ASC(MID$(N$,9-I,1))-48)*2^(I-1)
2030 NEXT:RETURN
2040 N=ASC(MID$(N$,2,1)):RETURN
2050 .
2100 --MNEMONIC SEARCH--
2110 M0=1:M1=58
2120 MN=M0+INT((M1-M0)/2)
2130 IF MN$(MN)=MN$ THEN RETURN
2140 IF M1-M0 < 4 THEN 2170
2150 IF MN$<MN$(MN) THEN M1=MN:GOTO 2120
2160 M0=MN:GOTO 2120
2170 MN=M0-1
2180 MN=MN+1:IF MN$=MN$(MN) THEN RETURN
2190 IF MN<>M1 THEN 2180
2200 MN=0:RETURN
2210 .
2300 --ADDRESSING MODE--
2310 IF LEFT$(MN$,1)="B" AND MN$<>"BRK" THEN AD=12:RETURN
2320 IF AD$="#" THEN AD=1:RETURN
2330 IIF AD$<>"" THEN 2380
2340 IF OP$="" THEN AD=4:RETURN
2350 IF LEFT$(MN$,1)="J" THEN 2370
2360 IF N<256 THEN AD=3:RETURN
2370 AD=2:RETURN
2380 IF AD$="A" THEN AD=5:RETURN
2390 IF AD$="(,X)" THEN AD=6:RETURN
2400 IF AD$="(),Y" THEN AD=7:RETURN
2410 IF AD$<>",X" THEN 2440
2420 IF N<256 THEN AD=8:RETURN
2430 AD=10:RETURN
2440 IF AD$<>",Y" THEN 2470
2450 IF N<256 THEN AD=9:RETURN
2460 AD=11:RETURN
2470 IF AD$="()" THEN AD=13:RETURN
2480 AD=0:RETURN
2490 .
2500 --PARSE OPERAND--
2510 OP=0:LW=LEN(WD$):N1=0:NF=N1:OP$="":AD$=OP$
2520 IF LW=0 THEN RETURN
2530 IF LW=1 AND WD$="A" THEN AD$=WD$:RETURN
2540 I=1:T2$=""
2550 T1$=MID$(WD$,I,1):T1=ASC(T1$)
2560 IF T1$="("OR T1$=")"OR T1$="#"OR T1$="," THEN AD$=AD$+T1$:GOTO2610
2570 IF T1$="X"OR T1$="Y" THEN IF T2$="," THEN AD$=AD$+T1$:GOTO2610
2580 IF T1$="'"OR T1$="$"OR T1$="%"OR (T1$>="0"AND T1$<="9")AND OP=0 THEN NF=1
2590 IF T1=43 OR T1=45 THEN OP=LEN(OP$)+1
2600  OP$=OP$+T1$
2610 T2$=T1$:IF I<LW THEN I=I+1:GOTO 2550
2620 IF OP=0 THEN RETURN
2630 N1=VAL(MID$(OP$,OP))
2640 OP$=MID$(OP$,1,OP-1)
```

PROGRAM FILE

```
2650 RETURN
2660 .
2700 --VARIABLE SEARCH--
2710 P1=PT:PT=PS
2720 PT=FNC(PT):Y=3
2730 GOSUB 1010
2740 IF C$<>":" THEN 2810
2750 GOSUB 1110
2760 IF LEN(OP$)>LEN(WD$)+2 THEN 2810
2770 IF LEFT$(WD$,LEN(OP$))<>OP$ THEN 2810
2780 N$=MID$(WD$,LEN(OP$)+2)
2790 GOSUB 1910
2800 VF=2:PT=P1:RETURN
2810 GOSUB 1610
2820 IF E=1 THEN 2720
2830 VF=1:PT=P1:RETURN
2840 .
3000 --PROGRAM START--
3010 -----------------
3020 GOSUB 5010:REM ..INITIALISE..
3030 GOSUB 5610:REM ..FIND SOURCE..
3035 PRINT"FOUND AT"PS:PT=PS
3040 Y=4:GOSUB 1110:REM ..WORD..
3050 N$=WD$:GOSUB 1910:REM ..NUMBER..
3060 PRINT "START OF CODE AT ";
3070 K=N:GOSUB 1210
3080 PRINT WD$"  "N
3090 AS=N
3100 IF E=0 THEN GOSUB 1110
3110 N$=WD$:GOSUB 1910
3120 PRINT "        STORE AT ";
3130 K=N:GOSUB 1210
3140 PRINT WD$"  "N
3150 SS=N:S=SS:A=AS
3160 PRINT:INPUT "CONTINUE  N OR <R>";Q1$
3170 IF Q1$<>"" THEN END
3180 PRINT
3190 :
3200 PT=FNC(PT):L=0:LF=0:REM..NEWLINE..
3210 GOSUB 1410:GOSUB 1710:WD$=""
3215 VF=1:LB$=""
3220 Y=3:GOSUB 1010:IF E<>2 THEN Y=3:VF=0
3224 IF C$=";" THEN 3230
3225 IF C$="*" THEN 4410
3226 IF E<>1 THEN GOSUB 1110
3230 MN$=WD$:WD$=""
3240 IF E<>0 THEN 3260
3250 GOSUB 1110:Y1=Y
3260 GOSUB 2510
3270 C=FNC(PT)-2
3280 IF CHR$(PEEK(C))<>":" THEN 3335
3290 Y=C-PT
3300 Y=Y-2:GOSUB 1010
3310 IF C$=":" OR C=32 THEN 3335
3320 LB$=C$+LB$
3330 GOTO 3300
3335 Y=Y1:IF MN$<>".TXT" THEN 3360
3342 IF RIGHT$(OP$,1)="'" THEN 3350
3344 GOSUB 1110:OP$=OP$+" "+WD$
3346 IF E<>1 THEN 3342
3350 WD$=OP$
3360 P$=LEFT$(" "+MN$+" "+WD$+BL$,38-L-LEN(LB$))+LB$+" "
3370 GOSUB 1810
3375 IF LEFT$(MN$,1)="*" THEN 3750
3376 IF VF=1 THEN 3750
3380 GOSUB 2110
3390 IF MD%(MN)=9 THEN 4810
3400 IF MN>0 THEN 3430
3410 P$=" ??":GOSUB 1810
3420 GOTO 3910
3430 IF NF=1 THEN 3490
3440 IF OP$="" THEN N=0:GOTO 3520
3450 GOSUB 2710
3460 IF VF=2 THEN 3510
3470 LB=128:N$="256":GOTO 3500
3480 :
3490 N$=OP$
3500 GOSUB 1910
3510 N=N+N1
3520 GOSUB 2010: REM    ADR MODE
3530 IF AD<>0 THEN 3560
3540 P$=" ?? ADR MODE":GOSUB 1910
3550 GOTO 3910
3560 IL=VAL(MID$(IL$,AD,1))
3570 MD=MD%(MN)
3580 K=MN%(MN) AND MK%(MD)
3590 T$=MID$(MD$(MD),AD,1)
3600 IF T$<>"E" THEN 3620
3605 IF AD=9 THEN AD=11:GOTO 3560
3610 IF AD=8 THEN AD=10:GOTO 3560
3615 GOTO 3540
3620 K=K OR (4*VAL(T$))
3630 :
3650 GOSUB 1510: REM  PRINT+STORE
3660 IF IL=1 THEN 3730
3670 N1=INT(N/256)
3680 K=N-256*N1
3690 GOSUB 1510
3700 IF IL=2 THEN 3730
```

```
3710 K=N1
3720 GOSUB 1510
3730 LB=LB+IL
3740 REM---------------
3750 POKE FNC(PT)-1,LB
3760 LB=0:P$=CHR$(13):GOSUB 1910
3770 GOSUB1610
3780 ON E GOTO 3200,3810
3790 .
3799 STOP
3800 --FIND LABELS--
3810 P$=P$+"END OF MAIN PASS"+P$+P$+"SEARCHING FOR LABELS"+P$+P$
3820 GOSUB 1810
3830 PT=PS:A=AS:S=SS
3840 PT=FNC(PT)
3850 GOSUB 4010:GOSUB 1610
3860 ON E GOTO 3840,3910
3870 .
3900 --TIDY UP--
3910 PT=PS
3920 PT=FNC(PT)
3930 POKE FNC(PT)-1,0
3940 GOSUB 1610
3950 IF E=1 THEN 3920
3960 IF DV=4 THEN CLOSE DV
3970 PRINTDN$"END":END:-----------------:END:
3980 ----------------
3990 :
4000 --LABELS--
4010 IL=PEEK(FNC(PT)-1)
4020 IF IL>127 THEN 4060
4030 A=A+IL:S=S+IL
4040 RETURN
4050 :
4060 IF IL=255 THEN 4710
4070 IL=IL AND 127
4080 Y=3:GOSUB 1110:MN$=WD$:GOSUB 1110
4035 LB$=WD$
4090 GOSUB 1410:GOSUB 2510 :REM   SPLIT INTO OP$
4100 P1=PT:PT=PS:A1=AS
4110 PT=FNC(PT)
4120 C=FNC(PT)-2
4125 C1=PEEK(C+1)
4130 IF C1<>255 THEN C1=127 AND C1:GOTO 4140
4135 Y=5:GOSUB 1110:N$=WD$:GOSUB 1910
4136 C1=N-A1
4140 IF CHR$(PEEK(C))=":" THEN 4190
4150 A1=A1+C1
4160 GOSUB 1610
4170 IF E=1 THEN 4110
4180 PT=P1:P$="NOT FOUND":GOSUB 1810:GOTO 3910:        ABORT
4190 T$="":VF=1:Y=C-PT
4200 Y=Y-2:GOSUB 1010
4210 T$=C$+T$:IF T$=OP$ THEN 4250
4220 IF LEN(T$)<LEN(OP$) THEN 4200
4230 VF=0:GOTO 4150
4240 GOSUB 1810:GOTO 3910
4250 REM
4255 GOSUB 1710
4256 P$=LEFT$(" "+MN$+" "+LB$+BL$,41-L)
4257 GOSUB 1810
4260 A1=A1+N1:A=A+1:S=S+1
4270 IF IL=2 THEN 4340
4280 K=A1-INT(A1/256)*256
4290 GOSUB 1510
4300 K=INT(A1/256)
4310 GOSUB 1510
4315 P$=CHR$(13):GOSUB 1810
4320 PT=P1:RETURN
4330 .
4340 K=A1-A
4350 IF K>129 OR -K>126 THEN K=0:P$=CHR$(13)+"TOO BIG":GOSUB1810:GOTO 4310
4360 K=K-1:IF K<0 THEN K=256+K
4370 GOTO 4310
4380 .
4400 --* PSEUDO OP--
4410 Y=4:GOSUB 1010
4420 IF C$<>"=" THEN 3910
4430 GOSUB 1110
4435 MN$="*="+WD$:
4440 IF LEFT$(WD$,1)="*"  THEN 4550
4450 N$=WD$:GOSUB 1910
4460 IF N>A THEN 4500
4470 PRINT"WARNING: NEW ADDR<OLD"
4480 INPUT "CONTINUE  N OR <R>";Q2$
4490 IF Q2$<>"" THEN 3910
4500 S=S+N-A
4510 A=N:LB=255
4520 WD$="":GOTO 3270
4530 .
4550 N$=MID$(WD$,3)
4560 GOSUB 1910
4570 IF N<128 THEN 4590
4580 PRINT"STEP>127??":N=127
4590 A=A+N:S=S+N
4600 LB=N
4610 WD$="":GOTO 3270
4620 .
4700 --NEW ADDR--
```

PROGRAM FILE

```
4710 Y=5:GOSUB 1110
4720 N$=WD$:GOSUB 1910
4730 S=S+N-A
4740 A=N
4750 RETURN
4760 .
4800 --'.' PSEUDO OP--
4810 ON MN%(MN) GOTO 4830,4900
4815 REM  .DAT  .TXT
4820 GOTO 3410
4825 REM  LB=1:GOSUB 1510: GOTO 3750
4930 N$=OP$:GOSUB 1910:N1=N
4840 LB=1:IF N<256 THEN 4880
4850 N1=INT(N/256)
4860 K=N-256*N1
4870 GOSUB 1510:LB=2
4880 K=N1:GOSUB 1510
4890 GOTO 3750
4900 :
4910 LB=0
4920 FOR I=1 TO LEN(OP$)
4930 K=ASC(MID$(OP$,I,1))
4940 IF K=ASC("'") THEN 4960
4950 LB=LB+1:GOSUB 1510
4960 NEXT:GOTO 3750
4995 .
5000 --INITIALISE--
5010 DIM KW$(75)
5020 DIM MN$(58)
5030 DIM MN%(58)
5040 DIM MD$(7)
5050 DIM MK%(7)
5060 DIM MD%(58)
5080 Z$="00000000":BL$="                    "
5090 IL$="2321122223323"
5095 UP$="":DN$="":HM$=""
5100 I=40960+157:J=0 : REM  KEYWORD STORED ON CBM64 HERE : CHANGE FOR VIC & PET
5110 I=I+1:KW$(J)=KW$(J)+CHR$(PEEK(I)AND127):IF PEEK(I)<128 THEN 5110
5115 PRINT HM$;DN$;DN$;DN$;KW$(J)"     "
5120 J=J+1:IF J<76 THEN 5110
5130 PRINT UP$"KEYWORDS SET UP"
5140 :
5150 FOR J=1 TO 58
5160 READ MN$(J),MD%(J),MN%(J)
5170 NEXT J
5180 :
5190 FOR J=0 TO 7
5200 READ MD$(J),MK%(J)
5210 NEXT J
5220 :
5230 RETURN
5235 DATA .DAT,9,1,.TXT,9,2
5240 DATA ADC,1,97,AND,1,33,ASL,3,6
5250 DATA BCC,0,144,BCS,0,176,BEQ,0,240
5260 DATA BIT,6,36,BMI,0,48,BNE,0,208
5270 DATA BPL,0,16,BRK,0,0,BVC,0,80
5280 DATA BVS,0,112,CLC,0,24,CLD,0,216
5290 DATA CLI,0,88,CLV,0,184,CMP,1,193
5300 DATA CPX,4,224,CPY,4,192,DEC,2,198
5310 DATA DEX,0,202,DEY,0,136,EOR,1,65
5320 DATA INC,2,230,INX,0,232,INY,0,200
5330 DATA JMP,7,76,JSR,0,32,LDA,1,161
5340 DATA LDX,5,162,LDY,5,160,LSR,3,74
5350 DATA NOP,0,234,ORA,1,1,PHA,0,72
5360 DATA PHP,0,8,PLA,0,104,PLP,0,40
5370 DATA ROL,3,42,ROR,3,106,RTI,0,64
5390 DATA RTS,0,96,SBC,1,225,SEC,0,56
5390 DATA SED,0,248,SEI,0,120,STA,1,129
5400 DATA STX,2,134,STY,2,132,TAX,0,170
5410 DATA TAY,0,168,TSX,0,186,TXA,0,138
5420 DATA TXS,0,154,TYA,0,152
5430 DATA 0000000000000,255
5440 DATA 231EE045E76EE,227
5450 DATA E20EEEE4E6EEE,231
5460 DATA E31E2EE5577EE,227
5470 DATA 031EEEEEEEEEE,243
5480 DATA 031EEEE5577EE,227
5490 DATA E20EEEEEEEEEE,247
5500 DATA E0EEEEEEEEEE8,223
5690 --FIND SOURCE--
5610 PRINT"SEARCHING FOR SOURCE"
5620 PS=10637:REM FIRST TRY
5630 IF CHR$(PEEK(PS+4))="[" THEN RETURN
5640 PS=FNC(43) : REM THIS IS START OF BASIC ON CBM64 : CHANGE FOR VIC & PET
5650 IF CHR$(PEEK(PS+4))="[" THEN RETURN
5660 PS=FNC(PS):PRINTFNC(PS+2)UP$
5670 IF PS<>0 THEN 5650
5680 PS=0
5690 PRINT"NOT FOUND":STOP
5700 --OUTPUT DEVICE--
5710 INPUT "OUTPUT TO PRINTER, Y/N";Q3$
5720 DV=0:IF Q3$<>"Y" THEN 3020
5730 DV=4:OPEN DV,DV
5740 GOTO 3020
5750 -----------------------------------
```

BBC Equation solver

by Philip Tudor

'Equation solver' is a novel application of a database-style program which is used to store, amend and delete a database of up to 200 expressions and, of course, solve them. It will be particularly useful to engineers, statisticians and others who regularly use complex formulae.

The program is menu-driven and has the following options:

1 Solve: the user selects the expression by its name or location; and is then prompted for the equation's unknowns and the answer is printed.
2 Learn: the user enters the expression and its name (which is checked before storing)
3 Delete: removes any expression
4 Menu: prints out a numbered list of all expressions held on either the screen or a printer
5 Dump: causes all screen output to be duplicated on a printer
6 Screen: turns off dump
7 Search: prints full details about an expression (name, location, expression, and so on, by entering only the name, part of name, location or expression
8 Load: load an expression from tape or disk
9 Save: save to tape or disk between two specified locations (to save all, specify top and bottom locations)

The equation limit of 200 expressions can be altered by changing the variable T% in line 2010.

There is one slight flaw that disk users should be aware of: when equations are saved, a new disk file is created. Should this fail, perhaps because the disk is full, then no error message is displayed. Consequently, the program fails to load.

```
LIST
   10REM ********************
   20REM **EQUATION SOLVER.**
   30REM **   BY:P.TUDOR   **
   40REM **   MARCH 1983   **
   50REM ********************
   60MODE7
   70PROCINITIALIZE
   80PROCTITLE
   90PROCEXPLAIN
  100TEST=0:PROCSELECTION:GOTO (100+(10*VAL(A$)))
  110PROCSOLVE:PROCCLS:GOTO100
  120PROCLEARN:PROCCLS:GOTO100
  130PROCDELETE:PROCCLS:GOTO100
  140PROCMENU:PROCCLS:GOTO100
  150PROCDUMP:PROCCLS:GOTO100
  160PROCSCREEN:PROCCLS:GOTO100
  170PROCSEARCH:PROCCLS:GOTO100
  180PROCLOAD:PROCCLS:GOTO100
  190PROCSAVE:PROCCLS:GOTO100
  200REM**TITLE**
  210DEFPROCTITLE
  220PROCCLS:IF PO%=1THENPRINT'"  **EQUATION SOLVER**''":GOTO230:ELSE:PRINT:FOR
I=1TO2:VDU141,134:PRINT"        **Equation Solver**":NEXT
  230ENDPROC
  240REM**EXPLAIN**
  250DEFPROCEXPLAIN
  260PRINT"'Equation Solver' has a variety of"'"commands to help you solve equat
ions"'"more quickly and easily. You can teach"'"it formulae, load & save formula
e and"'"it also incorporates a comprehensive"
  270PRINT"search system. It accepts commands in"'"either case. ('ESCAPE' to exi
t.)"
  280ENDPROC
  290REM**SELECTION**
  300DEFPROCSELECTION
  310PRINT'CHR$131;"A list of 'COMMAND' words follows"
  320PRINT'CHR$134"1."CHR$135"Solve...Select equation and solve."
  330PRINTCHR$134"2."CHR$135"Learn...Add new formula to memory."
  340PRINTCHR$134"3."CHR$135"Delete..Remove a formula from RAM."
  350PRINTCHR$134"4."CHR$135"Menu....Print out formulae in RAM."
  360PRINTCHR$134"5."CHR$135"Dump....Produce a hardcopy output."
  370PRINTCHR$134"6."CHR$135"Screen..Produce only monitor copy."
  380PRINTCHR$134"7."CHR$135"Search..Search memory for formula."
  390PRINTCHR$134"8."CHR$135"Load....Formulae,cass/disk to RAM."
  400PRINTCHR$134"9."CHR$135"Save....Formulae,RAM to cass/disk."
  410PRINT'"           ENTER COMMAND NUMBER."
  420ONERRORGOTO2040
  430A$=GET$:IFVAL(A$)>9ORVAL(A$)<1THEN430
  440ENDPROC
  450REM**LOAD**
  460DEFPROCLOAD
  470PROCCLS:PRINT'"LOAD:"''"Do you want to use cassette or disk     drive (C or
 D) ?":A$=GET$:PROCCHECK(A$):A$=R$:IFA$<>"D"AND A$<>"C"THEN470:*TAPE
  480IFA$="D"THEN *DISC
  490PRINT'"Do you want to add the formulae on ";:IFA$="D"THENPRINT"disc":ELSE:P
RINT"tape"
  500PRINT"to those in RAM or erase them before    starting (A or E) ?"
  510A$=GET$:PROCCHECK(A$):A$=R$:IFA$<>"E"AND A$<>"A"THEN490
  520IFA$="E"THEN N%=0
  530IFA$="T"THENPRINT'"Please PRESS play on TAPE drive."
  540Y=OPENUP"FORMULA":REPEAT:N%=N%+1
  550INPUT£Y,A$(N%),C$(N%),U$(N%):UNTIL EOF£Y
  560CLOSE£Y



  570ENDPROC
  580REM**SAVE**
  590DEFPROCSAVE
  600PROCCLS:PRINT'"SAVE:"':IFN%=0 PRINT"There are no formulae in RAM to be
 saved."''P$:A$=GET$:ENDPROC:ELSEPRINT'"Do you want to use cassette or disk
drive (C or D) ?":A$=GET$:PROCCHECK(A$):A$=R$:IFA$<>"D"AND A$<>"C"THEN600:*TAP
  610IFA$="C"THEN660
  620*DISC
  630PRINT'"Do you want to destroy the old file of  formulae ?":Z$=GET$:PROCCHEC
```

PROGRAM FILE

