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THE COMPLETE COMPUTING WEEKLY
50p DEC 1-7, 1983 Vol 1 No 39

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Pull-out and keep

Micropaedia Christmas Buyer's Guide
PCN's handy reference to the best of the micros in the shops.

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Osborne plans

Osborne UK expects to be going it alone next year and plans a flying start.

If it separates from its troubled US parent company, the UK arm aims to rehabilitate the Osborne portable micro with a package of selling points and services. These will include a price cut, refinements to its existing services, and changes in its direct marketing. It also expects to sub-contract out the manufacturing and carry out more local hardware and software development.

'With the recent downturn in demand, we have had ample opportunity to review our operations,' said Mike Healey, Osborne UK managing director. One result of this review is the feeling that the Osborne 1 is overpriced, despite the amount of free software that comes with the system. Its pricing will be 'revised' in the new year.

Mr Healey also spoke of a number of new services and refinements to its existing customer services. Osborne users should be able to buy a wider range of products directly from the company next year, particularly software and add-ons.

Bruce Durie of the Osborne User Group said he was 'absolutely satisfied' that Osborne UK would be able to meet the needs of users. 'The company is now able to make use of us as a support group,' he said, emphasising the close links between the supplier and its users.

There are thought to be about 7,000 Osborne users in the country, and Mr Durie will try to assemble as many of them as possible at a meeting at the Open University, Milton Keynes, on January 14. He asks any Osborne user intersted in attending to contact him at, 18 Crendon St., High Wycombe, Bucks.

The purpose of the meeting will be to re-assure users that Osborne isn't going to disappear from the UK, and to look for ways to use the experience of both the supplier and the users.

Apple takes software out of Lisa price

Apple UK has followed its US parent company in taking software out of the Lisa's price. The Lisa now costs £5,500.

The software, of course, is an essential part of Lisa's operation, but Apple says that with more third party software becoming available for Lisa it makes sense to offer customers the option.

You can't actually do much with Lisa on its own but you still have a base for either third party software, or for your own customised system. And the machine's specification is still impressive.

Business Systems International sells the Busifile database system, while the financial modelling package Modeller comes from Intelligence UK and Sunaccount, a Cobol business accounting package, is sold by Systems Union.

Logica will soon launch a Xenix package, while the mathematically based language APL6800 is also in the pipeline.

You'll still get the O/S Lisadesk with your unbundled Lisa, and Lisadraw, Lisaproject, Lisacalc, Lisagraph, Lisawrite and Lisalist will be available together at £

Dear Sir,

Enclosed find the press release for our new ROM based software for the BBC Micro aptly named Beebfont. The ROM has 6 standard scripts, 5 in upper & lower case and 1 in UPPER CASE ONLY. The facility for 2 user-defined character sets has also been provided.

TWO-FACED — It's amazing what you can do with a humble dot-matrix printer these days. Watford Electronics (0923 40588) is now selling a ROM-based program to make your letters and other documents more attractive. Beebfront gives you six new typefaces and allows you to define two of your own character sets. To sell for £45, Beebfront will be in competition with the disk-based Fancy Font (Issue 36). Fancy Font offers different sizes of font, more sets and costs £161.

Micro printer family grows with another Brother

Spring should see the lauch of the Brother EP-44, a much improved version of the Brother EP-22 portable typewriter/printer (Issue 35).

The EP-44 still has a built-in RS232 interface, but has a much larger memory than the EP-22's 2,000 charcters, has much better quality print with true descenders, and is send and receive, so you can use it as a terminal or even as an extension keyboard for your micro.

On top of this the editing facilities have been enhanced, and it will be possible to mix calculations and text. The Brother's brother costs around £230, and, large companies being what they are, is about to be joined by another brother.

This is the HR5, which is a printer only. It will cost £170, and will print at around 30cps. Its main feature is that it is very small, around half the size of an Epson, and emulates the MX80. So if you can get your micro running with an Epson, you should have no trouble with this one. It uses the thermal paper or thermally printed carbon ribbon system used by the EP-44. This system was adequate on the EP-22, but was much clearer on the pre-production models *PCN* saw.

Brother itself is now on the brink of a major commitment to the UK micro printer market, and will be giving interfacing support to customers. The company regards itself as having about a year's start on its nearest rivals, and should be producing a number of new products over the next year.

Torch first with Z80 card

Torch Computers has pushed Acorn into second place by bringing out a Z80 card for the BBC micro.

Torch already builds a Z80 into its disk pack but it announced last week that it had made a card for the BBC including the Z80 processor, 64K of RAM, its MCP operating system offering CP/M compatibility, and the Perfect suite of software.

The unit will cost £375.

The prices of Acorn's controversial second processors for the BBC are not expected to be as high as *PCN* reported last week. An official Acorn spokesman said that pricing on the 6502 and Z80 add-ons has yet to be decided, but he added that they were likely to cost a little under half what *PCN* had been told by an Acorn representative at Compec — this would put them below £175 and £400 respectively.

In quantities of 100 Z80 chips cost about £6 each.

Acorn net cast

In a move that could herald the end of Econet, Acorn has revealed that it is working on a new networking system based on the Cambridge Ring.