```
K(Z$):Z$=R$
 640IF Z$="Y"THEN *ACCESS FORMULA
 650IF Z$="Y"THEN *DELETE FORMULA
 660PRINT'"Which section of RAM do you wish to save(enter locations when prompt
ed)"
 670INPUT'"From:",A%:INPUT'"To:",B%:IFA%<1ORB%<1ORB%>N%THENPRINT'"Please use nu
mbers above 0 and that      exist in RAM.":GOTO670:ELSE:X%=A%
 680PRINT
 690Y=OPENOUT"FORMULA"
 700REPEAT
 710PRINT£Y,A$(X%),C$(X%),U$(X%):X%=X%+1:UNTIL X%=B%+1:CLOSE£Y:IF A$="D"THEN *A
CCESS FORMULA L
 720ENDPROC
 730REM**PRINTER OUTPUT**
 740DEFPROCDUMP
 750*FX5,1
 760*FX6,1
 770*FX8,4
 780VDU2:PO%=1
 790ENDPROC
 800REM**MONITOR ONLY**
 810DEFPROCSCREEN
 820VDU3:PO%=0
 830ENDPROC
 840REM**SEARCH FOR FORMULA**
 850DEFPROCSEARCH
 860PROCCLS:PRINT'"SEARCH:"'';:IFN%=0 PRINT"There are no formulae in RAM to be
    searched"''P$:A$=GET$:ENDPROC:ELSE:PRINT"Do you want to search for the equa
tion  by its NAME, FORMULA or LOCATION in the menu (1-";N%;")"
 870PRINT'"Enter 'N','F' or 'L' ?"
 880A$=GET$:PROCCHECK(A$):A$=R$:IFA$="N"THEN890ELSE IFA$="F"THEN990ELSE IFA$="L
"THEN1020 ELSE880
 890PRINT'"Do you know the full name (Y or N)"
 900A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN940ELSE IFA$="N"THEN910ELSE900
 910PROCCLS:PRINT'"Please enter as much of it as possible  (e.g. ADRATI for QUA
DRATIC) ?"
 920INPUTN$:PROCCHECK(N$):N$=R$:IFN$=""THEN920ELSE P%=0:FORL%=1TON%:IF INSTR(C$
(L%),N$)>0 THENPRINT'"Formula:";A$(L%)''"Name:";C$(L%)''"Location:";L%':P%=1:PRI
NTP$:A$=GET$:NEXT:ELSE:NEXT
 930IFP%=0THENPRINT'"There are no formulae with names         containing ";N$:GO
TO970ELSE970
 940INPUT'"What name is the desired formula stored under",N$:PROCCHECK(N$):N$=R
$
 950P%=0:FORI%=1TON%:IFC$(I%)=N$THENP%=1:PRINT'"Formula:";A$(I%)''"Name:";C$(I%
)''"Location:";I%''P$:A$=GET$:NEXT:ELSE:NEXT
 960IFP%=0THENPRINT'"There are no formulae stored under the   name of ";N$:GOTO
970
 970PRINT'"Do you want another search (Y or N) ?"
 980A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN860ELSE IFA$="N"THEN ENDPROC ELSE98
0
 990PRINT'"Enter the formula";:INPUTN$:PROCCHECK(N$):N$=R$
1000FORI%=1TON%:IFA$(I%)=N$THEN1040:ELSE NEXT
1010PRINT'"There is no such formula in RAM"''"Do you want another search (Y
N) ?":A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN860ELSE ENDPROC

1020PRINT'"What LOCATION is the formula (1-";N%;") ";
1030INPUTI%:IFI%>N% OR I%<1THEN1030ELSE 1040
1040PROCCLS:PRINT'"Formula:";A$(I%)''"Name:";C$(I%)''"Location:";I%'
1050PRINT'P$:A$=GET$:ENDPROC
1060REM**DELETE A FORMULA**
1070DEFPROCDELETE
1080PROCCLS:PRINT'"DELETE:":IFN%=0THENPRINT'"There are no formulae in RAM to de
lete."''P$:A$=GET$:ENDPROC
1090PRINT'"Do you want to DELETE the formula by     NAME or FORMULA (N or F)?"
1100A$=GET$:PROCCHECK(A$):A$=R$:IFA$="N"THEN1110ELSE IFA$="F"THEN1200ELSE1090
1110PRINT'"Enter the NAME of the formula";:INPUTN$:PROCCHECK(N$):N$=R$
1120FORI%=1TON%:IFC$(I%)=N$THENF%=1 ELSE NEXT
1130IFF%<>1THENPRINT'"There is no formula in RAM with that     name":GOTO1190:EL
SE F%=0
1140PRINT'"Formula:";A$(I%)''"Name:";C$(I%)'
1150PRINT"Are you sure (Y or N) ?"
1160A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN1170ELSE IFA$="N"THEN1110 ELSE1160
1170PRINT'"DELETED":C$(I%)="":A$(I%)="":U$(I%)=""
1180A%=0:FORI%=1TON%:IFC$(I%)<>""THENA%=A%+1:C$(A%)=C$(I%):A$(A%)=A$(I%):U$(A%)
=U$(I%):NEXT ELSE NEXT
1190N%=A%:PRINT'P$:A$=GET$:ENDPROC
1200PRINT'"Enter the formula to be DELETED";:INPUTN$:PROCCHECK(N$):N$=R$
1210FORI%=1TON%:IFA$(I%)=N$THENF%=1:ELSE NEXT
1220IFF%<>1THENPRINT'"There is no such formula in RAM":GOTO1280:ELSE F%=0
1230PRINT'"Formula:";A$(I%)''"Name:";C$(I%)'
1240PRINT"Are you sure (Y or N) ?"
1250A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN1260 ELSE IFA$="N"THEN1200 ELSE 125
0
1260PRINT'"DELETED":C$(I%)="":A$(I%)="":U$(I%)=""
1270A%=0:FORI%=1TON%:IFC$(I%)<>""THENA%=A%+1:C$(A%)=C$(I%):A$(A%)=A$(I%):U$(A%)
=U$(I%):NEXT ELSE NEXT
1280N%=A%:PRINT'P$:A$=GET$:ENDPROC
1290REM**MENU**
1300DEFPROCMENU
1310PROCCLS:PRINT'"MENU:":IFN%=0THENPRINT'"The store is empty"'';P$:A$=GET$:END
PROC:ELSE FORI%=1TON%:PRINT';I%;".";C$(I%);'';TAB(2);A$(I%);'';P$:A$=GET$:NEXT:E
NDPROC
1320REM**LEARN**
1330DEFPROCLEARN
1340LEARN=TRUE:PROCCLS:PRINT'"LEARN:":IFN%+1>T%THENPRINT'"The program has reach
ed its MAXIMUM      capacity":PRINT'P$:A$=GET$:ENDPROC:ELSE N%=N%+1
1350PRINT'"Enter the name of the NEW formula"
1360INPUTC$(N%):PROCCHECK(C$(N%)):C$(N%)=R$:IFC$(N%)=""THEN1360
1370PRINT'"Enter the NEW formula (Unknowns, 1 chr.)";
1380INPUTA$(N%):PROCCHECK(A$(N%)):A$(N%)=R$:IFA$(N%)=""THEN1380
1390p%=0:p1%=0:FORI%=1TOLEN(A$(N%)):x$=MID$(A$(N%),I%,1):IFx$=")"THENp%=p%+1ELS
E IFx$="("THENp1%=p1%+1
1400NEXTI%:IFp%<>p1%THENPRINT'"Please check that you have the same      number o
f left and right parentheses.":GOTO1380
1410PRINT'"Now, enter the single chr. unknowns      (e.g. AB for A+B)";:INPUTU$(
N%):PROCCHECK(U$(N%)):U$(N%)=R$:
1420FORL%=1TOLEN(U$(N%)):M%=ASC(MID$(U$(N%),L%,1)):IFM%<65ORM%>90THENPRINT'"I d
o not understahd, please re-enter     the unknowns as single alphabetic chr's.":G
OTO1410:ELSE NEXT
1430PRINT'"Are you sure (Y or N) ?"
1440A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN LEARN=FALSE:GOTO1450:ELSE:IFA$="N"
THEN N%=N%-1:GOTO1470:ELSE:GOTO1440
1450TEST=TRUE:PROCSOLVE:TEST=FALSE
1460PRINT'"STORED"
1470PRINT'P$:A$=GET$:ENDPROC
1480REM**SOLVE**
1490DEFPROCSOLVE
1500IF TEST=TRUE THEN1680

1510PROCCLS:PRINT'"SOLVE:"';IFN%=0THENPRINT"There are no formulae in RAM to be
    solved":PRINT'P$:A$=GET$:ENDPROC:ELSE:PRINT"Do you want to select the equat
ion to beSOLVED by its NAME, FORMULA or LOCATION in the menu (1-";N%;")"
1520PRINT'"Enter 'N','F' or 'L' ?"
1530A$=GET$:PROCCHECK(A$):A$=R$:IFA$="N"THEN1540ELSE IFA$="F"THEN1610ELSE IFA$=
```

```
"L"THEN1640 ELSE1530
 1540PRINT'"What name is the desired formula stored under";
 1550INPUTN$:PROCCHECK(N$):N$=R$:IFN$=""THEN1550
 1560FORI%=1TON%:IFC$(I%)=N$THEN1580ELSENEXT
 1570PRINT'"There is no formulae stored under the   name of ";N$:GOTO1600
 1580PRINT'CHR$134;A$(I%)''"Is this the correct formula ?"
 1590A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN1650
 1600PRINT'"Do you want another search":A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN
1540ELSEENDPROC
 1610PRINT'"Enter the formula";:INPUTN$:PROCCHECK(N$):N$=R$
 1620FORI%=1TON%:IFA$(I%)=N$THEN1650:ELSE NEXT
 1630PRINT'"There is no such formula in RAM"'"Do you want another search (Y or N
)?":A$=GET$:PROCCHECK(A$):A$=R$:IFA$="Y"THEN1610ELSE ENDPROC
 1640PRINT'"What LOCATION is the formula (1-";N%;") "::INPUTI%:IFI%>N% OR I%<1TH
EN1640ELSE 1650
 1650PROCCLS:PRINT'"Formula:";A$(I%)''"Name:";C$(I%)'
 1660PRINT"Enter the unknowns as prompted."
 1670FORK%=1TO LEN(U$(I%)):PRINT';MID$(U$(I%),K%,1);"=";:INPUTans
 1680IF TEST=TRUE THEN FORK%=1TOLEN(U$(N%)):ans=1:GOTO(1710+(10*((ASC(MID$(U$(N%
),K%,1)))-64)))
 1690GOTO(1710+(10*((ASC(MID$(U$(I%),K%,1)))-64)))
 1700IF TEST=FALSE THEN NEXT:ANS=EVAL(A$(I%)):PRINT'"The answer = ";ANS''P$:A$=G
ET$:ENDPROC
 1710NEXTK%:ANS=EVAL(A$(N%)):ENDPROC
 1720A=ans:GOTO1700
 1730B=ans:GOTO1700
 1740C=ans:GOTO1700
 1750D=ans:GOTO1700
 1760E=ans:GOTO1700
 1770F=ans:GOTO1700
 1780G=ans:GOTO1700
 1790H=ans:GOTO1700
 1800I=ans:GOTO1700
 1810J=ans:GOTO1700
 1820K=ans:GOTO1700
 1830L=ans:GOTO1700
 1840M=ans:GOTO1700
 1850N=ans:GOTO1700
 1860O=ans:GOTO1700
 1870P=ans:GOTO1700
 1880Q=ans:GOTO1700
 1890R=ans:GOTO1700
 1900S=ans:GOTO1700
 1910T=ans:GOTO1700
 1920U=ans:GOTO1700
 1930V=ans:GOTO1700
 1940W=ans:GOTO1700
 1950X=ans:GOTO1700
 1960Y=ans:GOTO1700
 1970Z=ans:GOTO1700
 1980REM**INITIALIZE**
 1990DEFPROCINITIALIZE
 2000P$="       "+CHR$134+"Press any key to continue"
 2010LEARN=FALSE:Z$="":TEST=1:ANS=0:x$="":p%=0:p1%=0:PO%=0:N%=0:T%=200:DIMA$(T%)
C$(T%),U$(T%)
 2020ENDPROC
 2030REM**USE AGAIN?**
 2040PROCCLS:PRINT" ";



 2050IF ERR=254 THENPRINT"There is no disc interface installed in this machine -
 please see your local    Acorn dealer for details of possible    installation."
:GOTO2150
 2060IF ERR=18 THENPRINT"You cannot divide by zero.":GOTO2150
 2070IF ERR=23 THENPRINT"Accuracy lost-number too extreme.":GOTO2150
 2075IF ERR=198 PRINT"The disk is full!":GOTO2150
 2080IF ERR=218 THENPRINT"Loading Error.":GOTO2150
 2085IF ERR=222 PRINT"The FORMULA file is not on this disk.":GOTO2150
 2090IF ERR=214 THENPRINT"There is no file to DELETE.":GOTO2150
 2100IF ERR=11 THENPRINT"Capacity is too high.":GOTO2150
 2110IF ERR=20 THENPRINT"The numbers were too extreme.":GOTO2150
 2120IF ERR=26 AND TEST=TRUE THEN PRINT"That equation was invalid.":N%=N%-1:TEST
=FALSE:GOTO2150
 2130IF ERR=22AND TEST=-1 PRINT'"STORED (if the variables are given a    certain
 value, the equation will not    work.)"''P$:A$=GET$:PROCCLS:GOTO100:ELSE:IF ERR
=22 PRINT"You cannot take the log of a negative   number or of zero.":GOTO2150
 2140IF ERR=21AND TEST=-1 PRINT'"STORED (if the variables are given a    certain
 value, the equation will not    work.)"''P$:A$=GET$:PROCCLS:GOTO100:ELSE:IF ERR
=21 THENPRINT"You cannot 'root a negative number.":GOTO2150
 2150PRINT'CHR$131;"Do you want to use this facility again?":VDU3:PO%=0:TEST=0:A
$=GET$:PROCCHECK(A$):A$=R$
 2160IF LEARN=TRUE THEN N%=N%-1:LEARN=FALSE
 2170IFA$="Y"THEN80 ELSEEND
 2180REM**LOWER CASE CHECK & CORRECT**
 2190DEFPROCCHECK(A1$)
 2200R$="":FORH%=1TOLEN(A1$):s$=MID$(A1$,H%,1):g%=ASC(s$)
 2210IFg%>96ANDg%<123THENr$=CHR$(ASC(s$)-32)ELSE r$=s$
 2220R$=R$+r$:NEXT
 2230ENDPROC
 2240REM**CHECK FOR PRINTER & CLS**
 2250DEFPROCCLS:IFPO%=1THEN VDU3:CLS:VDU2:ENDPROC ELSE CLS:ENDPROC

A list of 'COMMAND' words follows

1.Solve...Select equation and solve.
2.Learn...Add new formula to memory.
3.Delete..Remove a formula from RAM.
4.Menu....Print out formulae in RAM.
5.Dump....Produce a hardcopy output.
6.Screen..Produce only monitor copy.
7.Search..Search memory for formula.
8.Load....Formulae,cass/disk to RAM.
9.Save....Formulae,RAM to cass/disk.

       ENTER COMMAND NUMBER.
```

BBC B Astrorun

by K Sangrar

'Astrorun' is a vertically-scrolling scramble derivative with the object of destroying the nucleus that resides in the ninth screen. The nine stages are roughly arranged in three groups of three. After each group, you earn a bonus life and extra points are calculated on the number of missiles you have. There is a maximum of 20 missiles when fully stocked which are worth 2000 points, so try to be well stocked at these stages.

PROGRAM FILE

A number of options are available at the start of each game. You may choose the speed of the game; 1 is the fastest, 4 the slowest and the game defaults to one on loading, or you may select the difficulty; set to 1, with fewest enemies on loading, 9 being the most difficult, or 'T' may be selected for training mode.

Use the keys indicated during play. If things go badly press ESCAPE to return to the title page or SPACE and ESCAPE together to return you directly to the options.

The listing should be typed as given without any extra spaces, since the program is quite long. Disk owners will have to do some relocating to use the program from disk, or, type 'PAGE=&EOO:*TAPE <RETURN>' before loading from tape.

In the event of a 'NO ROOM' error, press BREAK, OLD the program and remove any extra spaces.

It's also advisable to omit line 10 in program three until the program is fully debugged.

If you want to save some typing omit lines 50 to 240 in program two and leave out program one entirely, since program one is only a title page and the instructions can be read from the listing.

The program is reasonably well structured, although meaningful variable and procedure names have been omitted to save memory. There is, therefore, still some room for a possible extra stage if desired.

Finally, and most importantly, my high score is 82000 which is two and a half times round all the stages. That will give you something to aim at!

```
PROGRAM ONE
-----------

>L.
   10REM ASTRORUN V1 (c) K. Sangrar
   20REM
   30MODE7:PRINT
   40FORA=145 TO150
   50PROCA(A)
   60NEXT
   70PRINT'CHR$130SPC12"By K. Sangrar"
   80VDU28,10.24,30,22
   90CHAIN""
  100
  110DEFPROCA(C)
  120PRINTCHR$C;CHR$154"  h7k4h7+$""k7!j7k4h7k4j7k4j5j5juj5"
  130PRINTCHR$C;CHR$154"  j7k5_3k4 j5 j7o0j5j5j7o0j5j5j7o5"
  140PRINTCHR$C;CHR$154"  ""!""! "" ""! ""!""! "" ""!""! "" ""!""!"
  150ENDPROC

>

PROGRAM TWO
-----------

>L.
   10REM ASTRORUN V1 (c) K. Sangrar
   20MODE1:PRINTTAB(15)"STOP TAPE":VDU7
   30PROCDEFCHARS
   40PROCTUNES
   50A=INKEY(200):CLS
   60VDU19,1,2;0;19,2,6;0;
   70COLOUR1:PRINTSTRING$(40,"_");
   80COLOUR3:PRINTTAB(15)"ASTRORUN"
   90COLOUR1:PRINTSTRING$(40,"_");
  100VDU28,0,31,39,6:COLOUR2
  110PRINT"    You are in command of a Space RaiderAssault Ship.  Your  mission
 is to pilotyour  craft as far as possible  into theenemy stronghold."
  120PRINT'"    Your mission is extremly  dangerous,so, your ship has been  give
n  deflectorshields and  fifteen  missiles  in orderto protect itself."
  130PRINT'"    Unfortunately, your shields will notprotect you from a direct co
llion exceptwith certain objects."
  140PROCcontinue
  150PRINT"    On  your  mission you will meet manyhazards. These include....."
  160PRINT''"ASTEROIDS"''"These come in two sizes and are worth 50points if shot
. A head on  collision is,of course, fatal."
  170PRINT''"SPACE MINES"''"These are  small  impact mines. They areworth 150 po
ints if shot"
  180PROCcontinue
  190PRINT"Hazards cont."
  200PRINT''"ROCKET LAUNCHERS"''"These are large twin  missile launchers.You rec
ieve 150 points for shooting themhowever,  if you line  yourself  up withthem, i
nstead  of crashing,  you pick upits  missiles and add them  to  your ownstock"
  210PRINT''"GATES"''"These  are  force  fields  which  can bebroken  by  flying
  through  the glowingpart.  This  gives  you  mystery points.Shooting the gates
 gives you 100 points"
  220PROCcontinue
  230PRINT"These are your controls;"''TAB(10)"'CAPS LOCK' -  LEFT"'TAB(10)"'CTRL
    - RIGHT"'TAB(10)"'RETURN'    -  FIRE"
 240PRINT''"You are  given three lives for each gameunless you  select 'T' for
training modein which you get five,  but,  you do notget to put your name in the
high scores."
 250PRINTTAB(15.16)"START TAPE":VDU7
 260VDU28,10,30,30,28,19,3,7;0;0;
 270ENVELOPE1.1,0,0,0,0,0,0,127,-3,-1,-5,126,100
 280ENVELOPE2,1,-1,-1,-1,200,200,200,127.0,0.-4,127.127
 290ENVELOPE3,4,8,12,8,2,1,2,126,0,0,-8,126,126
 300ENVELOPE4,3,1,-2,1,1,1,2,127,0,0.0,80,80
 310CHAIN""
 320
 330DEFPROCDEFCHARS
 340FORC=224TO255
 350VDU23,C
 360READA$
 370FORB=1TO15STEP2
 380VDUEVAL("&"+MID$(A$,B.2))
 390NEXT,
 400!&D00=&05060307
 410!&D04=&02010102
 420!&D08=&07030605
 430ENDPROC
 440
 450DEFPROCTUNES
 460FORN=&D10 TO&D84STEP4
```

```
470READA$:!N=EVAL("&"+A$)
480NEXT
490ENDPROC
500
510DEFPROCcontinue COLOUR3:*FX15
520PRINTTAB(8,22)"Press 'SPACE' to continue"
530REPEATC%=(C%+1)MOD12
540VDU19,3,C%?&D00!0;
550UNTILINKEY$(5)=" "
560CLS:COLOUR2:ENDPROC
570
580DATA E0713B1F1F3B71E0,004922DFFB449200
590DATA 078EDCFBFBDC8E07,92247F57577F2492
600DATA 0000FFFFFFFF0000,4924FEEAEAFE2449
610DATA 0000609009060000,1010103838101038
620DATA 387E7FFFFFFE7E18,E7BDFFFFFFFFBDE7
630DATA 0103070301010343,80C0E0C08080C0C2
640DATA 475F7F7F7F4F0307,E2FAFEFEFEF2C0E0
650DATA 422418DB99FF99C3,0D3F7F7FFFFFFF7F
660DATA A0F0FCFEFFFFFFFE,7FFFFF7F7F3F1F05
670DATA FEFFFFFEFEFCFC70,7EC399FFFFBD9999
680DATA 99BDFFBD99181818,000A2109261B4F97
690DATA 822805A84D7AFEC3,408410A442D8E174
700DATA 25570A269E064B13,4802800001804208
710DATA D0A2EC714862D1A4,2F870D1142092001
720DATA C3FD2C8A22890822,E5D2904A80124020
730DATA 3500000000000000,0A00000000000000
740
750DATA 01000001,51010C65,02510102,010C6501,51010251,04650102
760DATA 01045101,51010265,02650102,01027501,51010881,02510106
770DATA 02025101,65010C51,02510202,02026502,65020275,06510105
780DATA 01025101,65010251,06650106,01068101,75010681,06750106
790DATA 01068101,75010681,06750106,01065101,51010251,08650102
```

ROGRAM THREE

```
L.
   100NERRORVDU4:GOTO40
   20PROCI
   30MODE1:VDU23;8202:0:0:0;
   40REPEATPROCA
   50PROCS:REPEATPROCW
   60UNTILEnd%
   70PROCDS:UNTILFALSE
   80DEFPROCW
   90IFEnd% ENDPROC
  100PROCM("SPACE BOULDERS",0,0)
  110VDU19,1,2;0;:T%=0
  120REPEATPROCSHIP:S%=S%+1
  130IFRND(D%)>7 PRINTTAB(RND(39)-1,0)A$ELSEIFRND(D%)>7 PRINTTAB(RND(39)-1,0)a$
  140IFRND(100)=1PRINTTAB(RND(34)-1,0)G$ELSEIFRND(100)=1PRINTTAB(RND(34)-1,0)M$
  150T%=T%+1:UNTILT%=5000REnd%
  160IFEnd% ENDPROC
  170PROCM("METEOR RUN",42,24)
  180T%=0:D$=CHR$30+CHR$11+CHR$11:VDU19,1,3;0;
  190REPEATPROCSHIP:S%=S%+2:IFRND(D%)>7 PRINTTAB(RND(39)-1,0)A$
  200T%=T%+1:UNTILEnd% ORT%=500
  210IFEnd% ENDPROC
  220PROCM("EASY POINTS",42,24)
  230T%=0:VDU19,1,2;0;
  240REPEATPROCSHIP:S%=S%+1:IFRND(D%)>8 PRINTTAB(RND(39)-1,0)A$
  250IFRND(20)<3 PRINTTAB(RND(35)-1,0)G$
  260T%=T%+1:UNTILEnd% ORT%=500:IFEnd%ENDPROC
  270PROCB
  280PROCM("THE CANYON",0,0)
  290T%=0:BC%=129:P%=15:G%=16-D%/2:IFG%<8 G%=8
  300REPEATPROCSHIP:S%=S%+1:PROCCAN:IFRND(30)=1 PRINTTAB(P%+RND(G%-6),0)G$
  310IFRND(50)=1 PRINTTAB(P%+RND(G%-3),0)M$
  320T%=T%+1:UNTILEnd% ORT%=500
  330IFEnd% ENDPROC
  340PROCM("THE CAVERNS",42,24)
  350T%=0:BC%=129:P%=15:R%=17:G%=13-D%/2:IFG%<6:G%=6
  360REPEATPROCSHIP:S%=S%+1:P%=P%+RND(5)-3+2*((P%>29)-(P%<3))
  370R%=R%+RND(5)-3+2*((R%>29)-(R%<3)):COLOURO
  380PRINTTAB(P%.O)STRING$(G%,CHR$254)TAB(R%,0)STRING$(G%,CHR$254):T%=T%+1:UNTIL
End% ORT%=500
  390IFEnd% ENDPROC
  400PROCM("MINED  CAVERNS",42,24)
  410T%=0:BC%=129:P%=15:G%=19-D%/2:IFG%<11:G%=11
  420REPEATPROCSHIP:S%=S%+1:PROCCAN:IFRND(D%*2)>17 PRINTTAB(P%+RND(G%-1)-1,0)m$
  430IFRND(30)=1 PRINTTAB(P%+RND(G%-3),0)M$
  440IFRND(30)=1 PRINTTAB(P%+RND(G%-6),0)G$
  450T%=T%+1:UNTILEnd%ORT%=500:IFEnd% ENDPROC
  460PROCB
  470PROCM(" THE FINAL GATES  ",0,0)
  480T%=0:BC%=129:h%=0:x%=15:y%=0
  490REPEATPROCSHIP:S%=S%+1:x%=4*SIN(y%/PI):h%=h%+1:y%=y%+1:IFh%>31h%=0
  500IFh%<>0COLOUR128:PRINTTAB(16,0)"            "TAB(17+x%,h%)g$;ELSEPRINTFG$
  510T%=T%+1:UNTILEnd% ORT%=500:IFEnd%ENDPROC
  520PROCM("THE TRENCH",42,24):T%=0:BC%=129
  530sp$=CHR$31+CHR$17+CHR$0+STRING$(3,s$+CHR$11):D$=CHR$30+CHR$11+CHR$11
  540REPEATPROCSHIP:S%=S%+2:IFT%<450 PRINTsp$ ELSEPRINTTAB(19,0)s$
  550IF(T%MOD6)=0 ANDT%<430COLOUR1:PRINTTAB(14+RND(2)*3,1)CHR$233CHR$233CHR$233
  560IFT%>490ANDT%<496 PRINTTAB(17,1)G$ ELSEIFT%=499 COLOUR1:PRINTTAB(18,0)STRIN
G$(4,CHR$228)TAB(18,1)STRING$(4,CHR$228)
  570T%=T%+1:UNTILEnd% ORT%=500:IFEnd%ENDPROC
  580PROCM("THE NUCLEUS",42,24):T%=0:BC%=128:D$=CHR$30+CHR$11:VDU19,1,4;0;
  590REPEATPROCSHIP:S%=S%+1

  600IFI%=6 COLOUR1:PRINTFG$
  610IFT%=40COLOUR129:PRINTsp$
  620IFT%>10 ANDT%<60 COLOUR3:PRINTTAB(15,0)CHR$233STRING$(8,CHR$9)CHR$233
  630IFT%=42COLOUR129:PRINTsp$:COLOUR2:PRINTTAB(19,1)CHR$245CHR$247CHR$8CHR$8CHR
$10CHR$251CHR$253
  640T%=T%+1:UNTILT%=680REnd%:IFEnd%ENDPROC
  650IFX%=19 PROCM("CONGRATULATIONS",69,48)
  660VDU19,1,2,4;0;:D%=D%+1:PROCB:ENDPROC
  670DEFPROCM(x$,a,b)BC%=128:x$=x$+"   "
  680S%=S%+250:FORQ%=1TO34:IFEnd%NEXT:ENDPROC ELSEPROCSHIP:NEXT
  690D$=CHR$0+CHR$0
  700FORQ%=39TO0-LENx$STEP-2:PROCSHIP:COLOUR2:IFQ%>=0PRINTTAB(Q%,10)LEFT$(x$,40-
Q%);
  710IFQ%<0PRINTTAB(0,10)RIGHT$(x$,LENx$+Q%)
  720IFQ%=21-LENx$ DIV2 PROCF(a,b):FORq=1TO10:PROCSHIP:NEXT
  730NEXT:D$=CHR$30+CHR$11:CLS:ENDPROC
  740DEFPROCS PROCF(3,36)
  750VDU19,3,6;0:19,2,3;0;
  760IFtr L%=5 ELSEL%=3
  770D%=9+di:X%=19:End%=FALSE:S%=-250:C%=0:F%=0:H%=0:M%=15:k%=0
  780SOUNDO,4,5,1
  790CLS:ENDPROC
```

PROGRAM FILE

```
  800DEFPROCSHIP IFF%PRINTTAB(H%.F%)" "
  810PRINTTAB(X%,26)s$:COLOURBC%:PRINTD$:X%=X%+(INKEY-65AND(X%>1))-(INKEY-2AND(X
%<38)):VDU19,2,C?&D00;0;:PRINTTAB(X%,26)S$:C=(C+1)MOD12:IFINKEY-74ORF%PROCFIRE:I
FF%PRINTTAB(H%.F%)R$
  820REPEATUNTILTIME>s%:TIME=0:MOVEX%*32+16.208:C%=POINT(X%*32+16.208)+POINT(X%*
32+48,208):IFC%=0 ENDPROC
  830IFC%=4 S%=S%+100*RND(3):SOUND18,1,223.1:ENDPROC
  840IFC%=6 M%=M%+4:SOUND17,3,20.3:IFM%>20M%=20
  850IFC%=6 ENDPROC
  860PROCex:ENDPROC
  870DEFPROCFIRE IFF%THEN890
  880IFM%=0ENDPROC ELSEF%=24:H%=X%+k%:M%=M%-1:SOUND19,2,100,10:k%=k%EOR1:ENDPROC
  890F%=F%-1:C%=POINT(H%*32+16.1008-32*F%)+POINT(H%*32+16,1040-32*F%):IFC%<>0 PR
INTTAB(H%-1,F%-1)E$:SOUND16,1,4,4:SOUND0.4,5,2:S%=S%+50*C%:PRINTTAB(H%-1,F%-2)e$
:F%=FALSE
  900IFF%=2 PRINTTAB(H%.F%)" ":F%=FALSE
  910ENDPROC
  920DEFPROCI di=1
  930A$=CHR$17+CHR$1+CHR$239+CHR$240+CHR$8+CHR$8+CHR$10+CHR$241+CHR$242
  940M$=CHR$17+CHR$3+CHR$243+CHR$243+CHR$8+CHR$8+CHR$10+CHR$244+CHR$244
  950S$=CHR$17+CHR$3+CHR$17+CHR$128+CHR$234+CHR$235+CHR$8+CHR$8+CHR$10+CHR$236+C
HR$237
  960s$="  "+CHR$8+CHR$8+CHR$10+"  "
  970G$=CHR$17+CHR$3+CHR$224+CHR$17+CHR$2+CHR$225+CHR$225+CHR$225+CHR$225+CHR$17
+CHR$3+CHR$226
  980g$=CHR$17+CHR$1+CHR$228+CHR$228+CHR$17+CHR$2+CHR$230+CHR$230+CHR$230+CHR$17
+CHR$1+CHR$228+CHR$228
  990FG$=CHR$31+CHR$13+CHR$0+CHR$17+CHR$1+CHR$227+STRING$(13.CHR$228)+CHR$229
 1000a$=CHR$17+CHR$1+CHR$232:m$=CHR$17+CHR$3+CHR$238:R$=CHR$17+CHR$2+CHR$231
 1010e$="   "+STRING$(3,CHR$8+CHR$8+CHR$8+CHR$10+"   "):D$=CHR$30+CHR$11
 1020tr=FALSE:s%=1:X$=STRING$(3.CHR$8)+CHR$10
 1030E$=CHR$17+CHR$2+CHR$245+CHR$246+CHR$247+X$+CHR$248+CHR$249+CHR$250+X$+CHR$2
51+CHR$252+CHR$253
 1040DIMHS%(9),Names 200
 1050FORP=0 TO 9:HS%(P)=1000:$(Names+P*20)="BBC Computer":NEXT
 1060C=0:!&DF0=&20120DD0:?&DF4=&80:ENDPROC
 1070DEFPROCHI pl=10:*FX15
 1080IFtr S%=0
 1090SOUND16,0,4.20:VDU19,1,4;0;
 1100FORP=9TOOSTEP-1:IFHS%(P)<=S% pl=P
 1110NEXT:IFpl>9 GOTO1170
 1120FORP=9 TO pl+1 STEP-1
 1130HS%(P)=HS%(P-1):$(Names+20*P)=$(Names-20+20*P)
 1140NEXT:COLOUR3
 1150PRINTTAB(8,4)"YOU ARE IN THE TOP TEN !"''TAB(9)"PLEASE TYPE YOUR NAME:"'';
COLOUR129:PRINTTAB(10,9)SPC20TAB(11,9);
 1160$(Names+20*pl)=FNINPUT:HS%(pl)=S%
 1170ENDPROC
 1180DEFPROCsc COLOUR128:CLS:@%=7:VDU19.1.2;0;
 1190COLOUR3:PRINTSPC6STRING$(28,"_")''SPC11"ASTRORUN  HISCORES"'SPC6STRING$(28,
"_")
 1200COLOUR2:PRINTTAB(0,6)1;".  ";HS%(0)STRING$(25-LEN(STR$HS%(0)+$Names),".")$Na
mes
 1210COLOUR1:FORP=1TO9
 1220PRINTTAB(0,6+P*2)P+1;".  ";HS%(P)STRING$(25-LEN(STR$HS%(P)+$(Names+20*P)),".
")$(Names+20*P)
 1230NEXT:PROCwait(1000):ENDPROC
 1240DEFPROCdiff CLS
 1250PRINTTAB(11,10)"WHAT DIFFICULTY ?"TAB(4,12)"(1 TO 9 OR 'T' FOR TRAINING MOD
E)":REPEATK$=GET$:UNTIL(K$>"0" ANDK$<":")ORK$="T"
 1260IFK$="T"di=0:tr=TRUE:ENDPROC
 1270di=VALK$:tr=FALSE:ENDPROC
 1280DEFPROCspeed CLS
 1290PRINTTAB(11.15)"WHAT SPEED LEVEL ?"TAB(16,17)"(1 TO 4)":REPEATK$=GET$:UNTIL
K$>"0" ANDK$<"5"
 1300s%=4+VALK$:ENDPROC
 1310DEFPROCex SOUND16,1,6,5
 1320L%=L%-1:M%=15:h%=0:VDU19,2,3:0;
 1330PRINTTAB(X%-1,25)E$
 1340FORN=1TO2000:NEXT:IFL%=0 End%=TRUE:ENDPROC
 1350CLS:F%=FALSE
 1360X%=19:FORx%=X% TOX%-(3*L%-3)STEP-3
 1370PRINTTAB(x%,26)S$:NEXT
 1380PRINTTAB(13.30)"Score ";S%
 1390FORN=1TO2000:NEXT:CLS
 1400SOUND0,4,5.255:ENDPROC
 1410DEFPROCDS CLS:VDU19,3,6;0;
 1420IFS%>HS%(9)PROCHI:PROCsc:ENDPROC
 1430COLOUR3:PRINTTAB(12,3)"YOU SCORED ";S%
 1440PROCwait(1000):ENDPROC
 1450DEFPROCCAN COLOUR128:COLOUR1:c%=RND(5)-3:P%=P%+c%:IFP%<2 P%=2ELSEIFP%>26 P%
=26
 1460IFc%=0 PRINTTAB(P%,0)STRING$(G%," ") ELSEIFc%>0 PRINTTAB(P%-1.0)CHR$242STRI
NG$(G%-1," ")CHR$239 ELSEPRINTTAB(P%,0)CHR$240STRING$(G%-1," ")CHR$241
 1470ENDPROC
 1480DEFPROCOPT
 1490st=FALSE:TIME=0
 1500REPEATCLS
 1510VDU19,2,3;0:19,1,6;0;
 1520COLOUR1:PRINT'''TAB(10)"Press key for option"''
 1530COLOUR2:@%=8
 1540PRINT'1;" To change difficulty"
 1550PRINT'2;" To change speed"
 1560PRINT'3;" To view ship controls"
 1570PRINT'4;" To view point allocations"
 1580PRINT''TAB(8)"Or 'SPACE' to start game"
 1590K$=INKEY$(2000)
 1600IFK$="1"PROCdiff
 1610IFK$="2"PROCspeed
 1620IFK$="3"PROCcont
 1630IFK$="4"PROCpoints
 1640UNTILK$=" "ORTIME>2000
 1650IFK$=" "st=TRUE
 1660ENDPROC
 1670DEFPROCcont CLS:COLOUR3
 1680PRINTTAB(10.8)"Your controls are:"
 1690PRINT''TAB(9)"'CAPS LOCK'   - LEFT"
 1700PRINT'TAB(9)"'CTRL'         - RIGHT"
 1710PRINT'TAB(9)"'RETURN'       - FIRE"
 1720PROCwait(2000)
 1730ENDPROC
 1740DEFPROCpoints CLS:COLOUR3
 1750VDU19,1.2;0;19,3,6;0;
 1760PRINT''"POINTS FOR HITTING OBJECTS WITH MISSILES"
 1770PRINT''TAB(8)"Asteroid           - 50  points"
 1780PRINT''TAB(8)"Missile launcher - 150 points"
 1790PRINT''TAB(8)"Space mine         - 150 points"
 1800PRINT''TAB(8)"Canyon wall        - 50  points"
 1810PRINT''TAB(8)"Bonus of 100 to 300 points for"SPC10"passing through a gate"
 1820PRINT'TAB(8)"Extra missiles for passing"SPC14"through a missile launcher"
 1830PRINTTAB(3,4)A$TAB(3,7)M$TAB(3.10)m$TAB(1,17)G$TAB(3,20)M$:COLOUR129:PRINTT
AB(3,13)s$:COLOUR128
 1840PROCwait(2000):ENDPROC
 1850DEFPROCwait(T)COLOUR2:C=0:TIME=0
 1860PRINTTAB(7,30)"Press 'SPACE' to continue":*FX15
```

```
1870REPEATC=(C+1)MOD12:VDU19,2,C?&D00;0;
1880W$=INKEY$(10):UNTILTIME>T ORW$=" ":IFW$=" " sp=TRUE
1890COLOUR3:ENDPROC
1900DEFPROCA
1910sp=FALSE:IFINKEY-99THEN1960
1920REPEAT
1930PROCTITLE
1940PROCsc
1950UNTILsp
1960PROCOPT
1970IFst ENDPROC
1980GOTO1910
1990DEFPROCTITLE COLOUR128:CLS:VDU5
2000VDU19,1,4;0;19,2,0;0;19,3,3;0;
2010PROCL(218,732,51,-4):PROCL(218,732,51,0):PROCH(24,620.200)
2020PROCL(352,680,8,-8):PROCL(288,648,8,8):PROCL(352,616.8.-8)
2030PROCL(444,700,29,0):PROCH(424,680,100)
2040PROCL(552,680,24,0):PROCL(648,680,12,-8)
2050PROCL(726,680,12,-4):PROCL(678,632.12,4):PROCL(726,680,12,4):PROCL(772,632.
12,-4)
2060PROCL(824,680,24,0):PROCL(920,680,12,-8)
2070PROCL(972,680,24,0):PROCL(1060,680,24,0):PROCH(980,584,108)
2080PROCL(1120,680,24,0):PROCL(1216,680,12,-8):PROCL(1216,680,38,0):PROCH(226,5
28,1016)
2090GCOL0,1:MOVE424,400:PRINT"By K. Sangrar"
2100GCOL0,2:MOVE416,404:PRINT"By K. Sangrar"
2110VDU4:PROCwait(1000):VDU19,1,2;0;19,2,7;0;19,3,6;0;
2120ENDPROC
2130DEFPROCL(x%,y%,n%,a%)
2140IFINKEY-99 ENDPROC
2150FORN%=0TOn%
2160GCOL0,3:MOVEx%,y%:PRINTCHR$254
2170GCOL0,1:MOVEx%.y%:PRINTCHR$255
2180x%=x%+a%:y%=y%-4:NEXT
2190ENDPROC
2200DEFPROCH(x%,y%,n%)
2210IFINKEY-99 ENDPROC
2220GCOL0,3
2230FORN%=0TOn%STEP2
2240PLOT69,x%+N%.y%
2250NEXT:ENDPROC
2260DEFFNINPUT A%=0:X%=&F0:Y%=&D:CALL&FFF1:=$&DD0
2270DEFPROCB L%=L%+1:S%=S%+2000+100*M%
2280M%=20:PROCM("BONUS LIFE",21,18):ENDPROC
2290DEFPROCF(a,b)FORc=a TOa+b STEP3
2300SOUNDc?&D10,1,c?&D11,c?&D12
2310NEXT:ENDPROC
```

Commodore Honeypot

by Chris Haley

'Honeypot' is an enjoyable game for the Commodore 64 in which you must manoeuvre a bee around flowers to collect nectar for the hive.

Nectar is collected by hovering over one of the flowers which occasionally bloom and must be carried back to the hive. When you fill up the hive you move on to the next level.

However, life isn't all sweetness and honey for a bee as there's a large bird and an evil spider out to get you. Also, touching any other part of the plants is fatal as is contact with weeds; and, of course, flying into the sun is not recommended.

It's important that you visit each flower as it blooms, even though the ones furthest from the hive have the most nectar, as this will pollinate them and increase the chances of more flowers appearing when the existing ones disappear.

Read the REM statements at the beginning of the program as they contain vital coding instructions relating to Commodore's control characters. Consequently, there is no need to type these lines at all, so you should begin typing at line 900.

Make sure that you have a working joystick as this is the only way to control your bee.

```
10 REM ---------- HONEYPOT ----------
20 REM " ⌒                           "
30 REM "(C) C.S. HALEY 1984          "
40 REM " ‿                           "
50 REM COMMODORE SPECIAL SYMBOLS
60 REM "▼" CURSOR DOWN
70 REM "⅃" CURSOR UP
80 REM "▶" CURSOR RIGHT
90 REM "◀" CURSOR LEFT
100 REM "■" HOME (CURSOR)
110 REM "⅃" CLEAR SCREEN
120 REM "■" REVERSE CHARACTERS ON
130 REM "■" REVERSE CHARACTERS OFF
140 REM "■" BLACK
150 REM "■" RED
160 REM "◣" CYAN
170 REM "■" GREEN
180 REM "■" YELLOW
190 REM BECAUSE MY PRINTER DOES NOT
200 REM LIST THE CHARACTERS WHICH
210 REM REPRESENT THE COLOURS OBTAINED
220 REM USING THE COMMODORE LOGO KEY I
230 REM HAVE REPLACED THESE WHERE THEY
240 REM OCCUR IN THIS LISTING BY
250 REM ABBREVIATIONS FOR THE ACTUAL
260 REM COLOUR SHOWN IN SQUARE BRACKETS
270 REM FOR EXAMPLE [LT.GRN].
280 REM "■" DELETE - THIS ONLY OCCURS
290 REM LINE 1510 AND IS USED TO MOVE
300 REM THE SUN TO THE LEFT. TO OBTAIN
310 REM THIS, KEY IN THE LINE OMITTING
```

PROGRAM FILE