As the result of collaboration between Acorn and Cambridge University's Computer Laboratory, the company hopes to offer a £50 CMOS chip that will allow BBC Bs and other micros to interface with a second generation of the highly rated ring network.

Apart from its low cost compared to other networking systems like Ethernet, the improved ring offers a high data transfer rate. A Cambridge Ring using fibre optic cable could operate at 100Mbits per second and carry video signals in addition to data and voice signals.

Hermann Hauser, an Acorn director, has said that the Cambridge Ring will replace Econet as the standard networking system for the BBC. Existing users will be able to upgrade to the new system when it becomes available at the end of next year. In practice it wouldn't be so much an upgrade as a replacement.

Econet uses twin twisted pairs of wires in a bus configuration with a collision detection protocol. It is, therefore, completely incompatible with the Cambridge Ring which uses a single twisted pair of wires (or in the fastest version, optical fibre cable) in a ring configuration with an 'empty slot' protocol.

Its main drawback is that it may have missed the boat if it is to become an industry standard. IEEE, the American standards institute, has opted for Ethernet, which is similar in concept to Econet but operates at speeds approaching that of the Cambridge Ring. Meanwhile IBM has announced a network of its own using a token passing protocol (a station can only transmit if it is in possession of a token that is passed to each station in turn).

The other drawback could be cost. If Acorn keeps costs down to the £50 per station it has quoted it will certainly make it attractive. But other manufacturers are likely to wait and see if Acorn can deliver the goods before committing themselves to buying Cambridge Ring chips.

Torch Computers, for example, which sells its own upgraded version of Econet, called Torchnet, will not say if it will switch to the ring.

'The first Cambridge Ring is certainly excellent,' said Ray Anderson, Torch's software director, 'and, in principle, we are interested in the technology. But we would want to know more about what Acorn's product can do together with firm prices and delivery dates before we started to give it active consideration.'

Old ROM back in some BBCs

By John Lettice

If you're buying a BBC Model B this Christmas, you may be in for a surprise. The Model B is selling so well that Acorn is facing a chip shortage, and as a result is using stocks of its 1981 Basic ROM chip in some machines.

It's difficult to tell what your chances of buying a BBC with the old chip are, because the percentage will vary depending on the availability of the new ones. An Acorn spokesman told *PCN* that the numbers involved were very small.

But from the customer's point of view you have no comeback on Acorn if you do find you've bought a machine with the 1981 chip. Although most Model Bs are now produced with the 1982 Basic ROM, the specifications Acorn quotes are for the 1981, so this is the only chip Acorn is legally obliged to use.

Most customers will still get the enhanced chip, but a few will not. So if you're about to buy a BBC B, either get a guarantee that your dealer will exchange it if necessary, or check it before buying it. Hit the Break key and type REPORT, and it will either tell you Copyright 1981 or 1982.

But what if you've already bought a 1981 one? Will you be able to switch the chip later? Acorn says that it is working out a suitable policy for replacement of the old chips. Watch for developments in future issues.

Promises are no substitute for presents

For sale, or not for sale?

In the pre-Christmas bonanza of advertised new releases you would be well advised to phone suppliers to find out if what you want is, in fact, ready for sending on.

We've found several suppliers advertising programs which are not ready for release. Reasons given include: 'We had tape-duplicating problems, the new batch is coming in tomorrow'; 'The software's ready, we're just waiting for the cassette covers to come back from the printer'; 'We're out of stock at the moment', (the advertisement had been out only 3 days).

While these reasons may be true, it seems suppliers are advertising products which are not ready for delivery. Not that you would guess this from advertisements. Most of the products were displayed alongside well-known and available programs.

So, before you part with your Postal Order or cheque, take time to find out whether you can expect the package in a few weeks, or several months . . .

A-T calls in spreadsheet

Ashton-Tate, maker of software such as dBase II has withdrawn its Financial Planner spreadsheet.

A spokesman for A-T said that promised enhancements had not come through early enough and the company had therefore decided to pull the package in and to spend time on improving it. Financial Planner will be relaunched in 1984. The spokesman would not give a firm date, nor detail the 'substantial' improvements to be made, which are thought to concern recalculations, a weak feature.

Artless Hobbit

BBC Micro users can now get their hands on Melbourne House's best-seller The Hobbit, but they have to do without the program's graphics.

The BBC's 32K is enough room for text handling and other necessary routines, but the extra 16K in which the graphics routines reside on the Spectrum and Oric systems isn't there.

The Hobbit has been consistently popular since its launch in November last year and many people still number it among the best adventure games on the scene. Whether it will catch on without graphics remains to be seen. The BBC version costs £14.95 and comes with a copy of Tolkien's book and a 16-page instruction booklet.

Dragon deal

Dragon 32 users will not be offered an upgrade to the Dragon 64. Instead the company is looking at a trade-in deal.

'We are putting the wheels in motion at the moment to set that up,' said Dragon Data's Richard Wadman. 'The net cost to the user of moving to a 64 in this way could be about £85', he added.