```
320 REM THE DELETES THEN CURSOR BACK TO
330 REM THE APPROPRIATE POSITION IN THE
340 REM LINE, OPEN A GAP WITH THE
350 REM THE INSERT KEY AND THEN PRESS
360 REM THE DELETE KEY.
370 REM ALL OTHER SPECIAL SYMBOLS ARE
380 REM GRAPHICS USED TO MAKE THE SCENE
390 REM THE PARTS OF THE SCENE ARE:-
400 REM LINES 57020-57070 THE WEEDS
410 REM 57075-57140 THE FLOWER PLANTS
420 REM 57150-57180 THE HONEY STORE
430 REM 58020 THE SUN
440 REM 58030 THE CLOUD
450 REM 58040-58060 THE HIVE
460 REM 58085 THE GRASS
500 REM************************************
510 REM DO NOT TYPE IN THE REMS!
520 REM************************************
900 GOSUB40000:REM GOTO INITIALISATION
989 REM START OF MAIN GAME LOOPS
990 SS=PEEK(S(30)):SB=PEEK(S(31)):FORL=0TO31
1000 FORP=3TO7:FORJ=0TODF:FORI=0TO1
1009 REM DETECT FIRE BUTTON AND BEE DIRECTION
1010 FF=PEEK(49191)
1020 BD=PEEK(49189)
1060 SO=0
1070 IFFFANDBS>0THENBS=BS-1:SO=1:POKEN(18),0:POKEN(18),129:PRINT"[illegible] ";BS
1079 REM DETECT BEE COLLISIONS
1080 SS=PEEK(S(30)):SB=PEEK(S(31))
1090 IFSSAND1THENGOTO2000
1100 IFSBAND1THENGOTO3000
1109 REM MOVE SPIDER
1110 SD=PEEK(S(0))-PEEK(S(2))
1120 X2=X2+SGN(SD)*YJ:POKES(2),X2AND255
1130 IFABS(SD)<20ANDY2>SHTHENY2=Y2-YJ:GOTO1150
1140 IFY2<235THENY2=Y2+YJ
1150 POKE(S(3)),Y2
1170 POKER1,B(BD,I):POKER2,SP(I)
1174 REM MOVE BIRD
1175 X3=X3+XI:IF(X3>350)THENX3=0
1180 IF(X3AND256)THENPOKES(16),PEEK(S(16))OR4:POKES(4),X3AND255:GOTO1195
1190 POKES(16),PEEK(S(16))AND251:POKES(4),X3AND255
1195 S5=PEEK(S(5))+INT(5.5-10*RND(0)):IFS5<185ANDS5>115THENPOKES(5),S5
1200 BN=BN-ND:IFBN<0THEN5000
1210 POKES(37),BC(BN/25):POKEN(0),250-BN*2
1300 NEXT:NEXT
1399 REM GROW PLANTS
1400 SO=PEEK(S(21))
1405 IFPL(P)THEN1430
1410 IFRND(0)*10*(8-P)>FF%THEN1445
1420 PL(P)=1:FF%=FF%-8+P
1430 FX=1-FX:PRINTBL$;PP$(P);PH$(PL(P),FX);:SO=SOORPS(PL(P))
1435 PL(P)=PL(P)+1
1440 IFPL(P)>8THENSO=SOAND(NOT2↑P):POKES(39+P),4:IFPL(P)=10THENPL(P)=0
1445 SO=SOOR(PS(PL(P)))↑P:POKES(21),SO
1490 NEXT
1499 REM DISPLAY SCORES
1500 PO%=PO%+HN+BS+BN+FF%:PRINT"[illegible]";PO%;
1505 PRINT"[illegible]";FF%;" [illegible]";
1510 PRINT"[illegible]";
1520 PRINT"[illegible] ";
1530 IFBN<0THEN5000
1550 NEXT
1554 REM NIGHTFALL
1555 POKE53280,0:POKE53281,0
1560 GOTO5060
1999 REM BEE COLLISIONS WITH OTHER SPRITES
2000 IFSSAND6THEN2030
2010 FORF=3TO7:IFSSANDFP(F)THENPOKES(F+39),10:FF%=FF%+1:IFBN<100THENBN=BN+8-F
2020 NEXT:GOTO1100
2030 IF(SSAND2)AND(ABS(PEEK(S(1))-PEEK(S(3)))>15)THEN1100
2050 IFSOTHENPOKES(1),PEEK(S(1))-20:POKEN(18),0:POKEN(18),33:GOTO1100
2060 GOTO 5000:REM GOTO DEATH SCENE
2999 REM BEE COLLISIONS WITH DATA
3000 BX=PEEK(S(0)):BU=PEEK(S(16))AND1:BY=PEEK(S(1))
3010 IFBY>65ANDBY<130THEN1110
3020 IFBU=0THENIFRND(0)<CDTHEN5000
3030 IFBN>35THENBN=BN-10:HN=HN+10:GOTO3045
3040 IFHN>0THENBN=BN+10:HN=HN-10
3045 IFHN>500THEN6000
3050 PRINTBL$;H$;HS$(HN/25);:GOTO1110
4999 REM DEATH OF BEE
5000 SYS49213:POKES(3),235:POKER1,248:POKEN(4),0
5010 BY=PEEK(S(1)):DR=(235-BY)/246:POKEN(11),17
5020 FORIW=255TO10STEP-2:FORJW=0TO1
5030 BY=BY+DR:POKES(1),BY:POKEN(8),IW-JW:POKER2,SP(JW)
5040 NEXT:NEXT:POKEN(11),0:BB=BB-1
5050 IFBB>0THENBN=25:BS=11-LV:GOSUB58500:SS=PEEK(S(30)):SB=PEEK(S(31)):GOTO1010
5060 POKES(32),7:POKES(33),0:POKES(21),0
5070 PRINT"[illegible]DO YOU WANT ANOTHER GAME?[illegible]"
5080 GETA$:IFA$=""THEN5080
5090 IFA$="Y"THENGOSUB57500:GOTO990
5100 SYS10
5999 REM INCREMENT DIFFICULTY LEVEL
6000 LV=LV+1:PRINT"[illegible]";LV;"[illegible]"
6010 F1=0:POKEN(4),0:POKEN(11),0:POKEN(4),33:POKEN(11),33
6020 FORIW=0TO1:FORJW=0TO253STEP2:F1=F1+1:POKEN(1),JW:POKEN(8),F1:NEXT:NEXT
6025 POKEN(11),0:POKEN(4),0
6030 POKEN(0),200:POKEN(1),1
6040 PRINT"[illegible]
6050 DF=DF-1:IFDF<0THENDF=0
6060 BS=11-LV:IFBS<0THENBS=0
6070 YJ=YJ+1:XI=XI+1
6080 HN=100:BN=25:FF%=10:SH=SH-2
6090 ND=LV/5:CD=CD+0.1
6100 GOSUB58000
```

```
6110 GOTO990
39999 REM DISPLAY INSTRUCTIONS
40000 POKE53280,7:POKE53281,0
40010 PRINT"                    HONEYPOT":PRINT
40020 PRINT"  THE OBJECT OF THE GAME IS TO FILL THE"
40030 PRINT"HONEYCOMB IN THE HIVE WITH HONEY, USING"
40039 REM INITIALISE VARIABLES
40040 PRINT"THE BEE TO COLLECT NECTAR FROM THE "
40050 PRINT"PLANTS AS THEY FLOWER. THIS ALSO"
40060 PRINT"FERTILIZES THE PLANT AND INCREASES THE"
40070 PRINT"CHANCE OF ANOTHER PLANT GROWING. THE"
40080 PRINT"FLOWERS FURTHEST FROM THE HIVE HAVE THE"
40090 PRINT"MOST NECTAR. THE BEE DARKENS AND ITS"
40100 PRINT"BUZZ DEEPENS AS IT FILLS WITH NECTAR."
40110 PRINT"  THE BEE WILL DIE IF IT RUNS OUT OF"
40120 PRINT"NECTAR OR IF NIGHT FALLS BEFORE THE"
40130 PRINT"HIVE IS FULL. AVOID FLYING INTO PARTS"
40140 PRINT"OF PLANTS OTHER THAN THE FLOWERS AND"
40150 PRINT"DO NOT FLY INTO THE SUN."
40160 PRINT"  THE SPIDER AND BIRD WILL CATCH THE"
40170 PRINT"BEE IF THEY CAN BUT THE BEE CAN ESCAPE"
40180 PRINT"BY USING ONE OF ITS FEW STINGS."
40190 PRINT"  CONTROL THE BEE WITH A JOYSTICK IN"
40200 PRINT"PORT 2, FIRE CONTROLS THE STING."
49999 REM READ M/C AND SPRITE DATA
50000 C=0:FORK=49200TO49384
50005 READA:C=C+A:POKEK,A:NEXT
50008 READT:IFT<>CTHENPRINT"ERROR IN MACHINE CODE DATA - TOTAL =";C:STOP
50010 POKE49190,1:POKE49192,25:POKE49193,65:POKE49194,65:POKE49195,220
50015 C=0:FORK=240TO248:I=K*64:FORJ=0TO63
50020 READA:C=C+A:POKEI+J,A:NEXT:NEXT
50030 READT:IFT<>CTHENPRINT"ERROR IN SPRITE DATA - TOTAL =";C:STOP
50040 DIM S(47),B(1,1),N(29),PH$(9,1),HS$(20)
50045 FORI=0TO46:S(I)=53248+I:NEXT
50050 R1=2040:R2=2041
50060 B(0,0)=240:B(0,1)=241:B(1,0)=242:B(1,1)=243
50070 SP(0)=244:SP(1)=245
50080 FORI=0TO7:FP(I)=2↑I:NEXT
50090 FORI=0TO28:N(I)=54272+I:NEXT
50100 BC(0)=1:BC(1)=7:BC(2)=8:BC(3)=10:BC(4)=2
56000 POKEN(0),200:POKEN(1),1:POKEN(2),0:POKEN(3),7:POKEN(5),9:POKEN(6),64
56010 POKEN(19),9:POKEN(20),0:POKEN(14),170:POKEN(15),25
56020 POKEN(12),15:POKEN(13),255
56050 POKES(6),31:POKES(7),195
56060 POKES(8),79:POKES(9),195
56070 POKES(10),128:POKES(11),195
56080 POKES(12),175:POKES(13),195
56090 POKES(14),223:POKES(15),195
56100 POKES(27),1
56110 POKES(39),0:POKES(40),0:POKES(41),0
56120 POKES(29),4:POKES(30),0
56125 POKER1,240:POKER2,244:POKE2042,246:FORII=2043TO2047:POKEII,247:NEXT
57000 BL$=""
57010 PP$(3)="":WP$(0)=""
57020 FORI=1TO4:PP$(3+I)=PP$(2+I)+"":WP$(I)=WP$(I-1)+"":NEXT
57030 WH$(0)=""
57040 WH$(1)=""
57050 WH$(2)=WH$(1)+""
57060 WH$(3)=WH$(0)+""
57070 WH$(0)=WH$(0)+"↑":WH$(1)=WH$(1)+"↑":WH$(4)=WH$(1)
57075 PH$(0,0)="":PH$(0,1)=""
57080 PH$(1,0)="[LT.GRN.]":PH$(1,1)=PH$(1,0)
57090 PH$(2,0)="[LT.GRN.]":PH$(2,1)="[LT.GRN.]"
57100 PH$(3,0)="[LT.GRN.]":PH$(3,1)="[LT.GRN.]"
57110 PH$(4,0)="[LT.GRN.]":PH$(4,1)="[LT.GRN.]"
57120 PH$(5,0)="":PH$(5,1)="":PH$(6,0)="":PH$(6,1)="":PH$(7,0)="":PH$(7,1)=""
57130 PH$(8,0)="":PH$(8,1)=PH$(8,0)
57140 PH$(9,0)="":PH$(9,1)=PH$(9,0)
57150 H$=""
57160 HS$(0)="":HS$(1)="":HS$(2)="":HS$(3)="":HS$(4)=""
57170 FORI=5TO17STEP4:FORII=ITOI+3
57180 HS$(II)=""+HS$(II-4):NEXT:NEXT
57500 FF%=10:BB=3:PO%=0
57510 DF=4:CD=0.2:ND=0.2:LV=1
57520 BS=10:HN=100:BN=25
57530 VJ=4:SH=188
57540 FORI=0TO9:PS(I)=0:NEXT:PS(5)=2:PS(6)=2:PS(7)=2
57550 XI=10
57800 PRINT"        [ORANGE]PRESS ANY KEY TO CONTINUE"
57810 GETA$:IFA$=""THEN57810
57999 REM SET UP SCREEN
58000 FORI=3TO7:PL(I)=INT(RND(0)*19)-10:IFPL(I)<0THENPL(I)=0
58010 NEXT:FORII=42TO46:POKES(II),4:NEXT
58015 POKES(32),6:POKES(33),6
58020 PRINT""
58030 PRINT"[LT.GREY]"
58040 PRINT"";BL$;"";
58050 PRINT"[BROWN][ORANGE]"
58055 PRINT"[BROWN][ORANGE]"
58060 PRINT"[BROWN][ORANGE]"
58065 PRINTBL$;H$;HS$(HN/25)
58070 FORIW=0TO4:PRINTBL$;WP$(IW);WH$(IW);BL$;PP$(IW+3);
58080 FORJW=0TOPL(IW+3):PRINT"";PH$(IW,0);:NEXT:NEXT
58085 PRINTBL$;""
58500 POKES(2),80:POKES(3),235:Y2=235:X2=60
58510 POKES(0),30:POKES(1),190:POKES(16),1
58520 POKES(4),0:POKES(5),132:X3=0
58530 POKES(28),1:POKES(37),7:POKES(38),1
58540 PRINT"STINGS     SCORE      SEEDS      BEES  ";
58550 PRINT"";BS;
58560 PRINT"";PO%;
58570 PRINT"";FF%;" ";
58580 PRINT"";BB;""
58600 POKES(21),7:POKEN(24),15:POKEN(4),0:POKEN(4),65:SYS49200
59000 RETURN
59999 REM INTERRUPT SPRITE ROUTINE
```

PROGRAM FILE

```
60000 DATA 120,169,74,141,20,3,169,192,141,21,3,88,96,120,169,49
60010 DATA 141,20,3,169,234,141,21,3,88,96,72,138,72,152,72,169
60020 DATA 0,141,39,192,173,144,220,170,41,16,208,5,169,1,141,39
60030 DATA192,138,41,8,208,39,169,1,141,37,192,173,16,208,74,144,8,173,0,208,205
60040 DATA 41,192,176,20,173,0,208,24,109,38,192,141,0,208,144,8
60050 DATA173,16,208,9,1,141,16,208,138,41,4,208,39,169,0,141,37,192,173,16,208
60060 DATA 74,176,8,173,0,208,205,40,192,144,20,173,0,208,56,237
60070 DATA 38,192,141,0,208,176,8,173,16,208,41,254,141,16,208,138
60080 DATA 41,2,208,15,173,1,208,205,43,192,176,7,24,109,39,192
60090 DATA 141,1,208,138,41,1,208,15,173,1,208,205,42,192,144,7
60100 DATA 56,237,38,192,141,1,208,104,168,104,170,104,76,49,234,20165
60999 REM BEE1 SPRITE
61010 DATA 0,0,0,128,0,0,128,0,0,32,0,0,33,64,0,37
61020 DATA 69,0,37,85,64,57,85,0,170,85,0,41,85,160,41,105
61030 DATA 105,1,105,105,2,105,105,0,169,104,0,41,160,0,130,32
61040 DATA 0,130,32,2,8,8,2,32,2,0,0,0,0,0,0,0
61099 REM BEE2 SPRITE
61100 DATA 1,1,0,5,69,64,5,85,0,129,85,0,129,84,0,32
61110 DATA 68,0,34,168,0,33,106,0,41,105,128,57,105,96,169,105
61120 DATA 104,41,105,105,34,105,105,0,169,105,0,41,160,0,34,32
61130 DATA 0,130,32,0,136,32,0,136,8,0,0,0,0,0,0,0
61199 REM BEE3 SPRITE
61200 DATA 0,0,0,0,0,2,0,0,2,0,0,8,0,1,72,0
61210 DATA 81,88,1,85,88,0,85,108,0,85,170,10,85,104,105,105
61220 DATA 104,105,105,64,105,105,128,41,106,0,10,104,0,8,130,0
61230 DATA 8,130,0,32,32,128,128,8,128,0,0,0,0,0,0,0
61299 REM BEE4 SPRITE
61300 DATA 0,64,64,1,81,80,0,85,80,0,85,65,0,21,65,0
61310 DATA 17,8,0,41,136,0,169,72,2,105,104,9,105,108,41,105
61320 DATA 106,105,105,104,105,105,136,105,106,0,10,104,0,8,136,0
61330 DATA 8,130,0,8,34,0,32,34,0,0,0,0,0,0,0,0
61399 REM SPUG1 SPRITE
61400 DATA 0,0,0,0,0,0,0,0,0,0,0,0,6,0,24,9
61410 DATA 0,36,9,0,36,19,0,50,21,158,106,21,173,106,20,201
61420 DATA 202,20,109,138,20,63,10,4,30,8,4,0,8,0,0,0
61430 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
61499 REM SPUG2 SPRITE
61500 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,6
61510 DATA 0,24,15,0,60,13,128,44,13,158,108,21,173,106,20,228
61520 DATA 202,20,109,138,20,63,10,15,30,2,15,0,2,0,0,0
61530 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
61599 REM BIRD1 SPRITE
61600 DATA 0,56,0,6,252,0,31,126,0,15,191,0,7,223,128,3
61610 DATA 239,0,129,254,0,231,255,136,255,255,244,127,255,247,127,255
61620 DATA 254,127,255,255,255,255,236,227,255,128,128,31,0,0,9,0
61630 DATA 0,4,128,0,2,64,0,7,112,0,10,168,0,0,0,0
61699 REM FLOWER SPRITE
61700 DATA 0,8,0,0,28,0,0,62,0,3,190,224,7,221,240,7
61710 DATA 221,240,7,235,240,3,235,224,12,255,152,31,62,124,63,255
61720 DATA 254,31,62,124,12,255,152,3,235,224,7,235,240,7,221,240
61730 DATA 7,221,240,3,190,224,0,62,0,0,28,0,0,8,0,0
61799 REM DEAD BEE SPRITE
61800 DATA 0,0,0,0,0,0,0,136,8,0,136,32,0,130,32,0
61810 DATA 34,32,0,41,160,0,169,105,34,105,105,41,105,105,169,105
61820 DATA 104,57,105,96,41,105,128,33,106,0,34,168,0,32,68,0
61830 DATA 129,84,0,129,85,0,5,85,0,5,69,64,1,1,0,0,33079

READY.
```

BBC Function key lister

by A Wood

'Function key lister' is a short and simple program to display the contents of the BBC's function keys. Instructions: type it in and enter RUN.

```
10REM  Function key lister
20REM  January 1984     By A.C.G.Wood
30FORQ%=0TO3STEP3
40P%=&D02
50[OPTQ%
60.keyshow
70LDA#&FF:STA&72
80LDY&70
90SEC:CPY#16:BCC D:RTS:.D
100LDA&B00,Y
110CMP#&FF:BNE L0
120STA&71:STA&72:SEC:BCS P
130.L0 STA&71
140LDY#0
150.L1
160CPY&70:BEQ next
170LDA&B00,Y
180SEC
190CMP&71
200BCC next
210SEC
220CMP&72
230BCS next
240STA&72
250.next INY
260CPY#&11
270BNE L1
280.P
290LDA#32:JSR&FFEE
300LDA#ASC"*":JSR&FFEE
```

```
310LDA#ASC"K":JSR&FFEE
320LDA#ASC"E":JSR&FFEE
330LDA#ASC"Y":JSR&FFEE
340LDA&70:SEC:CMP#10:BPL L2
350CLC:ADC#ASC"0":JSR&FFEE:SEC:BCS L3
360.L2 TAY:LDA#ASC"1":JSR&FFEE:TYA
370CLC:ADC#ASC"0"-10:JSR&FFEE
380.L3 LDA#34:JSR&FFEE
390LDY&71
400SEC:CPY&72:BEQ L6
410.L5 LDA&B01,Y:SEC:CMP#32:BPL L4
420TAX:LDA#ASC"|":JSR&FFEE
430TXA:CLC:ADC#64
440.L4 JSR&FFEE
450INY:CPY&72:BNE L5
460.L6 LDA#34:JSR&FFEE:JSR&FFE7:RTS
470.list LDA#0:STA&70
480.K1 JSR keyshow:INC&70:LDY#16:CPY&70:BNE K1:RTS
490J:NEXT
```

Apple II Menu

by Mike Norris

This neat little routine for Apple users prsents a menu of options on the screen with one displayed in reverse mode. This option can be selected by pressing the RETURN key, or you can move on to another option by pressing the space bar. This then highlights the next choice down in reverse mode, and so on.

Pressing the space bar when the last menu item is highlighted returns you to the first option.

The programs referee feels that it will help a user in selecting the right menu option, as the highlighting focuses attention on one item at a time.