Dragon will be putting plenty of resources behind the 64 in the new year and it is also looking at MSDOS to complement OS-9 on its business system. Mr Wadman said that the Dragon 32 would probably fade into the background, as far as sales are concerned, in the middle of next year but he added, 'That doesn't mean that we will be strangling it on January 1.'

He scoffed at suggestions that Dragon Data had considered pulling out of the home computer business in the wake of the financial problems that came to a head in September (Issue 27). 'We intend to expand our range,' he said.

Two early new year disk drives for Oric

The long awaited Oric drives will be available in January — twice.

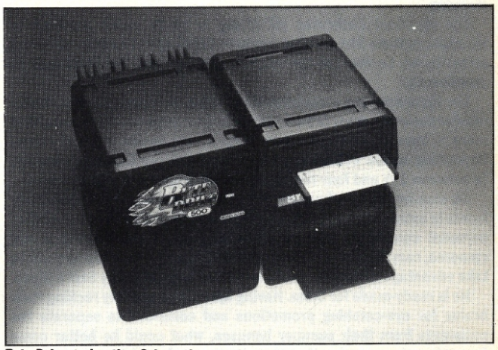
First off the starting blocks will be Byte Drive 500, which will be available in early January for the Oric, BBC B and Apple. Stocks of these are being built up by manufacturer ITL Kathmill, (0634) 815464.

Next in line will be Oric's own drives, which an Oric spokeswoman claims will be launched at the Northern Computer Fair on January 17.

The official Oric drives are said to be in production, but the spokeswoman could not give *PCN* information about numbers being produced. ITL, on the other hand, says it has been holding back on the launch of Byte Drive 500 until stocks were large enough to satisfy shops.

The ITL product's specifications are impressive. The basic unit consists of a small black single-disk box, using 3in. Hitachi disks with a formatted capacity of 220K per side, and a claimed typical access time of 3 milliseconds. The idea is that all micros use the same unit, plus a separate power supply that fits into a matching case. A connecting 'hybrid cable' has the machine-specific interface built in. For a complete single disk system for the Oric you'd pay £299, including VAT.

ITL says the disk system doesn't interfere with the micro's internal memory, so you should have no problems running existing programs. The Oric version is compatible with the redesigned Oric ROM, and if you have the old ROM it includes a number of enhancements that tackle some difficulties you may have encountered.



Byte Drive — beating Oric to the punch.

It's planned to get the system available for other micros soon, and a Spectrum version is scheduled for April or May. An upgrade to 5.25 in. disks is also scheduled, and ITL wants to beef up the capacity of the system while holding the price, at least for a year.

But why start with Oric? ITL tells us that 'disk drives were promised for several other micros, Oric didn't have them, and we aimed at where we saw the need.' Design of the system started in July, just before Oric started referring to its 'coming soon' drives.

Meanwhile, the Spectrum — no relation — chain of computer shops is selling a disk system for the ZX Spectrum for £245. It's made by Interactive Instruments, and is currently exclusive to the Spectrum chain. It works for the 16K or 48K, and uses 100K single-sided double-density 5.25 in. disks.

The sudden explosion of drives for low-cost micros looks like starting a new war in the market. If more manufacturers using the new 3 in. and 3.5 in. disks come into the market, cheap storage should take several giant steps, and you could be throwing away your tape recorder by next Christmas.

But another pioneer of home micro disk systems, the French company Cyborg, does not expect to ship before January.

VIEW FROM JAPAN

Santa-san and a micro Christmas

By Serge Powell

'Tis but a short time to Christmas and all across Japan young kiddies are dreaming of ROM and RAM, and their joysticks are tucked carefully beneath the futons in the hope that old Santa-san will soon be there.

Or are they?

For a Shinto-Buddhist country it seems that Japan has certainly managed to get into the swing if not the spirit of Christmas. Here we are, as I write this, not yet out of November, and last night the television news covered a parade of Santa Clauses in some remote part of Japan. Even without that I've already become so used to seeing Santa Clauses in the store windows that if the hordes of Japanese salary men that board my commuter train each morning suddenly did so bedecked in red suits and sporting white beards in place of their three-piece suits I might not notice the difference.

The retailers certainly seem to be gearing up for business in what would appear to be the normal Christmas fashion. The stores are bulging with electronic gew-gaws including many new computer models and a lot of new games, especially since the advent (if that is the right word in this context) of MSX Basic.

But gearing up for business in the normal Christmas fashion begs a number of questions in a non-Christian society. Actually, the average Japanese family's idea of Christmas is for poppa-san to travel home on Christmas Eve with what is known as a Christmas cake, but instead of being filled with nuts, fruit and loose change it is little more than a birthday cake decorated with Merry Christmas icing rather than Happy Birthday.

The standard Christmas gift-giving is pretty much confined to inconsequentials like woollen jumpers (apologies to sheep shearers everywhere). So why are the retailers getting ready for Christmas so assiduously?

The Japanese have a quaint custom called the Bonus Season. Unlike most seasons, it comes twice a year — in December and June — and it is more a form of deferred salary than a real bonus in most cases. Depending on how well the union has negotiated the deal, it can amount to between 1½ and four times your monthly salary in a lump sum.

No wonder the shopkeepers and store managers are rubbing their hands in anticipation of heavy sales, especially of high ticket items like personal computers with all the trimmings, video recorders and cameras, cars, and foreign holidays, and no wonder they are so quick to take advantage of that old western custom personified by Santa Claus.

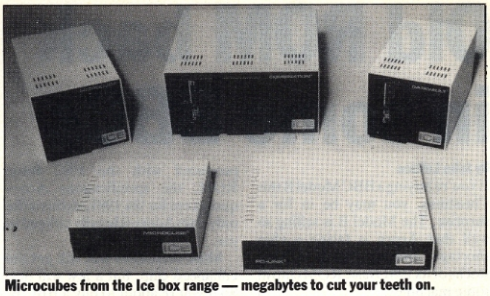
He is ready-made for them. Having spent June and July racking their brains for eye-catching promotions and come-ons to separate the recipients from their summer bonuses, what could be better come December than an idea that their brethren abroad have had almost 2,000 years to fine tune.

And so Santa Claus becomes the excuse the retailers give to individuals (and surprisingly not so much to families, which presumably have to consider things like mortgages) so that they can purchase the thing they would probably be buying anyway.

But this is hardly the season to be cynical. When all is said and done, we all know that it's better to give than to receive, and if retailers can give Shinto-Buddhists an excuse for getting into computers there may be something to be said for the Christmas ideal of peace on earth and goodwill to men the way it works in Japan.

But it's still a fascinating mixture of the sacred and the profane; the spirit of Christmas and the world of wage bargaining. In Japan, of course, it might be argued that the spirit of Christmas is not so much sacred as irrelevant, but in the world of commerce nothing is irrelevant that can be turned to profit.

With the unions and the bosses sitting around a table and agreeing that a rather substantial amount of income should be handed over at this time of year, and with the consumer actually getting to it before the tax-man, there should be plenty of goodwill flying around; why shouldn't the computer industry and the retailers catch a piece of it?



Microcubes from the Ice box range — megabytes to cut your teeth on.

Mass storage in the Ice age

Ice has launched a range of Winchester disk drives and associated back-up devices. Amongst them is the Microcube which Ice claims utilises the latest developments in hard disk technology.

The Microcubes are 3.5in drives and are available in capacities of 5 and 10Mb. They will interface with the Apple II, IBM PC, Sirius/Victor and Epson QX10.

Ice provides the interface card, installation and operating manual, full support software, not to mention one year's on-site maintenance as standard.

Contact Ice (07842-47271)

A New Year's revolution?

Business micro users can look forward to better products and better service next year.

David Broad, managing director of UK micro maker Comart, told a recent meeting organised by the Computer Retailers Association (CRA) that 1984 would sort out some micro suppliers and see others improving their standards.

'Nineteen eighty-four will certainly see the exit of many of the camp followers,' he said. But other micro makers and 'professional' dealers will add to the functions and services they can offer users, he predicted.

'I think that all micro manufacturers will become more applications-oriented,' Mr Broad said. He suggested that software endorsement schemes would become much more common than they have been. On the system software front he forecast that utilities would increasingly be built into the machine and included in the sale price, with much improved documentation.

'A 12-month warranty will be the order of the day,' he said, adding that fast repair and return times backed up in the first place by improved reliability from the manufacturers would give users an easier ride in the coming year.

His speech to the CRA meeting also gave a hint of a reduction in the price of UK-produced micros. The duty barriers that discriminate against imported components in contrast to imported systems are coming down, he said.

Without sticking his neck out on the subject of technology, Mr Broad predicted closer co-operation between suppliers of both hardware and software particularly in the area of networking. 'Clients are going to insist on compatibility,' he said.

Transform your Spectrum with a real keyboard

A Beckenham company looks set to beat Fuller to the punch with a full-size keyboard for the ZX Spectrum.

Transform (658-6350) says that it is currently manufacturing the keyboard and it expects to be able to demonstrate it at the ZX Micro Fair in London at the weekend. By mid-December it should be in full production.

The keyboard unit will take the Spectrum with or without an Interface 1 attached. Its features include a space bar, numeric pad, separate exponentiation mode and decimal point key.

Transform will be offering The Telesound beeper with the unit to transfer sound to your TV speaker.

With a gentle dig a Fuller, whose FDS has been pictured in advertisements and spoken of in awed tones for several months, Transform has declared that it will not be advertising the keyboard until it is confident that it will be able to meet. The unit will cost £99.99.

VisiOn arrives . . .

VisiCorp's Lisa-like operating environment, VisiOn, is finally available for delivery, following its announcement earlier this year. But users may be disappointed when they investigate the prices and discover the drawbacks.

Like Microsoft's MSDOS enhancement, VisiOn aims to give a more friendly interface by using multiple windows on the screen and a desktop mouse to select options and move text and data.

VisiOn also allows you to run several tasks concurrently and switch easily from one application to another.

The VisiOn screen looks similar to Apple's expensive Lisa system with the notable omission of the icons (small pictures of everyday objects that represent computer functions).

VisiCorp describes the screen display as a desktop metaphor; it has tried to create an electronic analogy of what happens on the average desk.

Using VisiOn, a collection of files can be taken from the filing drawer and spread on the desk. A file can be opened and worked on, and information moved between files, using the mouse to select commands.