```
120   LET STROBE =  - 16368: LET KEY =  - 16384
140   DIM MENU$(10)
160   DATA 5
180   DATA     *** MAIN MENU  ***
200   DATA GO FOR A WALK
220   DATA PLAY WITH THE COMPUTER
240   DATA WATCH T.V.
260   DATA READ A BOOK
280   DATA EXIT
300   REM
400   READ MANY
420   FOR J = 0 TO MANY
440   READ MENU$(J)
460   NEXT J
500   REM
520   GOSUB 10000
540   HOME : VTAB 10
560   PRINT "SO YOU WANT TO ";MENU$(CHOICE)
580   VTAB 23
600   END
990   REM
10000  REM  MENU
10020  HOME : VTAB 2: HTAB 20 -  LEN (MENU$(0)) / 2
10040  INVERSE : PRINT MENU$(0): NORMAL
10060  LET MODE = 0
10080  FOR J = 1 TO MANY
10100  GOSUB 20000
10120  NEXT
10140  VTAB 24: HTAB 1
10160  PRINT "SPACE BAR TO CHOOSE. RETURN TO GO";
10180  LET CHOICE = 1
10200  LET MODE = 1: LET J = CHOICE: GOSUB 20000
10220  POKE STROBE,0
10240  LET HIT =  PEEK (KEY)
10260  IF HIT < 128 THEN  GOTO 10240
10280  LET HIT = HIT - 128
10300  IF HIT <  > 13 AND HIT <  > 32 THEN  GOTO 10220
10320  IF HIT = 13 THEN  RETURN
10340  LET MODE = 0: LET J = CHOICE: GOSUB 20000
10360  LET CHOICE = CHOICE + 1
10380  IF CHOICE > MANY THEN  LET CHOICE = 1
10400  GOTO 10200
19990  REM
20000  REM PRINT OPTION 'J'
20020  VTAB 2 * J + 4: HTAB 20 -  LEN (MENU$(J)) / 2
20040  IF MODE = 1 THEN  INVERSE
20060  PRINT MENU$(J)
20080  NORMAL
20100  RETURN
29990  REM
63000 D$ =  CHR$ (4): PRINT D$: PRINT D$;"SAVE MENU2"
```

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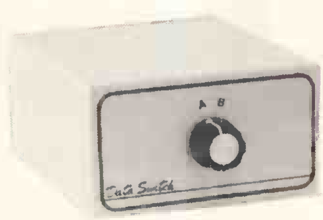

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BACK ISSUES SERVICE

Here is a guide to PCW back issues. Hardware reviews/Benchtests are indexed by manufacturer, software by product name.

HARDWARE

A

MANUFACTURER	PRODUCT	ISSUE
Acorn	Speech System	January 1984
Acorn	Electron	October 1983
Acorn	BBC Micro	January 1982
Acorn	Teletext Adaptor	April 1984
Acorn	BBC Speech Chips	April 1983
ACT	Apricot	October 1983
ACT	Sirius 1	February 1982
Adman Electronics	Adman Speech Synthesiser	January 1984
AGF	Programmable Joystick	December 1983
AMS	Disc Drive : 3in	January 1984
Apple	Lisa	July 1983
Apple	III	May 1982
Apple	Macintosh	March 1984

B

British Micro	Mimi 801	July 1982
Brother	EP44	April 1984

C

C/WP	Cortex	December 1983
Camputers	Lynx	March 1983
Canon	AS-100	December 1983
Canon	CX-1	November 1982
Canon	X-07	March 1984
Casio	PB-100	May 1983
Casio	fx-9000p	February 1983
Casio	602p	May 1982
Casio	FP-10 Printer	April 1982
Coleco	Adam	April 1984
Commodore	715	January 1984
Commodore	64	May 1983
Compudata	Tulipsystem 1	October 1983
Conchess	Monarch/Ambassador/ Escourter	March 1983
Corvus	Concept	March 1983
Currah	Microspeech Unit	January 1984

D

Dacom Systems	Buzzbox	January 1984
DCP Microdevelopments	Speech Pack	August 1982
Digihurst	Microsight 1	October 1983
Digital Equipment	Rainbow 100	November 1982
Dragon Data Ltd	Dragon 32	August 1982

E

Eaca International	Colour Genie	June 1983
Electroni-Kit	FX System	November 1983
Electroplay	My Talking Computer	November 1983
Epson	QX-10	July 1983
Epson	HX-20	December 1982
Epson	FX-80	July 1983
Epson	PX-8	June 1984

F

Ferranti	Argus PPC	November 1983
Fidelity	Prestige	February 1983
Fortune	Fortune 32:16	August 1983
Future	FX20	October 1983

G

Gavilan	Gavilan MC	February 1984
GCE	Vectrex System	August 1983
GCS	Ferrett	June 1984
Gemini	Multiboard	February 1982
GRiD	Compass	June 1984
Gulfstream	Hyperion	October 1983

H

Hewlett-Packard	HP-75C	November 1982
Hewlett-Packard	15C and 16C	September 1982
Hewlett-Packard	HP86	October 1982
Hewlett-Packard	HP-125	April 1982
Hewlett-Packard	HP-IL	March 1982
High Tech Electronics	Sid 1 Colour Board	April 1982
Hitachi	MB16001	June 1983
Hitachi	Peach	May 1982

I

IBM	9000 Instrumentation Computer	March 1983
IBM	PC Junior	March 1984
Ikon	Hobbit	January 1984
IO Research Ltd	Pluto	December 1982

J

Jonos	Jonos	April 1984
Jupiter Cantab	Ace	January 1983

L

LSI	M-Four	April 1983

M

Magus Computer Systems Ltd	Add-On Graphics Board	September 1983
Mannesmann Tally	MT160L Dot-Matrix Printer	August 1983
Mattel	Aquarius	November 1983
Microwriter Ltd	Microwriter	September 1982
Milton Bradley	Phantom	July 1983
Monroe	Monroe 8820	April 1982
Motorola	MC68000	December 1982
Multitech	Micro-Professor II	September 1983

N

NCR	Decision Mate V	August 1983
NEC	PC-8201A	December 1983
NEC	APC	September 1983
Notting Dale Itec	G007 Graphics Module	March 1983
Novag	Constellation	October 1983

O

Olivetti	M20	September 1982
Oric Products	Oric I	April 1983
Osborne	Executive	July 1983

P

Positron	9000	October 1982

R

Robocom Ltd	Bit Stik	November 1982

S

Sage	II	February 1983
Scisys	Chess Champion Mark 5	January 1983
Semi-Tech	Pied Piper	September 1983
Sharp	MZ-700	February 1984
Sharp	PC 1251	February 1983
Sharp	PC 1500	June 1982
Sharp	MZ-80A	June 1982
Sharp	MZ-80A	April 1984
Shelton Instruments	Sig/Net	April 1983
Sinclair	Microdrive	October 1983
Sinclair	ZX Spectrum	June 1982
Sinclair	ZX81 Printer	January 1982
SMT	Goupil-3	December 1983
Sord	M5	August 1983
Sord	Exleigh Expert	August 1982
Spectravideo	SV-318 and SV-328	March 1984

T

Tandata	Homedeck	April 1984

T

Tandy	MC-10	November 1983
Tandy	Model 100	August 1983
Texas Instruments	TI Professional	May 1983
Texas Instruments	TI-88	July 1982
Texas Instruments	TI-99/4A	March 1982
Texas Instruments	TI-59	January 1983
Torch Computers	Torch	January 1983
Tradecom	Newbrain AD	July 1982
Tycom	Microframe	January 1984

W X

Walters Microsystems	120 Printer	December 1982
Watanabe	Personal Plotter	February 1982
Wave Mate	Bullet	February 1984
William Stuart Systems	Chatterbox	January 1984
Wren Computers	Wren	April 1984
Xerox	16/8	February 1984
Xerox	820	January 1982

SOFTWARE

PROGRAM	ISSUE
1-2-3	April 1984
1-2-3	November 1983
1982 Database Roundup	December 1982
1983 Database Roundup	December 1983
1983 Spreadsheet Roundup	December 1983
A	
Accountancy Programs (General)	June 1983
Aquila	September 1982
B	
Benchmarks Explained (Reference Article)	January 1984
Beta	August 1983
Brainstorm	February 1984
Busifile	January 1984
Busipost	February 1983
C	
Cardbox	August 1982
Color Scarfman	December 1982
Condor Database	November 1982
D	
Databases (Choosing One)	March 1982
Dataplan	August 1983
Dataprism	March 1983
DBMS2	June 1982
Delta	October 1983
Desq	December 1983
DMS	March 1982
Dragon Disks	June 1984
E	
E40	September 1982
Ecalc	July 1983
Everyman	February 1984
Expert-Ease	June 1984
F	
Falc	January 1984
Financial Director	June 1983
FMS80	April 1982
Freqout	February 1982
H	
Homeword	February 1984
HP41-C Text Editor	November 1982
Home Accounts/Finance Manager	January 1984

I L	
Information Management	April 1984
Infostar	September 1983
Lisawrite	August 1983
M	
Master Planner	April 1984
Master Planner	October 1983
Mathemagic/Graphmagic	August 1983
Micro FCS	October 1983
Micropen	May 1983
Microscript	May 1983
Microtax	July 1983
MS-DOS & CP/M-86	October 1982
MS-DOS 2	May 1983
Moneywise	June 1984
Multiplan	April 1983
O	
Omnis	July 1983
Open Access	June 1984
Optimum	November 1983
P	
Peachcalc	March 1984
Pearl	October 1982
Perfect Calc	October 1983
Personal Data Base	March 1984
Petspeed	April 1983
Plannercall	May 1983
Prophet II	March 1983
R	
Rescue	April 1983
Revelation	April 1984
S	
Sage 400 (Accounting)	October 1983
Scred	August 1983
Scripsit 2.0	February 1982
Search and Find	December 1983
Select	September 1982
Silicon Office	July 1982
System Builder	June 1984
Software Various	April 1984
Superdeflex	January 1983
Superfile	January 1983
T	
The Financial Planner	December 1983
The Spreadsheet	September 1983
TKI Solver	February 1984
Tomorrow's Office	June 1983
V	
View	August 1983
Visi On	November 1983
Visi Calc	June 1983
Visuall	February 1984
Vu-Calc (for Spectrum)	September 1983
W	
Word Handler II	March 1983
Word	June 1984
Wordspell	March 1984
Workslate	January 1984
dBase II	May 1982

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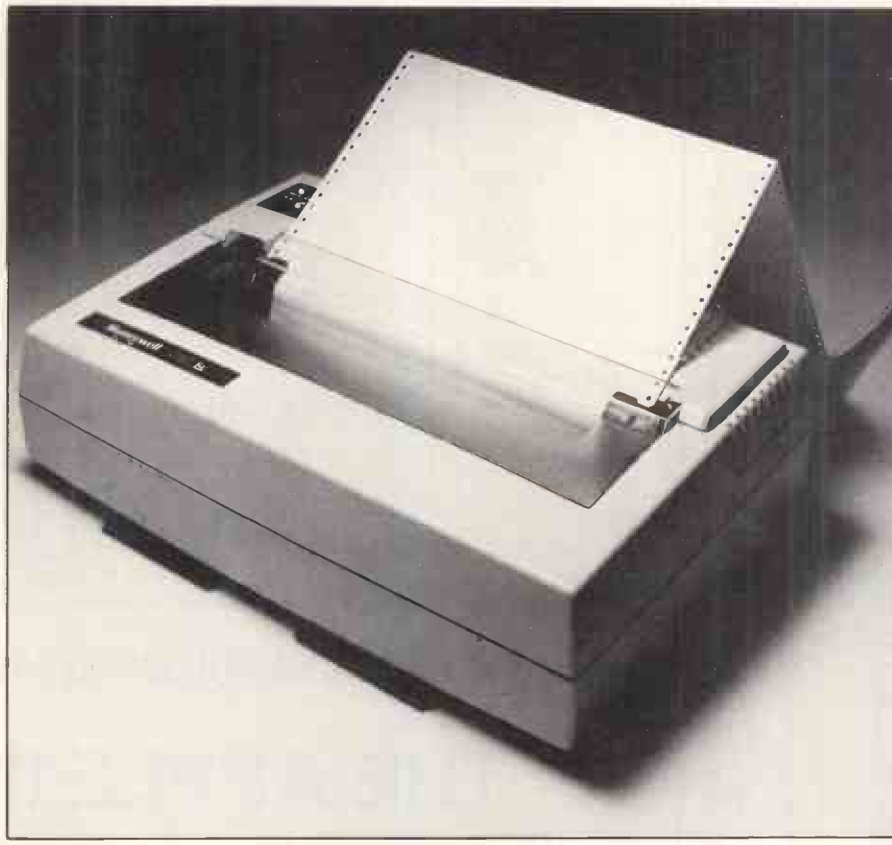

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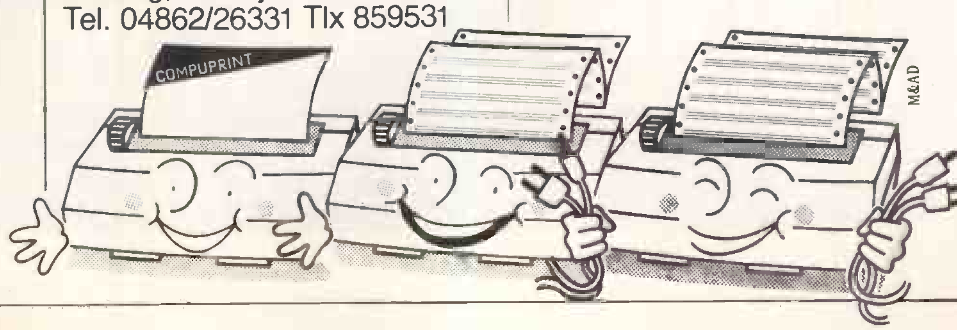

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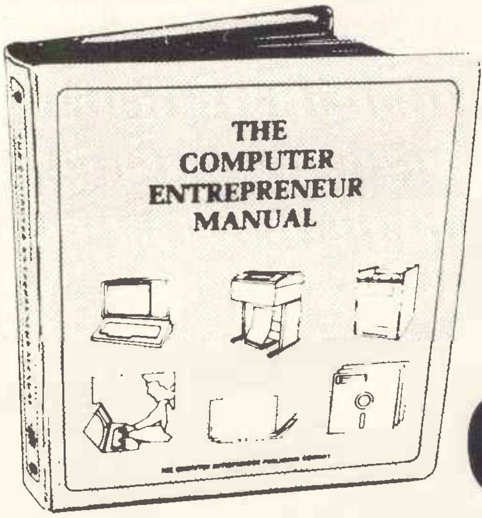

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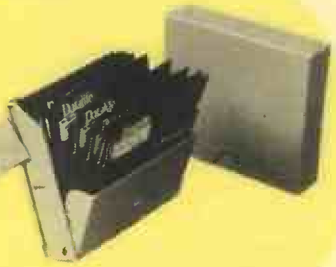

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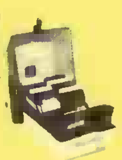

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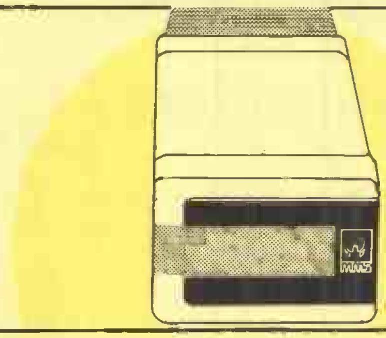

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You may leave the rest to US!!

URGENT ORDERS

If you're posting your order omit the word FREEPOST from our address, and use our normal post code GU30 7EJ and do not forget to stamp it First Class. If you are telephoning your order please make it clear that you wish to pay for your goods to be sent to you by First Class Post.

FIRST CLASS RATES

EXC VAT	5¼″	8″
First Ten-Pack	2.00	2.50
2nd and subsequent Ten-Pack	1.50	2.00

TRADE CORNER FREE AEROPLANE

Don't keep sitting there in front of your VDU, get outside and fly our aeroplane. Just call and ask for your flier, and we'll send you our latest trade pack with prices, special offers and sample unlabelled diskette and mailer. We'll also enclose a DPC application form telling you how to buy at our 10,000 prices yet order only in 50's.

BARGAIN CORNER

5¼" SUPERLUXE DISK LIBRARIES

Diskette binders at £4.90 each (normally £9.90) p&p 50p each. 10+ post free

5¼" DISKETTES

Supplied in a FREE SEE 10 library box

PRICES EXC VAT	10-40	50-90	100+
S/S 48 tpi Diskettes	13.90	12.90	11.90
D/S 48 tpi Diskettes	20.90	19.90	18.90

Don't be fooled – these diskettes are brand new and come with our normal full money-back guarantee. They are mostly non hub ring labelled or unlabelled BASF, Dysan, Rhone Poulenc, Memorex etc. where the boxes have had the cellophane removed. We are even supplying them in a FREE SEE 10 library box!! At these prices you can't lose – Hurry!

To: DISKING FREEPOST, Liphook, Hants, GU30 7BR. U.K

Qty	Description	Price exc VAT

Total Goods Value exc VAT
Total Delivery and insurance
Sub Total exc VAT
VAT
Value of cheque payable to Disking

NAME:
ADDRESS:
TEL NO:
Or please charge my credit card No

Access, VISA & Diners Cards Welcome

spectrum

NEWS! NEWS! NEWS!

Sensational Commodore Offers

We've five fantastic offers on Commodore's micro pacesetters – for the home or the home office. If you've been thinking of a home computer – or an add-on for your own Commodore – now's the time!

Spectrum's specialist Home Computer Centres are probably the UK's leading Commodore dealers – and with offers like these, it's not hard to see why!

We've an extra special bonus, too –take the coupon to your Spectrum dealer for a full 50p off a host of top software titles for the Commodore CBM64, SX-64 and VIC-20.

So hurry along to your local SPECTRUM Home Computer Centre NOW – we're nationwide so there's a store near you. With savings like these you can't afford to miss out!

Now in stock!

Double your disc capacity with the

OPUS Dual Density Disk Interface Kit for the BBC Model 'B'

£120

Incredible value for money!

Commodore SX-64

Portable Package

SAVE OVER £525

All this for only £799

What a great deal for the small business, or the executive on the move! We've SLASHED THE PRICE of this complete, ready-to-use package featuring the incredible Commodore SX-64 Portable Colour Computer. It has a powerful 64K RAM memory, plus a detachable, full-function keyboard plus built-in disk drive AND colour monitor.

Not only that – the package also includes an MPS-801 dot matrix Printer, plus 3 popular business pro grams – Easy File, Easy Script word-processing and Easy Stock.

All this can be yours at a truly amazing £525 off our normal list Price – at Spectrum NOW!

Includes:
Commodore SX64 Portable Computer
Plus!
MPS 801 Printer & 3 Popular business programs Easy file, Easy script & Easy stock.

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

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Up to £1000 Instant Credit

● There's up to £1,000 worth of Instant Credit available on a Spectrum Chargecard. See your local SPECTRUM dealer for written details (UK mainland only) Typical APR -29.8%

Latest News

for up to date news, information & offers from SPECTRUM - see PRESTEL page 600181 for details

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Micro Dealer UK's TOP 50

Britains No.1 Weekly Software Chart

PROGRAM	SUPPLIER	MACHINE	PRICE
Tornado Low Level	Vortex	Spectrum	£5.95
Tales of the Arabian Knights	Interceptor	CBM 64	£7.00
Sabre Wolf	Ultimate	Spectrum	£9.95
Beach Head	Access	CBM 64	£9.95
Lords of Midnight	Beyond	Spectrum	£9.95
War of the Worlds	CRL	Spectrum	£5.95
Mugsy	Melbourne House	Spectrum	£6.95
Full Throttle	Micromega	Spectrum	£6.95
Trashman	Quicksilva	CBM 64	£7.95
World Cup	Artic	Spectrum	£6.95
Valhalla 64	Legend	CBM 64	£14.95
House of Usher	Anirog	Spectrum	£6.95
Psytron	Beyond	Spectrum	£7.95
Son of Blagger	Alligata	CBM 64	£7.95
Air Traffic Control	Microgen	Spectrum	£9.95
3D Tank Duel	Real Time	Spectrum	£5.95
Jack & the Beanstalk	Thor	Spectrum	£5.95
Jet Set Willy	Software Projects	Spectrum	£5.95
Kosmic Kanga	Micromania	Spectrum	£5.95
Encounter	Novagen	CBM 64	£9.95
Android 2	Ocean	CBM 64	£6.90
Titanic	R & R Software	Spectrum	£7.95
Match Point	Psion	Spectrum	£7.95
Hulk	Adventure International	CBM 64	£9.95
Fighter Pilot	Digital	Spectrum	£7.95
Worse Things Happen at Sea	Silversoft	Spectrum	£5.95
Factory Breakout	Poppysoft	Spectrum	£5.95
Star Trooper	Melbourne House	CBM 64	£6.95
Sheep in Space	Llamasoft	CBM 64	£7.50
Blue Thunder	Richard Wilcox	CBM 64	£6.95
Flight Path 737	Anirog	VIC 20	£7.95
Oracles Cave	Dorcas	CBM 64	£6.95
Football Manager	Addictive	CBM 64	£7.95
Micro Olympics	Micro User	BBC	£5.95