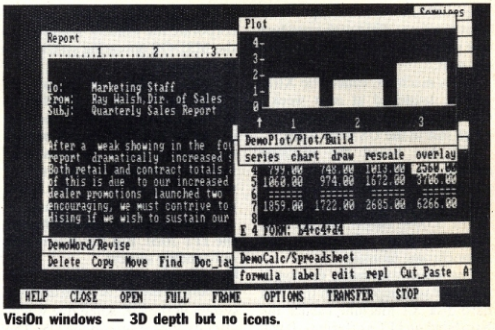
For the inexperienced user, there are two levels of 'help' information. Placing the screen pointer on a command generates a one-line comment describing what the command does. For more detailed information the 'HELP' command brings a 'help' window on screen, According to VisiCorp, VisiOn keeps track of what you are doing and anticipates what help you may want.

Unlike Microsoft's enhanced MSDOS, VisiOn is not an operating system, but sits on top of the OS providing a consistent interface between the user and the applications program. And, unlike the Microsoft offering, it will cost extra.

These differences could be crucial. If you use, say, an MSDOS system, your favourite programs will run under the enhanced MSDOS even if they don't take advantage of the mouse and multiple windows. With VisiOn, the same programs would have to be re-written.

Since there will be far fewer people using VisiOn rather than MSDOS, it seems likely that fewer software companies will customise their programs to work with VisiOn.

At the moment only a spreadsheet, a graphics package and a word processor will work under VisiOn, all written by VisiCorp. A database manager is promised for next spring.



VisiOn windows — 3D depth but no icons.

The only other programs in the pipeline are communications packages being developed jointly with other software companies, which will add micro-mainframe links and networking.

The costs of VisiOn could be another disincentive. The Applications Manager costs £375 (plus VAT), to which must be added the cost of the aplications packages and the mouse.

For a user wanting VisiOn Calc and VisiOn Graph the cost will be £935 (plus VAT). With VisiOn Word the price rises to £1,170 (plus VAT).

Dealers at the UK launch were less than impressed with VisiOn. As one put it: 'VisiCorp is built around the success of one product, Visicalc, and that has had its day. I sell 40 Lotus 1-2-3 packages for every copy of VisiCalc.

'All that VisiOn seems to offer is a more user-friendly competitor for 1-2-3 but without the database. At £1,200 a throw it is hardly good value for money.'

And Microsoft opens windows

MS-Windows' opening screen — a mouse-controlled cursor and icons.

Windows on micros are about to become one of the biggest promotional drives since the double-glazing boom. The reason? Microsoft Windows is going to be standard equipment on the micros of 23 manufacturers.

MS-Windows was launched in the US two weeks ago (Monitor, Issue 38) and made its first appearance in the UK last week. In the interval it has found further support from hardware and software suppliers, and a roll of companies that will support the product reads like a Who's Who of microcomputing.

IBM's name isn't on the roll but that doesn't deter Microsoft from hailing MS-Windows as an opportunity to create 'a standard user interface and development environment'. In other words, what you do with a micro and the way you do it is about to become more consistent across a range of different machines.

MS-Windows is an extension to MSDOS 2.0 and on the machines of 23 suppliers it will be part of the package. Microsoft UK's general manager David Fraser expects it to make little or no difference to the cost of the system.

To use it you need 192K of RAM, twin floppies, a bit-mapped display and a mouse. The system lets you select a job from a row of icons, split the screen to accommodate windows featuring several applications, and initiate procedures without touching the keyboard.

For the sake of speed, MS-Windows loads all the selected applications into RAM when it is booted. Data can be transferred between applications, but the system may have restrictions when running jobs requiring a great deal of memory. Microsoft is looking into forms of swapping.

MS-Windows features passive and intelligent windows; a block of text, for example, may be realigned when the window in which it appears is moved to another area of the screen, while a simple display may be clipped as its window shrinks. It also allows over-printing part of a window with a relevant 'help' box.

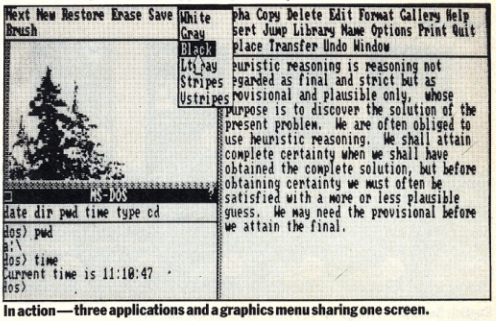
In alphabetical order, MS-Windows' 23 suporters are: Altos, Apple/Rana, Burroughs, Bytec, Columbia, Compaq, Computer Devices, Convergent Technologies, Data General, DEC, Eagle, Hewlett-Packard, Honeywell, ITT, Mindset, NCR, Polo Microsystems, Seequa, Tandy, Televideo, Texas Instruments, Wang and Zenith.

Software producers supporting the system are Ashton-Tate, Context MBA, Lotus, Peachtree, Software Arts and Software Publishing, and ACT and Micro Focus seem likely to join them.

The first systems with MS-Windows are due out in the US on April 30.

Each manufacturer implements the package, usually by adding two device drivers — an interface to handle the keyboard and mouse input, and another for the screen output.

It may be that Microsoft needs the suport of IBM to stand a real chance of establishing a standard with MS-Windows. Mr Fraser pointed out that IBM doesn't usually follow suit. It will not pronounce on windows until it is ready to.



In action — three applications and a graphics menu sharing one screen.

ITT extras

The multinational ITT Corporation is set to take on IBM with a product that undercuts the PC by about five per cent.

ITT's machine, called the Xtra, will be launched at next week's Comdex show in Las Vegas and will be on sale in the US from April.

ITT has based the machine around the 8088 processor and is promising IBM compatibility. It will be offered in two versions.

The $3,000 model has 128K of RAM, twin floppies and monochrome monitor.

The more expensive version is intended to compete with the IBM hard disk XT machine (hence the Xtra label on ITT's offering). It will have a 10Mb hard disk.

Apart from the lower cost, ITT is pinning its hopes on the extras it has built into its machine, including communications facilities to link into ITT services such as electronic mail. There is also a tilt and swivel mechanism on its monitors and a redesigned keyboard.

ITT says the machine will incorporate the window extension to the MSDOS operating system (report, page 5).

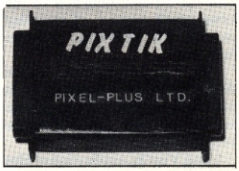
Unlike IBM, ITT is not an established computer manufacturer. Its main involvement in computing has been as a maker of terminals and printers and its previous foray into the personal computer field was through a deal with Apple which allowed the company to assemble Apple IIs and sell them as the ITT 2020. But this was not an outstanding success.

■ Co-incidentally, IBM has announced the PC XT/370 desktop system in the UK some five weeks after its appearance in the US. The XT/370 looks identical to the PC's hard disk cousin, the XT, but it interfaces to IBM's VM mainframe operating environment and gives a wider range of functions to users. With 10Mb of hard disk it will cost £8,228 plus VAT, and you will also have to fork out £919 for the software.

IBM ON THE LINE — ACT has adapted its electronic mail package Micromail to support the IBM PC, opening the service up to many new users. The package lets subscribers send and receive messages, link to Telecom Gold, and send telexes. It costs £109 for which you get access to an electronic mailbox for a year, communications software, and documentation. ACT, distributor of the Sirius and manufacturer of the Apricot, is on 0272 211733.

Keeping time with a PC

Unspectacular though it may look this modest little device is unusual. It is called Pixtik and is a real-time clock that fits externally to the IBM PC. You plug it into the parallel printer port and slot the printer into it. It has a power supply good for two years and costs £57.70 from Pixel-Plus, 0530 62565.



SOFTWARE

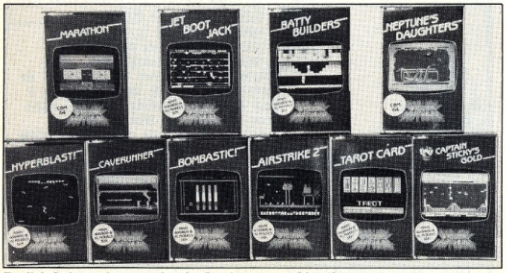
PCN rounds up the latest add-ons.

Games

Atari: English Software (061-835 1358) has expanded its Atari range with games for the 400, 800, 600XL and 800XL, costing £9.95 each. The titles include Batty Builders, Airstrike 2, and Caverunner. And Allrian (0753 45201), a newcomer to the Atari field, is publishing a series in 16K for the full range of micros. Supplied on cassette, at £7.50 each, they are Intruder Alert, Rings of the Empire, Space Trap, Giant Slalom, and Crazitack.

Colour Genie: The Ipswich Software Factory has released three games for Lowe's Colour Genie, each costing £8. A-10 Bomber is a Scramble-type game, Geniepede pits you against spiders and scorpions, and Martian Rescue involves picking up a ship-wrecked crew while avoiding Martian attackers and asteroid storms.

Commodore: An interesting idea from Audiogenic caters for both Vic 20 and Commodore 64 users. Its new cassettes store different versions of the same game on either side. Two in this series are currently available: Cataclysm and Bonzo. Cataclysm is shoot-em-up style and costs £5.95; Bonzo, for £7.95 has ladders, levels, and boxes. Broderbund, the US software producer distributed in the UK by Softsel (01-844 2040) has adapted its Spare Change cartoon game for the Commodore 64. There are already for the Apple and Atari. In this game you own a Spare Change Arcade and have to stop pilfering by two Zerks. Marketing Micro Software, closer to home in Ipswich (0473 462721), has a US import for the 64 called Zeppelin Rescue, costing £19.95 on disk or £17.95 on tape. Another from the same company, Conqueror, is for the Vic 20. This has a medieval setting and costs £15.95.



English Software's range for the Atari systems old and new.

Zeppelin Rescue and Conqueror among others from Marketing Micro Software.

Business

Sanyo: A book-keeping system with the promising name of Prophet has been launched for Sanyo micros by Logitek (0257 426644). It includes sales, nominal and purchase ledgers, invoicing, stock control, payroll, and a report generator. The full package costs £750 plus VAT.