Beaky & the Eggsnatchers	Fantasy	CBM 64	£7.50
Gilligans Gold	Ocean	CBM 64	£6.90
Atic Atac	Ultimate	Spectrum	£5.50
Flight Path 737	Anirog	CBM 64	£7.95
Micro Olympics	Micro User	Spectrum	£5.95
Stock Car	Micro Power	BBC	£7.95
Cybertron Mission	Micro Power	CBM 64	£7.95
Stop the Express	Sinclair	Spectrum	£5.95
Aviator	Acornsoft	BBC	£14.95
Heathrow ATC	Hewson	CBM 64	£7.95
Automania	Microgen	CBM 64	£7.95
Felix in the Factory	Micro Power	CBM 64	£7.95
Star Blitz	Softek	Spectrum	£6.95
Skull	Games Machine	CBM 64	£7.95
Code Name Mat	Amsoft	Amstrad	£8.95
Hunter Killer	Amsoft	Amstrad	£8.95

Amstrad Software all at £8.95

EDUCATIONAL SOFTWARE	Time Man 2	Roland on the ropes	3-D Invaders
Wordhang	Map Rally	Electron 22622	Alien Break-In
Happy Numbers	ARCADE GAMES	Gems of Stradus	Atom smasher
World Wise	Home Runner	Chess	Electro Freedy
Animal,Vegetable,Mineral	Harrier Attack	Laser Wrap	Fire Blaster
Happy Letters	Sultans Maze	Haunted Hedges	Admiral Graf Spee
Happy Writing	Spanner Man	Codename Matt	Star Commands
Time Man 1	Oh Mummy	Xanagrams	Crazy Golf
	Roland In Care	Hunter Killer	Punchy

BBC Model B

Package Offer

HURRY!
Offer extended
WHILE STOCKS LAST

Including FREE!

- BBC Cassette recorder
- 5 pieces of software

when you purchase a BBC 'B' from Spectrum.

The BBC MODEL B, probably the most flexible personal microcomputer available today. Using powerful BBC BASIC, the BBC B is widely accepted as providing the educational standard for computer learning.

The model B features a variety of interface ports allowing easy connection not just of ordinary peripherals but also second processors or devices to give access to teletext or prestel services.

SPECTRUM PRICE

£399

Opus Disk Drive For BBC 'B'

Here's the very latest in 5¼" disk drives for your BBC Micro.

The Opus 5401 is a single-sided 40 Track drive with direct-drive and microprocessor control. This reliable and advanced drive has our 1-Year guarantee.

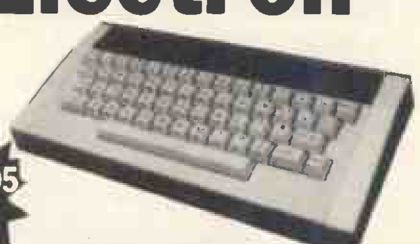
Call in at your local Spectrum dealer and ask for the product by name.

SPECTRUM PRICE **£149.95**

Including: MANUAL & UTILITIES DISC.

Acorn Electron

The Electron gives high quality graphics output to either colour T.V. or monitor. Sound can be generated through the internal loudspeaker. The Electron comes complete with a free introductory cassette, containing 19 free programmes and two manuals - the User Guide and "Start programming with the Electron".



SPECTRUM PRICE **£199.95**

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

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Up to £1000 Instant Credit

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Latest News

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Everything you've ever wanted for your ZX Spectrum

DK'Tronics Keyboard

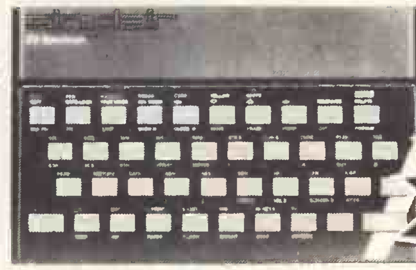
for ZX Spectrum

SPECTRUM PRICE

£45

D'Ktronics Lightpen £19.95
D'Ktronics Dualport Joystick Interface £13.00
D'Ktronics Portable Joystick Interface £22.95

ZX Spectrum 48K



SPECTRUM PRICE

£129.95

Quickshot MkII Joystick

SPECTRUM PRICE

£11.95

STONECHIP ACCESSORIES

ECHO AMPLIFIER For the ZX SPECTRUM £19.95

Programmable Joystick Interface £24.95

Coming soon SPECTRUM KEYBOARD WITH SOUND NO NEED TO TAKE YOUR SPECTRUM APART £59.95

Prism VTX 5000 Modem

NOW, YOUR ZX SPECTRUM IS YOUR KEY TO THE WORLD with the incredible PRISM VTX 5000 MODEM

- Versatile modem for ZX Spectrum (16K or 48K) versions
- Slim design fits easily, matches your micro
- Instant access to Prestel™ & Micronet 800 information services
- Instant communication with other ZX Spectrum users

SAVE £20

Sensational Summer Price

£79.95

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SPECTRUM PRICE

£69.95

ALPHACOM 42 For Dragon, BBC, Commodore, Atari (Interfaces extra)
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Paper Rolls for Alphacom Printers
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CURRAH Speech Synthesiser . £29.95
DK'TRONICS Lightpen £19.95
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STACKLIGHT Rifle with 3 FREE GAMES............... £27.50

Sinclair ZX INTERFACE 2
The new ROM Cartridge/Joystick Interface. Loads programs instantly! Takes two joysticks! Just plug in and play. **ONLY £19.95**
Plus New ROM cartridge software.

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

Computer Dealers

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The new Electron from Acorn. Ask any child at school why it's worth £199.

Most British children have one thing in common with the new Electron microcomputer: they speak the same language.

You see, the Electron is the first micro remotely in this price range to use BBC Basic, the computer language that is rapidly becoming the standard in British schools.

But that's not all. Most children will feel at home with the Electron as soon as they lay hands on it.

This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

So now children will be able to continue their computer studies at home. They'll be able to use the same educational programs they use at school. And, if asked nicely, they'll be able to help willing adults take their first steps into computing.

All this for only £199.

<u>A micro technology break-through.</u>

And now a few reasons for adults why the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result, the Electron delivers twice as many characters across the screen as its closest competitor.

<u>Built to last and to grow.</u>

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style: robustly constructed with a good, solid 'feel.' It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

<u>A gentle teacher.</u>

The Electron plugs straight into virtually any TV set and cassette player so you will be

ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.

<u>A free taste of its versatility.</u>

You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

<u>A widening range of software.</u>

To help you realise some of that potential, Electron software already ranges from "Personal Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely important for the Electron and even now O and A Level revision papers are being processed for Electron users.

<u>How to get your Electron.</u>

The Acorn Electron can be found at local Acorn dealers and major high street stores. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.

Technical Specifications

<u>Hardware.</u>
2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

<u>Software.</u>
BBC BASIC.
Extensions include interger, floating point and string variables. multi dimensional arrays: IF...THEN...ELSE, REPEAT...UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn Electron.

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Colour graphics	●	●	●		●
Multi-user				●	
Hard disk storage		●	●	●	●
Upgradeable		●	●	●	●
Expandable		●	●	●	●
Communications	●	●	●	●	●
Transportable	●	●			●
Networking	●	●	●	●	

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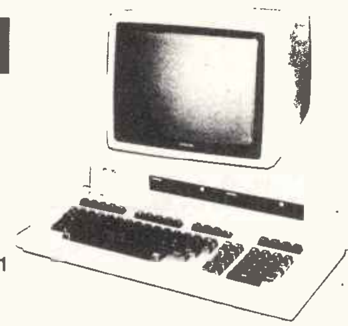

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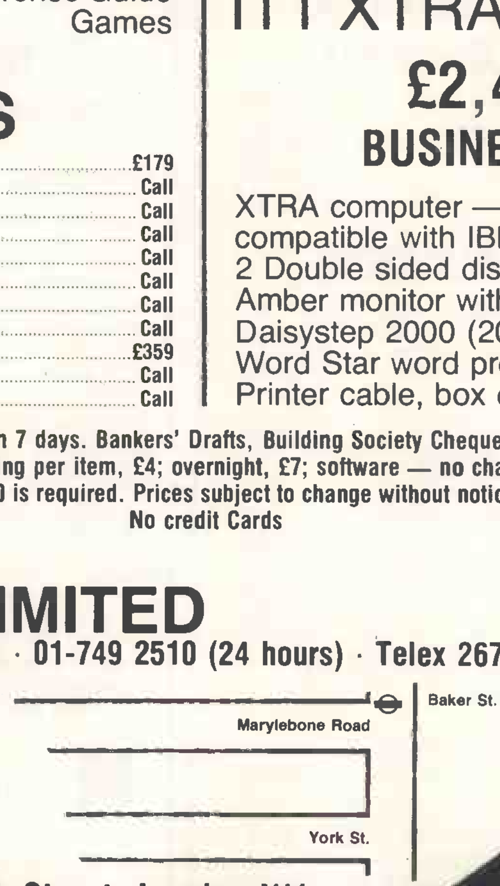

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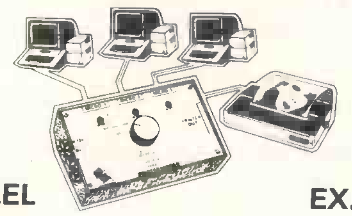

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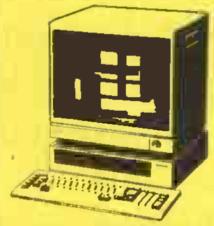

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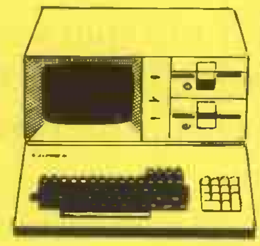

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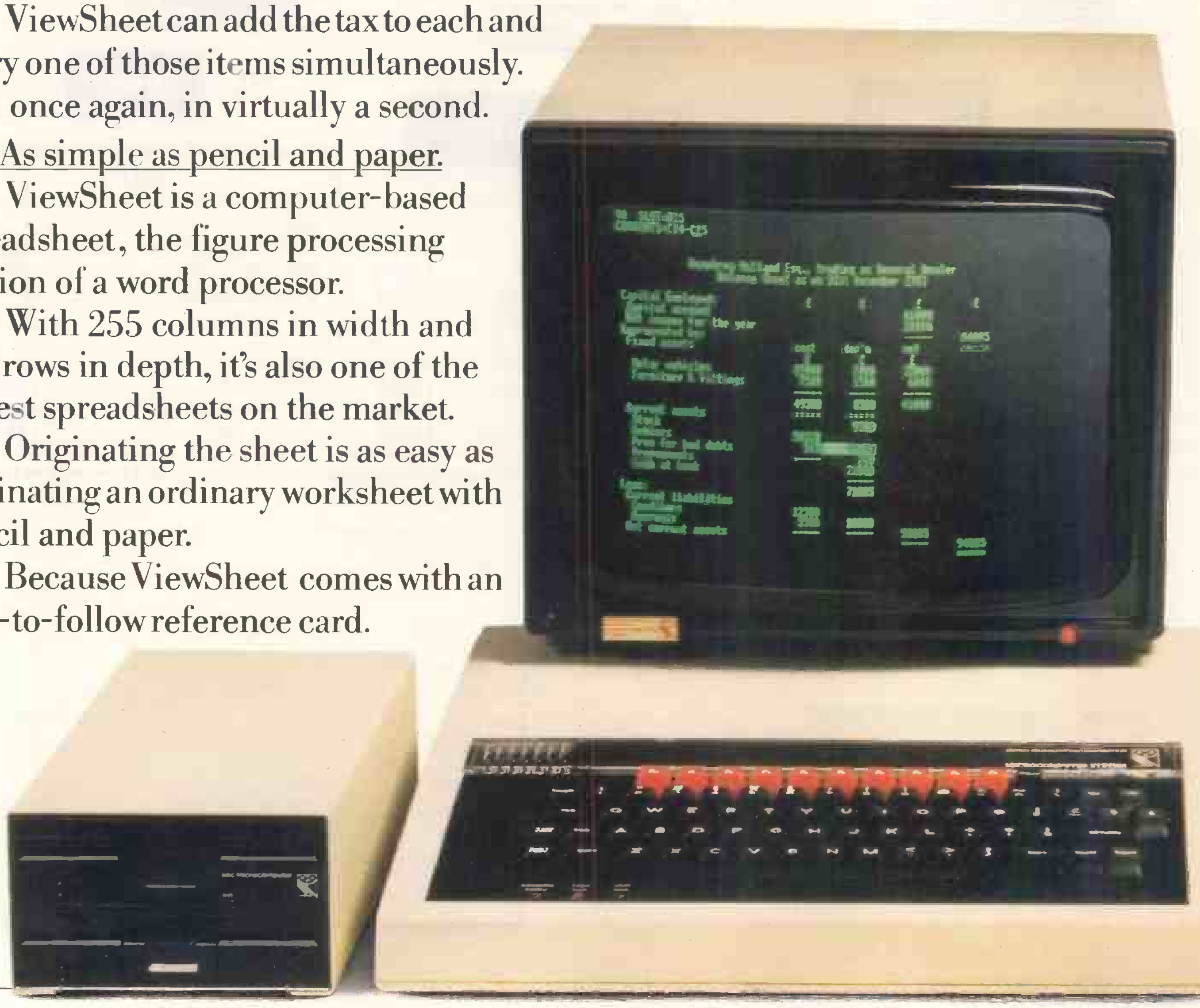

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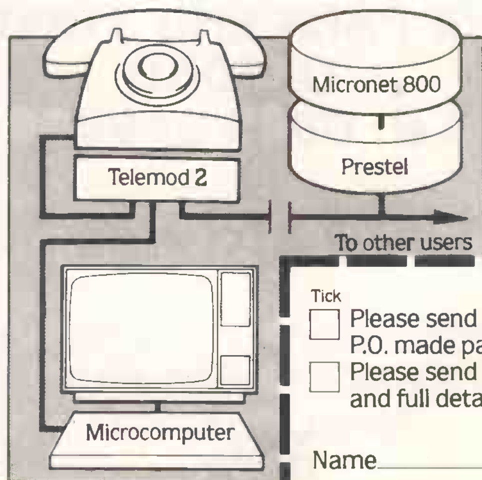

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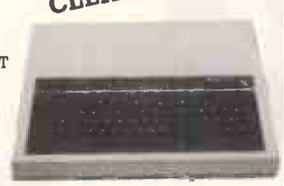

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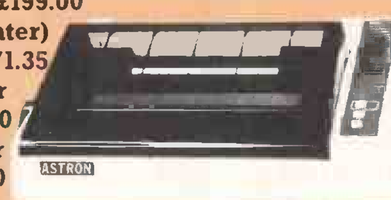

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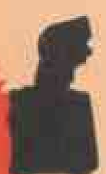

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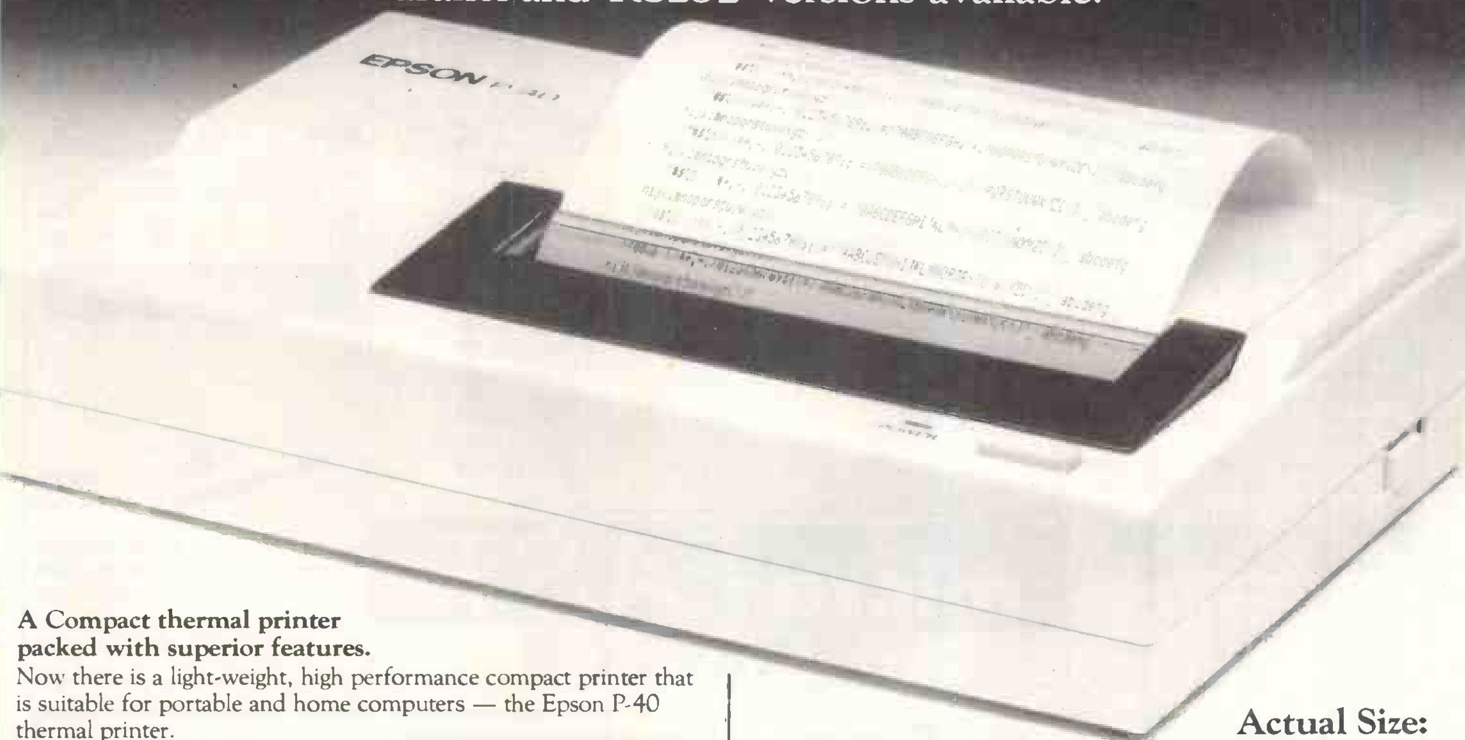

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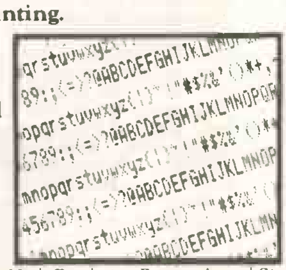

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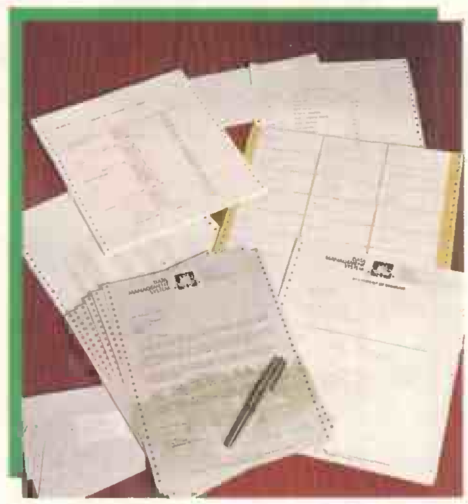
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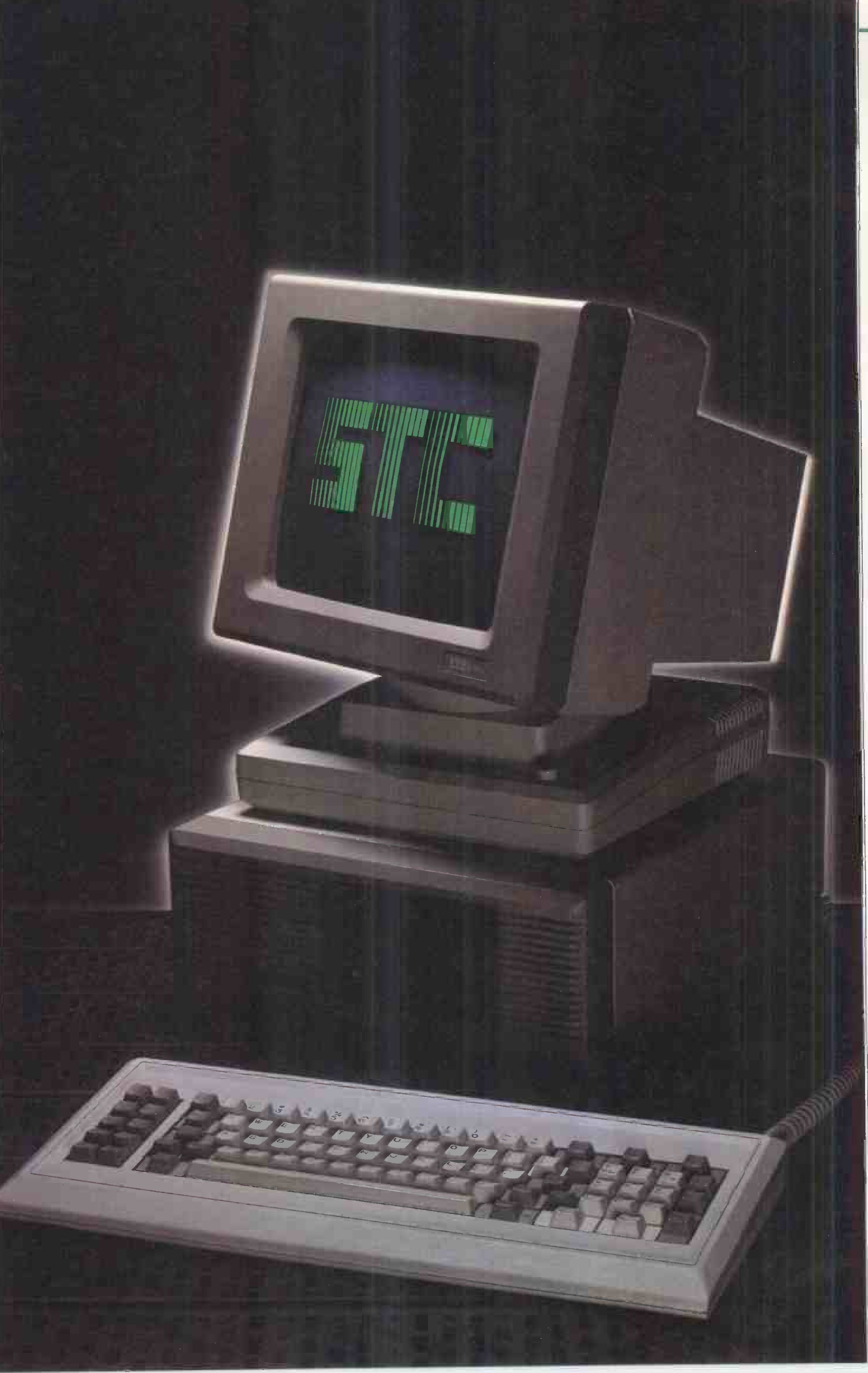
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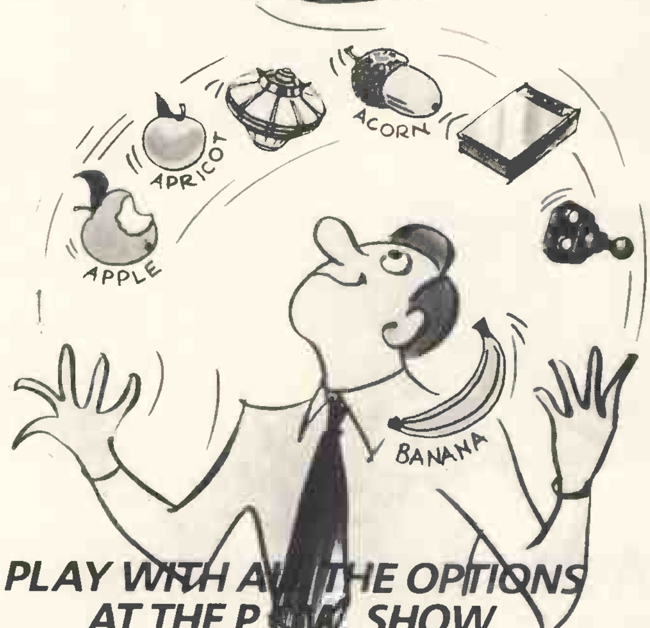

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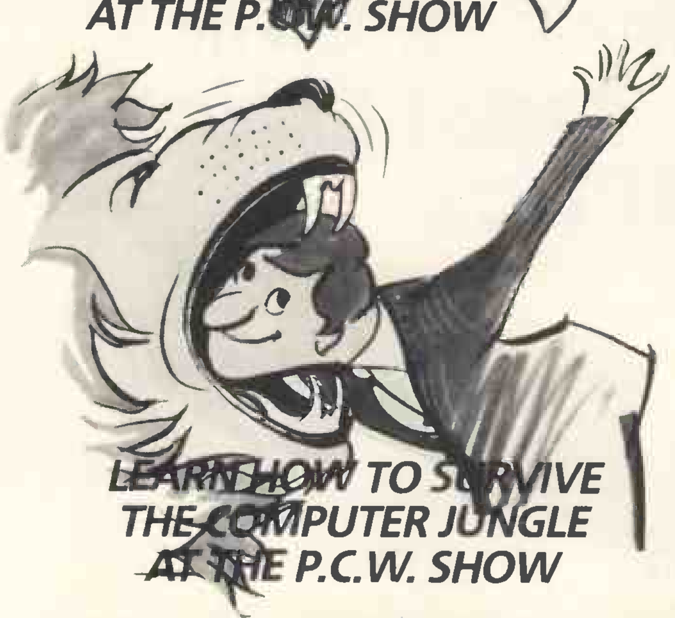

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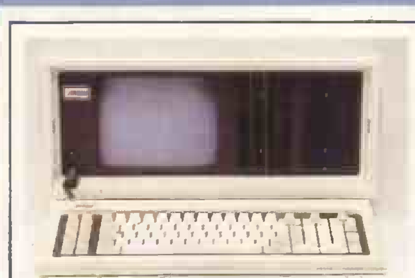

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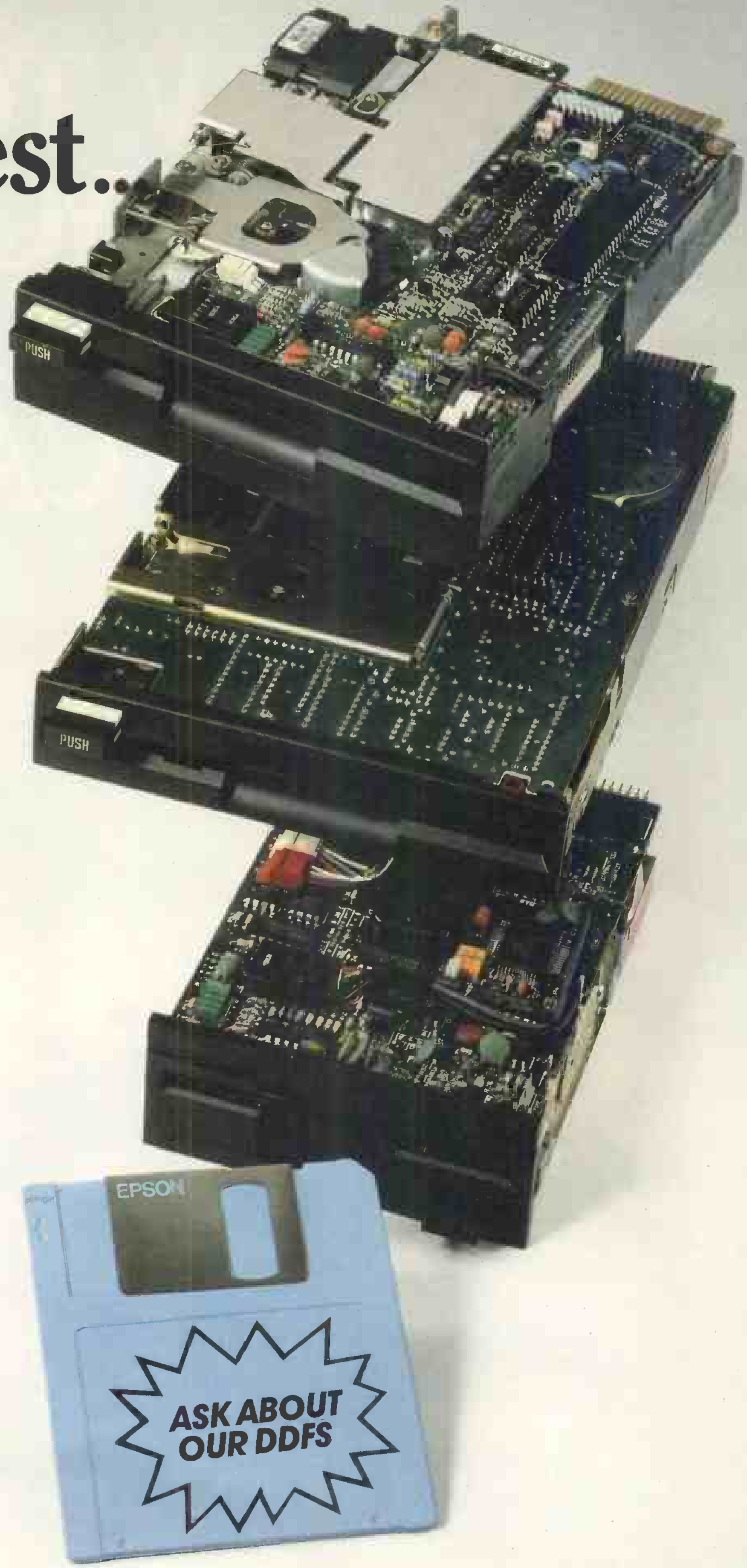

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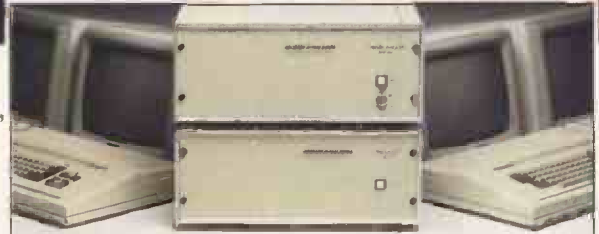

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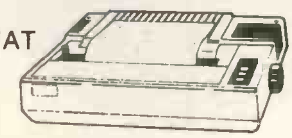

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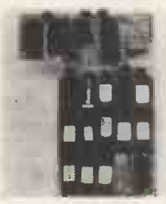

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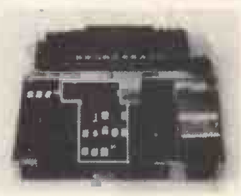

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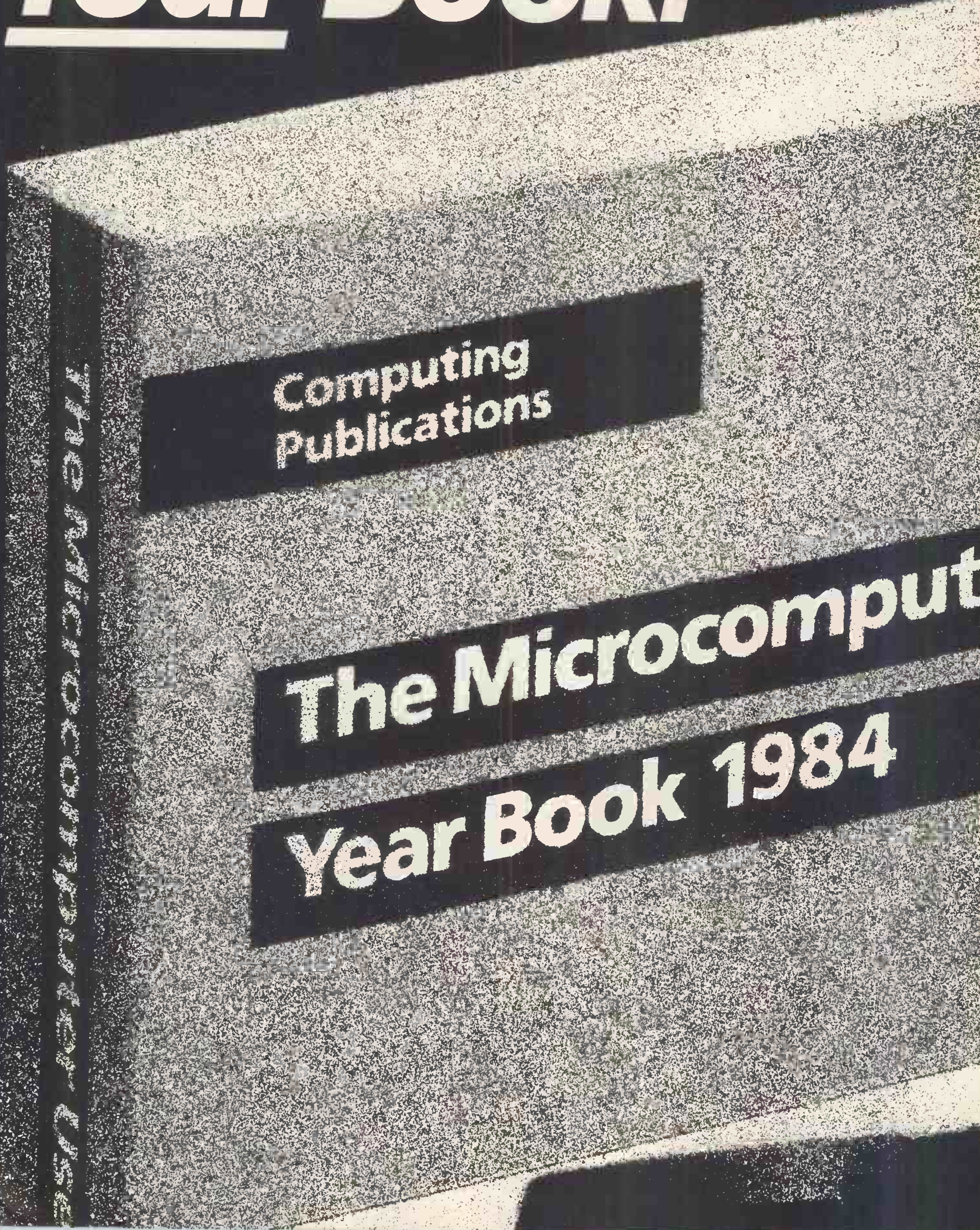

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CHIP CHAT

Solicitor sue thyself: one software house tells ChipChat of an interesting conversation with its solicitors. Initial reaction when the lawyers called was 'Oh, no, what have we done now?' But the solicitors had other things on their minds. Their question was: 'We've acquired a disk version of M Basic, and we wonder whether you could possibly photocopy your manual and send a copy over?'

Waste not: all that pre-launch publicity for IBM's Peanut, which turned out to be the PC Junior, is going to be put to good use. US firm Leading Edge plans to launch its own Peanut micro, taking proud place alongside its Elephant disks and Gorilla printers.

QDOS clues: Sinclair has sent *PCW* some QL documentation which we aim to publish in November. However, there's a catch. We have to pass back to Sinclair any errors found in testing the routines — presumably, we send them back with a bill for debugging attached.

And one for the VAT-man: a reader called to say that her QL invoice didn't add up properly. Apparently, there's some problem with the figure for VAT. And when *The Financial Times* decided to write about the QL, it renamed the machine the GL. That couldn't possibly stand for Ghost Leap, could it?

Open season: 13% of businessmen are reported to belong to golf clubs, and a similar number — poor souls — to take no holidays. But 28% own a home computer. No wonder we struggle in the Open.

Technology transfer: US software house Epyx sent the Russian Embassy a copy of its Olympic Games program to provide some kind of recreational compensation for the real thing. The Embassy called back to thank Epyx — and to ask for an Atari version rather than the Commodore 64 one sent. 'You see', the caller explained, 'we don't have any Commodore computers.'

Right on: the people handling publicity for the *PCW* Show describe computer clubs as places where enthusiasts can meet 'to share meaningful programs and experiences'. Next thing, there'll be jacuzzis in every club-house.

Whose washing machine did you buy?: consumer choice magazine *Which?* picked the Dragon 32 to put on its July front cover. The report inside rated the BBC B as 'best on test', arguing that 'there's plenty of software for it'. The Dragon was 'worth thinking about'. ChipChat started thinking and remembered an earlier *Which?* report that was particularly attracted to the ZX81 and Atari 400 because of their spill-proof covers.

Showdown: Commodore has postponed its Leeds show because of its move to Corby. Bets are now being taken on the number of senior Commodore staff who will finally make the move north. This month's other Commodore rumour raises the possibility that the 264 was renamed the Plus 4 because Amstrad arrived with its CPC464.

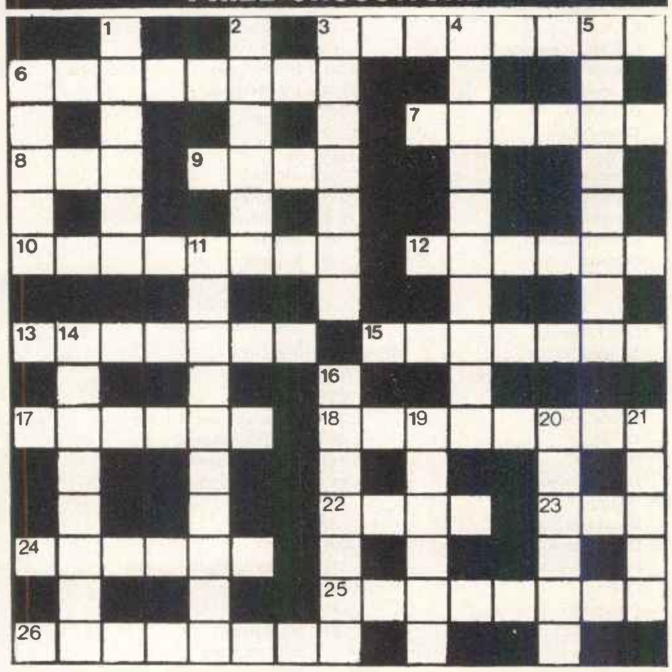
Good game(s): CRL promises a version of the *Magic Roundabout* for late summer while Mikro-Gen is offering Wally instead. Time for bed.

Smarties: winner of this year's applied statistics competition, run by London University and the Central Statistical Office, was a study comparing whelks on exposed and sheltered shores. Runner-up was 'a wide-ranging cross disciplinary study of the well known confectionery (Smarties) from various economic and consumer aspects'. Sinclair donated the prizes which were presented in Sir John Boreham's office (where else?). Chip Chat thankfully notes that the ceremony was 'brief'.

Ripe Apples: the first thing visitors to Apple's Cork factory see as they enter the shop-floor is a piece of serious Japanese-style graffiti. 'We believe in excellence, comradeship and self-fulfilment', or a message to that effect, is the joint declaration by the 200-strong workforce who produce some 400 IIc's a day, together with II's, III's and Lisas. The factory has brought a touch of glamour to Cork: say you work for Apple and parking tickets miraculously disappear. Production methods are a combination of labour-intensive assembly (three screws in and pass it on) and sophisticated testing. All the test equipment is based on Apple computers, so IIc's are checked out by IIe's, and IIe's by III's. Apple is confident that no cheating goes on.

Rib-on: if you're shopping early for Christmas for the micro man who has everything, you could do worse than consider the Ribbon Guide. This eminent volume contains 'for the first time, comprehensive information on all office machine and business computer ribbons available'. And it's updated quarterly. Other readers' suggestions for similarly essential Christmas presents are welcome.