Sirius: Croydon systems company Encotel (01-686 9687) has added a built-in calculator to the newly-released version of Spellbinder for the Sirius. At £320, it includes assembler files of video and printer drivers, editing characters, microprograms and documentation. Paperless offices are also the aim of Micro Nationwide (0293 511482) with its Memo 2000 package. Running at 1200 bps, this lets a Sirius user hook into Telecom Gold, other Sirius systems, or compatible computers. Versions for the IBM PC, Apricot, and NCR Decision Mate V are planned.

Commodore: Also from Broderbund (see under Games) comes Bank Street Writer, a word processor for the Commodore 64. In the US it costs $69.95.

IBM PC: ACS of London (01-883 7302) has been appointed by Micro Marketing International and IMSI of the US to distribute their products in the UK, bringing over programs for the IBM PC. Four-Point Graphics costs £132; Bisybase, to schedule your day, costs £183; Job Costing is £183; and Investment Manager, compatible with Lotus 1-2-3, costs £199.

CP/M, MSDOS: Corporate Modelling Consultants has unveiled Unifor, a £950 statistical forecasting package for business systems. It provides the tools to develop models from which forecasts can be made.

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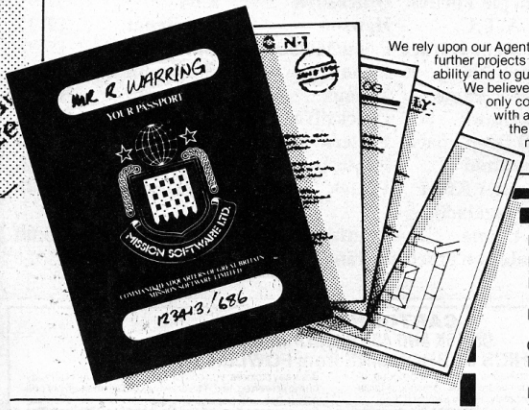

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PCN Charts

This top 30 games list is compiled from both independent and multiple sources across the nation. It reflects what's happening in high streets in the two weeks up to November 10 and, like the micro charts, does not take account of mail order sales. The micro charts this week show the number of machines sold in the same two-week period so they tell the story in the high street between November 11 and November 25.

GAMES

Top Thirty

			GAME TITLE	PUBLISHER	MACHINE	PRICE
▲	1	(5)	Valhalla	Legend	Spectrum	£14.90
▼	2	(1)	Lunar Jet Man	Ultimate	Spectrum	£5.50
►	3	(3)	Flight	Psion	Spectrum*	£5.95
▲	4	(12)	Ant Attack	Quicksilva	Spectrum	£6.95
▲	5	(—)	Atic Attack	Ultimate	Spectrum	£5.50
▼	6	(4)	Hobbit	Melbourne	Spectrum*	£14.95
▼	7	(2)	Manic Miner	BugByte	Spectrum	£5.95
▲	8	(9)	JetPac	Ultimate	Spectrum*	£5.50
▲	9	(22)	Splat!	Incentive	Spectrum	£5.50
►	10	(10)	Gridrunner	Llamasoft	Vic 20*	£6.00
▼	11	(6)	Hovver Bovver	Llamasoft	C64	£7.50
▲	12	(—)	Arcadia	Imagine	V20*	£5.50
▲	13	(15)	Horace and the Spiders	Psion/Melbourne	Spectrum*	£5.95
►	14	(14)	Chukkie egg	A&F	Spectrum	£6.90
▼	15	(8)	Kong	Ocean	Spectrum	£5.90
▲	16	(—)	Computer War	Thorn	V20*	£29.99
▲	17	(23)	Harrier Attack	Martech/Durell	Oric	£6.95
▼	18	(7)	Zoom	Imagine	Spectrum	£5.50
▲	19	(29)	Bugaboo	Quicksilva	Spectrum	£6.95
▲	20	(28)	Corridors of Genon	New Generation	Spectrum	£5.95
►	21	(21)	Purple Turtles	Quicksilva	C64	£7.95
▼	22	(13)	H.A.T.C.	Hewson	Spectrum	£7.95
▲	23	(—)	Hungry Horace	Psion/Melbourne	Spectrum*	£5.95
▼	24	(18)	Scrabble	Psion	Spectrum	£15.95
▲	25	(—)	Sheer Panic	Visions	Spectrum	£5.95
▲	26	(—)	Skyhawk	Quicksilva	Vic 20	£7.95
▼	27	(19)	3D Deep Space	Postern	Atari*	£8.00
▲	28	(—)	Pyramid	Fantasy	Spectrum	£5.50
▲	29	(—)	Hunter Killer	Protek	Spectrum	£7.05
▲	30	(—)	Metagalactic Llama	Llamasoft	Vic 20	£6.00