PRIZE CROSSWORD



CLUES ACROSS

3 Inversion, for example, in the race (8)
6 Warm fire for cooking chips (8)
7 Shops requiring auxiliary backing? (6)
8 Group of characters in contention at court (3)
9 Blast! — a job for Linda Lovelace? (4)
10 Welsh priest gets part of the operating system (8)
12 A bit of one in a political organisation (6)
13 Statements in support of metrication? (7)
15 Malfunction that doesn't bear examination (7)
17 Chips thinly sliced (6)
18 Catch in occult medium (8)
22 Statement of basic literacy. . . (4)
23 . . . and one that's conclusive (3)
24 Perform an operation on Siamese twins? (6)
25 Machine requiring small change from one travelling to work (8)
26 Hereditary factor needs speed to code automatically (8)

CLUES DOWN

1 Novel output device, perhaps (6)
2 Graphic battle disaster (6)
3 Fishing, perhaps, to make connections in the system (7)
4 Car rug one gets on the computerised production line (10)
5 Poor rate for employee (8)
6 Joined as a current safe-guard (5)
11 Hollerith's fortune-teller? (4,6)
14 Spare altimeter part needed for this process (4,4)
16 A hug that could prove deadly (7)
19 Award for a disk Gary put out in *Melody Maker* (6)
20 ? Yes (6)
21 Communist rising started by company programmer (5)

Cut out or photocopy your entry and submit it to *PCW* by 19 September. You could win £10!

July winner: R Freeman, Ware, Herts.

July solutions:

SOLUTIONS ACROSS

7 Magneticdisks 9 Register 10 Atari 14 Halt 15 Hashtotal 17 Directory 18 Menu 23 Clive 24 Emulator 25 Randomnumbers

SOLUTIONS DOWN

1 Ampersand 2 H9 3 Femto 4 Micro 5 Ideal 6 ASCII 8 Starttime 11 Iteration 12 Nasty 13 Third 16 Linenoise 19 Acorn 20 Melon 21 Jeans 22 Dummy 26 EG

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Apple have put your finger on it!

BASIC Converter Chart '84

Personal Computer World

WALLCHART

SEPTEMBER 1984

BASIC CONVERTE

Those rotten manufacturers still insist on making machines that won't talk to each other in the same language. Some enlightened people are having a go with MSX, but in the meantime and in response to overwhelming demand, here's the 1984 PCW Converter Chart.

We've added six new Basics, covering the latest machines, and revised and updated the chart. It isn't possible, of course, to cover every micro nor every command supported by each of the machines included. What this chart aims to do is to provide an at-a-glance syntax comparison using Microsoft Basic as a reference point. The chart won't convert programs for you but it will save you the trouble of getting hold of piles of manuals — and even when you've got them it's often the beginning, not the end of your worries.

To use the chart, first check that the keyword you want isn't in the box on the right. If it is, then you're lucky: it's one of the few that IS the same on every single machine featured here. Due to the limited amount of information we can squeeze into each box, it hasn't always been possible to indicate the full power of every statement. It should be assumed, therefore, that we're dealing with the most common uses of each statement, and that other uses may be available.

Something to watch out for: identical syntax may have different effects on different machines. FRE (exp), on the Enterprise for example, returns the amount of RAM free, but on the Colour Genie it returns the amount available for string storage only. Others to watch out for are SYSTEM and RND.

You'll notice we haven't included anything on sound and graphics: that's too complicated for a quick reference chart, but we've

BASIC RESERVED WORD

MACHINE	ASC Returns ASCII value of first character of string.	ATN Arctangent of expression.	AUTO	CALL Calls assembler language sub-routine	CHAIN Call a new program & pass variables to it.	CHR$ Gives one-char string with ASCII code of exp.	CLEAR CLEAR all [or selected] variables.	CLOSE Closes disk files — closes all files if no specification.
STANDARD MICROSOFT	ASC (string)	ATN (exp)	AUTO [lineno, val]	CALL var[(var, var . . .)]	CHAIN "filename"	CHR$ (exp)	CLEAR [exp,exp]	
AMSTRAD CPC 464	ASC (string)	ATN (exp)	AUTO [lineno, incl]	CALL addr [,parms]	CHAIN "filename" [,lineno, exp]	CHR$ (exp)	CLEAR [all] ERASE [list of] var NB: clears and removes arrays	CLOSEIN [NB cassette input file] CLOSEOUT [NB cassette output file]
APPLESOFT	ASC (string)	ATN (exp)		CALL addr	CHAIN "filename"	CHR$ (exp)	CLEAR	CLOSE "filename"
ATARI	ASC (string)	ATN (exp)			RUN "C:" NB: program must have been saved using SAVE "C:"	CHR$ (exp)	CLR	CLOSE [#fileno, fileno . . .]
BBC BASIC	ASC (string)	ATN (exp)	AUTO [lineno, val]	CALL addr [,var,var . . .]	CHAIN "filename"	CHR$ (exp)	CLEAR	CLOSE #fileno Note: CLOSE #0 to close all files
COLOR GENIE	ASC (string)	ATN (exp)	AUTO [lineno, val]	CALL adr Note: addr is given in hex		CHR$ (exp)	CLEAR [(exp)]	
COMMODORE 64 & VIC 20	ASC (string)	ATN (exp)		SYS (addr)		CHR$ (exp)	CLEAR (exp) CLR	CLOSE #fileno
ENTERPRISE IS-BASIC	ORD (exp)	ATN (exp)	AUTO [AT lineno] [STEP inc]	CALL (exp)	CHAIN [channel:] "name"	CHR$ (exp)	CLEAR [channel] [var]	CLOSE channel
IBM PC-BASIC A	ASC (string)	ATN (exp)	AUTO [lineno] [,inc]	CALL addr [var, . . ., var]	CHAIN filename	CHR$ (exp)	CLEAR	CLOSE [#] [filename]
MEMOTECH MTX 512	ASC (string)	ATN (exp)	AUTO [lineno] [,inc]	USR (addr)		CHR$ (exp)	CLEAR	DISC CLOSE # channel no
MSX BASIC	ASC (string)	ATN (exp)	AUTO [lineno] [,inc]	USR (addr)		CHR$ (exp)	CLEAR	DISK basic only
DRAGON 32	ASC (string)	ATN (exp)		EXEC addr		CHR$ (exp)	CLEAR (exp)	CLOSE #-fileno
MZ-80K (Tape Basic SP-5025)	ASC (string)	ATN (exp)	Tool kits only	USR (addr)	[available only in disk basics]	CHR$ (exp)	CLR	CLOSE [filename]
ORIC-1/ATMOS	ASC (string)	ATN (exp)		CALL addr		CHR$ (exp)	CLEAR	
SINCLAIR QL	CODE (str)	ATAN (exp)	AUTO [lineno] [,inc]	CALL addr [exp] [parms]	MERGE device	CHR$ (exp)	CLEAR	CLOSE # channel
TRS-80 II/GENIE	ASC (string)	ATN (exp)	AUTO [lineno, val]			CHR$ (exp)	CLEAR [(exp)] Note: Clears string space if exp given	[depends on OS; consult OS manual
ZX81	CODE (string) Note: ZX81 does not use ASCII code	ATN (exp)		LET var=USR (addr) Note: equivalent statement		CHR$ (exp) Note: ZX81 does not use ASCII code	CHRS (exp)	N/A — ZX81 does not support file-handling
ZX SPECTRUM	CODE (string)	ATN (exp)		LET var=USR (addr) Note roughly equivalent		CHR$ (exp)	CLEAR	CLOSE # channel no

MACHINE	INKEY$ Returns character typed at keyboard or null if no character used.	INPUT Read data from terminal.	INT Evaluates expression for largest integer contained.	LEFT$ Returns specified no. of characters starting at beginning of string.	LIST List specified program lines at terminal.	LLIST List specified program lines at printer.	LOAD Load a program file into memory.	LOG Natural logarithm of expression.
STANDARD MICROSOFT	INKEY$	INPUT [string:] var [,var. . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno, lineno]	LLIST [lineno, lineno]	LOAD ["filename"]	LOG(exp)
AMSTRAD CPC 464	INKEY$	INPUT [#no] [prompt] [var [list]]	INT (exp)	LEFT$ (exp, length)	LIST [lineno, lineno]	LIST [lineno, lineno], #8	LOAD ["filename"] [,addr]	LOG(exp) Note: LOG10(exp) gives Log base 10
APPLESOFT	Get var	INPUT [string,] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno, lineno] Note: '—' may be used in place of ','	[depends on interface arrangement — usually LIST"P]	LOAD filename	LOG(exp)
ATARI		INPUT [exp] var [,var . . .] or INPUT [exp] string-var	INT (exp)	string (start, length)	LIST [lineno, lineno]	LIST "P:"	CLOAD ["filename"] [cases] or LOAD "fileno-filename" [disk]	LOG(exp)
BBC BASIC	Get var [unlimited] time] or INKEY$ (time) Note: 100ths sec.	INPUT [string [,]] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno, lineno]	CTRL-B then LIST [lineno-lineno]	LOAD "filename" Note: '*DISK' or '*TAPE' to select device	LN(exp) NB: LOG(exp) gives common rather than natural log
COLOR GENIE	INKEY$	INPUT [string:] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno, lineno]	LLIST [lineno-lineno]	CLOAD "filename"	LOG(exp)
COMMODORE 64 & VIC 20	GET var	INPUT [string:] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno-lineno]	OPEN 4,4:CMD4: LIST [lineno-lineno] OPEN 3,4:CMD3: LIST [lineno-lineno]	LOAD ["filename"] [cass] or LOAD "filename",8 [disk]	LOG(exp)
ENTERPRISE IS-BASIC	INKEY$	INPUT channel [prompt exp] [IF MISSING exp]	INT (exp)	String name (1st char. no; last char. no)	LIST [channel] lineno [TO lineno] [,] . . .	See LIST	LOAD [channel:] [filename]	LOG(exp)
IBM PC-BASIC A	var $=INKEY$	INPUT [prompt] var [,var]	INT (exp)	LEFT$ (string, length)	LIST [1st line] [-last line] [,filespec]	LIST [lineno, lineno]	LOAD filename [,R]	LOG(exp)
MEMOTECH MTX 512	var $=INKEY$	INPUT [prompt] var [,var]	INT (exp)	LEFT$ (string, length)	LIST [1st line] [,last line]	LIST [lineno, lineno]	LOAD "filename"	LN(EXP)
MSX BASIC	var $=INKEY$	INPUT [prompt] var [,var]	INT (exp)	LEFT$ (string, length)	LIST [1st line] [-last line]	LLIST [lineno, lineno]	CLOAD filename	LOG(exp)
DRAGON 32	INKEY$	INPUT [string;] var [,var]	INT (exp)	LEFT$ (string, length)	LIST [lineno-lineno]	LLIST [lineno-lineno]	CLOAD ["filename"]	LOG(exp)
MZ-80K (Tape Basic SP-5025)	GET var	INPUT [string;] var	INT (exp)	LEFT$ (string, length)	LIST [lineno-lineno]	LIST/P [lineno-lineno]	LOAD ["filename"]	LN(exp) Note: LOG(exp) gives common log
ORIC-1/ATMOS	KEY$ [exact equivalent] also GET var [waits for key-press]	INPUT [string;] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno-lineno]	LLIST [lineno-lineno]	CLOAD "[filename]" [,S] Note: ',S' selects 300 baud	LOG(exp)
SINCLAIR QL	INKEY$ [channel [wait]]	INPUT [prompt] [channel] [var [,var] . . .]	INT (exp)	string (TO finish)	LIST [channel] 1st line [,last line] . . .	LIST #[channel] 1st line [,last line] . . .	LOAD device [incl. filename]	LN(exp) Note: LOG10(exp) also available
TRS-80 II/GENIE	INKEY$	INPUT [string;] var [,var . . .]	INT (exp)	LEFT$ (string, length)	LIST [lineno-lineno]	LLIST [lineno-lineno]	CLOAD "[filename]" [cass] or LOAD "filename" [disk/floppy tape]	LOG(exp)
ZX81	INKEY$	INPUT var	INT (exp)	string (TO finish)	LIST [lineno]	LLIST [lineno]	LOAD "[filename]"	LN(exp)
ZX SPECTRUM	INKEY$	INPUT [string;] var	INT (exp)	string (TO finish)	LIST [lineno] Note: will fill screen then ask SCROLL	LLIST [lineno]	LOAD "filename" [cass] Note: Microdrive manual for disk	LN(exp)

MACHINE	RANDOMIZE Reset random number generator.	READ Read from data statements into specified variables	RENUM Change program line numbers.	RESTORE Resets pointer to facilitate re-reading of DATA statements.	RESUME Return from ON ERROR sub-routine to stmt that caused error.	RETURN Return from sub-routine to statement following last GOSUB executed.	RIGHT$ Returns specified no. of characters starting at end of string.	RND Generates a random number.
STANDARD MICROSOFT	RANDOMIZE [exp]	READ var [,var . . .]	RENUM [lineno, val]	RESTORE	RESUME	RETURN	RIGHT$(string, length)	RND[exp]
AMSTRAD CPC 464	RANDOMIZE (exp)	READ var [,var . . .]	RENUM [new start no] [,old start no] [,inc]	RESTORE [lineno]	RESUME [line no] or RESUME NEXT	RETURN	RIGHT$ (exp, length)	RND[exp]
APPLESOFT		READ var [,var . . .]		RESTORE	RESUME	RETURN	RIGHT$(string, length)	RND(exp) Note: exp is a dummy variable
ATARI	RND (-exp)	READ var [,var . . .]		RESTORE [lineno]		RETURN	string(start NB: not strictly equivalent	RND(exp) Note: exp is a dummy variable
BBC BASIC	RND (-exp)	READ var [,var . . .]	RENUMBER [start] [,interval]	RESTORE (exp)		RETURN	RIGHT$(string, length)	RND(exp)
COLOR GENIE	RANDOM	READ var [,var . . .]	RENUM [lineno, val]	RESTORE	RESUME	RETURN	RIGHT$string, length)	RND(exp)
COMMODORE 64 & VIC 20	RND (-TI)	READ var [,var . . .]		RESTORE		RETURN	RIGHT$(string, length)	RND(exp) Note: exp is a dummy for VIC
ENTERPRISE IS-BASIC	RANDOMIZE	READ [IF MISSING exp:] var list	RENUM range [AT new start no] [STEP exp]	RESTORE [lineno]	RETRY	RETURN	Stringname(1st char no; last char no)	RND(exp)
IBM PC-BASIC A	RANDOMIZE (exp)	READ var [,var, . . .]	RENUM [new start no] [,old start no] [,inc]	RESTORE [lineno]	RESUME	RETURN [lineno]	RIGHT$ (exp, length)	RND(exp)
MEMOTECH MTX 512	RAND (exp)	READ var [,var, . . .]		RESTORE [lineno]		RETURN	RIGHT$ (exp, length)	RND(exp)
MSX BASIC		READ var [,var, . . .]	RENUM [new start no] [,old start no] [,inc]	RESTORE [lineno]	RESUME	RETURN [lineno]	RIGHT$ (exp, length)	RND(exp)
DRAGON 32		READ var [,var . . .]	RENUM [lineno, start, interval]	RESTORE		RETURN	RIGHT$(string, length)	RND(exp)
MZ-80K (Tape Basic SP-5025)	RND (-exp)	READ var [,var, . . .]	Tool kits only	RESTORE		RETURN	RIGHT$(string, length)	RND(exp)
ORIC-1/ATMOS		READ var [,var . . .]		RESTORE		RETURN	RIGHT$(string, length)	RND(exp) NB: non-standard — see Oric manual p.142
SINCLAIR QL	RANDOMIZE	READ var [,var . . .]	RENUM [old start no] [TO old end no;] [new start no], [inc]]	RESTORE	RETRY	RETURN exp	string,(start, TO)	RND [exp TO exp]
TRS-80 II/GENIE	RANDOM	READ var [,var . . .]	RENUM start, interval Note: Genie I and II only	RESTORE [lineno/exp]	RESUME [lineno]	RETURN	RIGHT$(string, length)	RND(exp)
ZX81	RAND (exp)					RETURN	string(start TO)	RND
ZX SPECTRUM	RAND (exp)	READ var [,var . . .]		RESTORE [lineno/exp]		RETURN	string(start TO)	RND

ER CHART '84

covered the subject in a series of articles (PCW January — May 1984) for a range of machines.

SHARED INSTRUCTIONS

ABS (exp)
COS (exp)
END NB not available on QL; can take parm on ENTERPRISE
FOR var = exp TO exp [STEP exp]
LEN (string) NB Space *must* be present for Memotech
LET var = EXP
REM text
SIN (exp)
SQR (exp)
STOP
TAN (exp)
VAL (exp) NB not available on QL

ABBREVIATIONS USED IN THIS CHART:

addr = address
exp = expression
parm(s) = parameter(s)
stmt = statement
var = variable
Square brackets [] indicate optional code.

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S & FORMATS

CONT Continue program execution.	DATA Lists data to be used in a READ statement.	DEF Define arithmetic string function.	DELETE Delete specified program lines.	DIM Allocates space for arrays, specifies max subscript values.	EDIT Edit a program line.	EXP Raises to power of expression.	FRE Returns remaining memory space.	GET Read a record from disk or tape file.	GOSUB Branch to a Basic subroutine.	GOTO Branch to a specified line number.	IF/THEN/ELSE If exp is true stmt is executed. If not ELSE or following line is executed.
CONT	DATA const [,const . . .]	DEF FNvar [(var,var . . .)] =exp	DELETE lineno [,lineno]	DIM var(sub) [,var (sub), . . .]	EDIT lineno	EXP)exp)	FRE(exp)	GET [#] lineno [,record no]	GOSUB lineno	GOTO lineno	If exp THEN [ELSE] stmt
CONT	DATA const [,const, . . .]	DEF FNvar [(parms)]=exp	DELETE [line no-line no]	DIM (list of) var (dimension list)	EDIT lineno	EXP(exp)	FRE(exp) Note: exp is a dummy variable	LINE INPUT #, [,prompt] [var list]	GOSUB lineno	GOTO lineno	If exp THEN stmt ELSE stmt
CONT	DATA const [,const . . .]	DEF FNvar (var)=exp	DEL lineno, lineno	DIM var(sub) [,var(sub) . . .]	[screen editing using CTRL keys]	EXP(exp)	FRE(exp) Note: exp is a dummy variable	INPUT var [,var . . .] NB: Get var(s) from current input device	GOSUB lineno/ var/exp	GOTO lineno	IF exp THEN stmt Note: no ELSE
CONT	DATA const [,const . . .]			DIM [or COM] var (sub) [,var (sub) . . .] NB: dimension ALL strings	[cursor editing]	EXP(exp)	FRE(exp) Note: exp is a dummy variable	GET #lineno, record	GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt Note: no ELSE
NB not available; use GOTO lineno	DATA const [,const . . .]	DEF FNvar [(var, var)]=exp	DELETE lineno, lineno	DIM var(sub) [,var(sub) . . .]	[cursor editing]	EXP(exp)	HIMEM-TOP	INPUT #lineno, record [,record . . .]	GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt [ELSE stmt]
CONT	DATA const [,const . . .]	[various DEF statements supported but none equivalent]	DELETE lineno-lineno	DIM var(sub) [,var(sub) . . .]	EDIT lineno	EXP(exp)	MEM Note: FRE (exp) returns available string space	INPUT #lineno, record [,record . . .]	GOSUB lineno	GOTO lineno	IF exp THEN stmt [ELSE stmt]
CONT	DATA const [,const . . .]	DEF FNvar =exp		DIM var(sub) [,var(sub) . . .]	[cursor editing]	EXP(exp)	FRE(exp Note: exp is a dummy variable	GET #lineno, record [,record . . .]	GOSUB lineno	GOTO lineno	IF exp THEN stmt Note: no ELSE
CONT	DATA const [,const, . . .]	DEF name [$] [parm list] = exp or DEF name [$] [parm list] END DEF for multi-line function	DELETE lineno [TO lineno] [,] . . .	DIM var (exp TO exp)	EDIT program Note: not line editor; makes another program current for LIST, RUN etc	EXP(exp)	FREE Note: prints RAM bytes available	LINE INPUT port, var	GOSUB lineno	GOTO lineno	IF exp THEN stmt ELSE stmt [END IF]
CONT	DATA const [,const, . . .]	DEF FNvar [(parms)]=exp	DELETE [lineno] [-lineno]	DIM var(sub) [,var(sub) . . .]	EDIT lineno	EXP(exp)	FRE(exp) Note: exp is a dummy variable	GET [#] filename [,rec no]	GOSUB lineno	GOTO lineno	If exp THEN stmt ELSE stmt
CONT	DATA const [,const, . . .]	DEF FNvar [(parms)]=exp		DIM var(sub) [,var(sub)] . . .	EDIT lineno	EXP(exp)		Disc INPUT # channelno	GOSUB lineno	GOTO lineno	If exp THEN stmt ELSE stmt
CONT	DATA const [,const, . . .]	DEF FNvar [(parms)]=exp	DELETE [lineno] [-lineno]	DIM var(sub) [,var(sub)] . . .	cursor editing	EXP(exp)	FRE(exp) Note: exp is a dummy variable		GOSUB lineno	GOTO lineno	IF exp THEN stmt /lineno
CONT	DATA const [,const . . .]	DEF FNvar (var)=exp	DELETE lineno-lineno	DIM var(sub) [,var(sub) . . .]	EDIT lineno	EXP(exp)	MEM	INPUT #-fileno, record	GOSUB lineno	GOTO lineno	IF exp THEN stmt [ELSE stmt]
CONT	DATA const [,const . . .]	DEF FNvar (var)=exp	Tool kits only	DIM var(sub) [,var(sub) . . .]	[cursor editing]	EXP(exp)	SIZE	INPUT/T record	GOSUB lineno	GOTO lineno	IF exp THEN stmt Note: no ELSE
CONT	DATA const [,const . . .]	DEF FNvar (var)=exp		DIM var(sub) [,var(sub) . . .]	EDIT lineno NB: does not use Microsoft editor	EXP(exp)	FRE(exp) Note: exp is a dummy variable		GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt [ELSE stmt]
CONTINUE or RETRY	DATA const [,const . . .]	DEF FNvar [$ or % or ' '] [parms]	DLINE range [range]	DIM var(sub) [,var(sub) . . .]	EDIT lineno [,step]	EXP(exp)		INKEY$(CHANNEL)	GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt ELSE stmt END if
CONT	DATA const [,const . . .]	Various DEF statements available but none equivalent	DELETE lineno-lineno	DIM var(sub)	EDIT lineno	EXP(exp)	FRE(exp) [TRS-80] or MEM [Genie]	INPUT #-fileno, record [,record . . .]	GOSUB lineno	GOTO lineno	If exp THEN stmt [ELSE stmt]
CONT				DIM var(sub)	EDIT Note: use cursor to select line	EXP(exp)			GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt Note: no ELSE
CONT	DATA const [,const . . .]	DEF FNvar [(var,var . . .)] =exp		DIM var(sub)	EDIT [lineno] Note: cursor line by default	EXP(exp)		Consult Microdrive manual	GOSUB lineno/ var/exp	GOTO lineno/ var/exp	IF exp THEN stmt Note: no ELSE

MID$ Gives specified no. of characters to the right of start position in string.	NAME Rename a file.	NEW Delete current program & data from memory.	NEXT End of FOR/NEXT loop.	ON ERROR Error trap subroutine.	ON/GOSUB GOTO lineno specified by evaluation of expression.	ON/GOTO GOTO lineno specified by evaluation of expression.	OPEN Open disk file.	OUT Put specified byte to specified output port.	PEEK Read byte from specified memory location.	POKE Put specified byte to specified memory address.	PRINT Write data to disk file.
MID$(string, start [,length]	NAME "filename" AS "filename"	NEW	NEXT var [,var . . .]	ON ERROR GOTO lineno	On exp GOSUB lineno [,lineno . . .]	On exp GOTO lineno [,lineno . . .]	OPEN mode [#] fileno "filename"	OUT port,byte	PEEK(addr)	POKE addr,byte	PRINT [[#] fileno] [exp] [,exp . . .]
MID$(string, start, length)		NEW	NEXT [var,var, . . .]	ON ERROR GOTO lineno	On exp GOSUB lineno, [lineno, . . .]	ON exp GOTO lineno [,lineno, . . .]	OPENIN filename OPENOUT filename	OUT port, byte	PEEK(addr)	POKE addr,byte	PRINT [# no], [print list], [using exp]
MID$(string, start[,length])	RENAME oldname, newname	NEW	NEXT [var,var . . .]	ONERR GOTO lineno	On exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	OPEN filename		PEEK(addr)	POKE addr,byte	PRINT exp [,exp . . .] NB: prints to current output device
string(start [,length])		NEW	NEXT var	TRAP lineno/ var/exp	ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	OPEN #fileno, mode control code, filename	[not equivalent]	PEEK(addr)	POKE addr,byte	PRINT #fileno record [,record . . .]
MID$(string, start[length])		NEW Note: under cert. circum. may be recovered using OLD	NEXT [var,var . . .]	ON ERROR stmt	ON exp/var GOSUB lineno [,lineno . . .]	ON exp/var GOTO lineno [,lineno . . .]	fileno=OPENIN [to read] or fileno= OPENOUT [to write]		?addr NB: '?' does NOT mean 'print' in BBC Basic	?addr,byte	PRINT #filename record [,record . . .]
MID$(string, start[,length])		NEW	NEXT [var,var . . .]	ON ERROR GOTO lineno	On exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]		OUT (port,byte)	PEEK(addr)	POKE addr,byte	PRINT #-fileno, record [,record . . .]
MID$(string, start[length])	OPEN 1,8,15, "RO: filename= filename" [disk only] N/A	NEW	NEXT [var,var . . .]		ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	OPEN #exp, fileno, mode, "filename"		PEEK(addr)	POKE addr,byte	PRINT #fileno record [,record . . .]
Stringname (1st char no; last char no)		NEW	NEXT [var,var, . . .]		ON exp GOSUB lineno [,lineno . . .]		OPEN channel: [NAME] device/filename [ACCESS mode]	OPEN channel [NAME] device/filename ACCESS OUTPUT	PEEK(addr)	POKE addr,byte	PRINT [channel] [,AT coordinates:] print list
MID$(string, start[,length])	NAME filename AS filename	NEW	NEXT [var,var, . . .]	ON ERROR GOTO lineno	ON [exp:COM: KEY:PEN:STRIG] GOSUB lineno	ON exp GOTO lineno	OPEN filename [FOR Mode] AS [#] filename [LEN=rec)	OUT port,data	PEEK(addr)	POKE addr,byte	PRINT [exp][;]
MID$(string, start[,length])	DISC REN string=string	NEW	NEXT var		ON exp GOSUB lineno	ON exp GOTO lineno	DISC OPEN # channel no, "filename", filetype, record length	OUT port,data	PEEK(addr)	POKE addr,byte	[DISC] PRINT [#channelno,] print list
MID$(string, start[,length])		NEW	NEXT [var,var, . . .]	ON ERROR GOTO lineno	ON exp GOSUB lineno	ON exp GOTO lineno	Disk Basic only	OUT port,data	PEEK(addr)	POKE addr,byte	PRINT [fileno,] list of arguments
MID$(string, start[,length])		NEW	NEXT [var,var . . .]		ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	OPEN mode, #-fileno "filename"		PEEK(addr)	POKE addr,byte	PRINT #-fileno. exp[,exp . . .]
MID$(string, start,length)	[available only in disk basics]	NEW	NEXT [var]	[available only in disk basics]	ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	ROPEN-read WOPEN-write	OUT (port),byte	PEEK(addr)	POKE addr,byte	PRINT/T record [,record . . .] Note: prints to cassette
MID$(string, start,length)		NEW	NEXT [var,var . . .]		ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]		POKE 3XX,val	PEEK(addr)	POKE addr,byte	
string(start TO finish)		NEW	NEXT identifier		ON var GOSUB lineno [lineno]	ON var GOTO lineno [,lineno]	OPEN channel, device [incl. filespec]		PEEK [or W or L](addr)	POKE [or W or L](addr),byte	PRINT [channel,] exp[,exp] . . .
MID$(string, start,length)	[depends on OS; consult OS manual]	NEW	NEXT [var,var . . .]	ON ERROR GOTO lineno	ON exp GOSUB lineno [,lineno . . .]	ON exp GOTO lineno [,lineno . . .]	[depends on OS; consult OS manual.]	OUT port,byte	PEEK(addr)	POKE addr,byte	PRINT #fileno, record [,record . . .] [cass]
string(start TO finish)		NEW	NEXT var						PEEK(addr)	POKE addr,byte	PRINT [AT] ("exp") Note: to screen
string(start TO finish)		NEW	NEXT var				Consult Microdrive manual	OUT port,byte	PEEK(addr)	POKE addr,byte	PRINT [AT] ("exp") Note: to screen

RUN Execute a program.	SAVE Save a program either onto disk tape.	SGN Returns 1 if exp>0 0 if exp=0 −1 if exp<0.	STRING$ Returns a string of specified length containing specified character.	STR$ Converts a numeric expression to a string.	SYSTEM Close files for return to operating system.	TROFF Trace off.	TRON Trace on.	USR Calls an assembler language subroutine which returns one value.	WAIT Suspend program execution for specified time.	WHILE/END Execute statements in WHILE/WEND loop as long as exp is true	WIDTH Sets printer carriage/screen width.
RUN [lineno]	SAVE filename	SGN(exp)	STRING$(length string	STR$(exp)	SYSTEM	TROFF	TRON	USR(parameter)	WAIT port,mark [,select]	WHILE exp WEND	WIDTH(val)
RUN ["filename"] or [line no]	SAVE "filename" [, file type] [,binary parms]	SGN(exp)	STRING$ (length,string)	STR$(exp)		TROFF	TRON	Note: See CALL	WAIT addr, mask [,inversion]	WHILE exp WEND	WIDTH exp
RUN [lineno]	SAVE filename fileno	SGN(exp)		STR$(exp)		NOTRACE	TRACE	USR(parameter)	WAIT addr, exp [,exp]		POKE 32, left margin; POKE 33, screen width
RUN	CSAVE "filename" [cass] or SAVE "fileno.filename" [disk]	SGN(exp)		STR$(exp)	BYE NB: not equivalent			USR(parameter)			POKE 82, val (left margin); POKE 83, val (right margin)
RUN	SAVE "filename" Note: see note under LOAD	SGN(exp)	STRING$(length, string)	STR$(exp)	*DISK NB: disk-handling done through Basic so not true eq.	TRACE OFF	TRACE ON	USR(parameter)	(no WAIT stmt but see INKEY$)	REPEAT stmt UNTIL exp Note: reverse logic	WIDTH val Note: 0='unlimited'
RUN [lineno]	CSAVE "filename" Note: only first character significant	SGN(exp)	STRING$(length, string	STR$(exp)	SYSTEM statement not equivalent	TROFF	TRON	USR(parameter)			
RUN [lineno]	SAVE ["filename"] [cass] or SAVE "filename".B [disk]	SGN(exp)		STR$(exp)				USR(parameter)	WAIT addr, exp,exp		
RUN [lineno]	SAVE [channel:] filename	SGN(exp)		STR$(exp)		TRACE ON [TO channel] /OFF	TRACE ON [TO channel]	see CALL	WAIT DELAY integer	DO WHILE exp EXIT DO or CASE exp CASE else	SET option
RUN [lineno]	SAVE "filename" [,A,P]	SGN(exp)	STRING$ (length,string)	STR$(exp)	SYSTEM	TROFF	TRON	USR(exp)	WAIT port, exp[,exp]	WHILE exp WEND	WIDTH exp
RUN [lineno]	SAVE "filename"	SGN(exp)		STR$(exp)				USR(parameter)			
RUN [lineno]	CSAVE "filename"	SGN(exp)	STRING$ (length,string)	STR$(exp)		TROFF	TRON	USR(parameter)			WIDTH (exp)
RUN [lineno]	CSAVE "filename"	SGN(exp)	STRING$(length, string)	STR$(string)		TROFF	TRON	USR(parameter)			
RUN	SAVE "filename"	SGN(exp)		STR$(exp)	BYE			USR(parameter) Note: does not return any value			
RUN [lineno]	CSAVE "filename" [,S] [,AUTO] Note: AUTO = auto-run	SGN(exp)		STR$(exp)		TROFF NB: only as statement, not command	TRON NB: only as statement or TRON:RUN command	USR(parameter) or & (parameter)	WAIT exp Note: exp in 100ths of second	REPEAT stmt UNTIL exp Note: reverse logic	POKE 49, val NB: refers to printer not to screen
RUN [lineno]	SAVE device [lineno [lineno]] . . .	SGN(exp)	FILL$(string, length)	Note: conversion automatic on assignment				See CALL (or use EXEC)	PAUSE [delay]	REPEAT name IF cond EXIT name END REPEAT name	Full window control commands
RUN [lineno]	CSAVE "filename" [cass] or SAVE "filename" [disk/ floppy tape]	SGN(exp)	STRING$(length, string)	STR$(exp)		TROFF	TRON	USR(parameter)			
RUN [lineno/ var/exp]	SAVE "filename"	SGN(exp)		STR$(exp)				USR(addr)	PAUSE exp Note: halts screen display only		
Run [lineno/ var/exp]	SAVE "filename" [cass] Note: Microdrive manual for disk	SGN(exp)		STR$(exp)				USR addr	PAUSE no. of frames (50/second)		