*Denotes available on other machines

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3. ATIC ATAC	ULTIMATE	£4.50
4. LUNAR JETMAN	ULTIMATE	£4.50
5. PSST	ULTIMATE	£4.50
6. ZZOOM	IMAGINE	£4.49
7. ZIP ZAP	IMAGINE	£4.49
8. ARCADIA	IMAGINE	£4.49
9. HALL OF THE THINGS	CRYSTAL	£6.50
10. ROMMELS REVENGE	CRYSTAL	£6.50
11. THE DUNGEON MASTER	CRYSTAL	£6.50
12. TRANS TOWER	RICHARD SHEPHERD	£5.25
13. DEVILS OF THE DEEP	RICHARD SHEPHERD	£5.25
14. KONG	OCEAN	£5.20
15. PENETRATOR	MELBOURNE HSE	£5.95

COMMODORE 64		
1. KONG	ANIROG	£6.99
2. SCRAMBLE	ANIROG	£6.99
3. ATTACK OF MUTANT CAMELS	LLAMASOFT	£6.50
4. GRID RUNNER	LLAMASOFT	£6.50
5. HOOVER BOWER	LLAMASOFT	£6.50

VIC 20		
1. METALLAMA'S	LLAMASOFT	£5.25
2. GRIDRUNNER	LLAMASOFT	£5.25
3. ARCADIA	IMAGINE	£4.75
4. BEWITCHED	IMAGINE	£4.75
5. JET PAC	ULTIMATE	£4.75

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The *Graphics Subrougine* is in machine code. The user writes his own Basic program, loads on the Graphics Subrougine and accesses this from the Basic program.

A booklet explains in detail that to move a drawing you need to tell the Graphics Subrougine where the drawing is in the memory, where an instruction sequence is, where you want the drawing to start on the screen, the length and height of the drawing, and the speed of movement. All this is done using *Basic* commands. The Graphics Subrougine occupies less than 760 bytes.

It moves a drawing by altering the area of memory containing the screen display. You do not even need to draw any pictures; you could just move whatever is already on the screen eg. text. The drawings that are moved are one colour (ink and paper). You can also use the Graphics Subrougine to draw and colour a stationary drawing. The time taken to draw and colour a picture which fills the entire screen is a 1/10 second.

A 3 × 3 characters drawing involves typing in 81 numbers and uses up 81 bytes.

Please send me ..... copies of the Graphics Subrougine and instructions at £10 each
Cheque/P.O. to Fowler Software, Hendon Mill, Nelson, Lancs.
Mr/Mrs/Miss.....
Address .....
.....
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PCN Charts

Neither mail order nor deposit-only orders are included in these listings. The prices quoted are for the no-frills models and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, is updated every alternate week.

PCN Charts are compiled exclusively for us by MRIB (Computers), London, (01) 408 0250.

HARDWARE

Top Twenty up to £1,000

	MODEL		PRICE	DISTRIBUTOR
▲	1 (3)	CBM 64	£220	(CO)
▼	2 (1)	Spectrum	£99	(SI)
▼	3 (2)	BBC B	£399	(AC)
►	4 (4)	Vic 20	£140	(CO)
▲	5 (6)	Oric 1	£99	(OR)
▲	6 (7)	Dragon 32	£170	(DD)
▲	7 (8)	TI/994a	£90	(TI)
▼	8 (5)	ZX/81	£45	(SI)
►	9 (9)	Atari 800	£300	(AT)
▲	10 (11)	Apple 11e	£750	(AP)
▲	11 (15)	Sharp MZ700	£240	(SH)
▲	12 (13)	Lynx 48/96	£225	(CA)
▲	13 (16)	Tandy Colour	£180	(TA)
▲	14 (19)	Colour Genie	£168	(LO)
▼	15 (12)	Sharp MZ80A	£349	(SH)
▲	16 (18)	CGLM 5	£150	(SO)
▼	17 (10)	Atari 400	£150	(AT)
▲	18 (—)	Newbrain A	£268	(GR)
▼	19 (14)	Aquarius	£70	(MA)
▼	20 (17)	Electron	£199	(AC)

Top Ten over £1,000

►	1 (1)	ACT Sirius	£2,525	(ACT)
►	2 (2)	IBM PC	£2,392	(IBM)
▲	3 (4)	Apple III	£2,780	(AP)
▲	4 (5)	Commodore 8000 series	£1,200	(CO)
▼	5 (3)	HP86A	£1,570	(HP)
▲	6 (9)	Apricot	£1,719	(ACT)
▲	7 (—)	Kaypro	£1,949	(CKC)
▼	8 (6)	Epson QX10	£1,995	(EP)
▼	9 (8)	DEC Rainbow	£2,714	(DEC)
▲	10 (—)	Televideo TS-800 series	£1,495	(MD)

AC Acorn Computers. **ACT** — ACT. **AP** — Apple Computer. **AT** — Atari International. **BM** — British Micro. **CA** — Camputers. **CO** — Commodore. **DEC** — Digital. **DR** — Dragon Data. **EP** — Epson. **HP** — Hewlett Packard. **IBM** — IBM. **LO** — Lowe Electronics. **LL** Lucas Logic. **MA** — Mattel. **OL** — Olivetti. **OR** — Oric. **SH** — Sharp. **SI** — Sinclair. **SO** — Sord. **TA** — Tandy. **TI** — Texas Instruments.

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The extra commands available are:

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- DELETE — Basic line/block delete.
- EXAMINE — reads tape headers and displays information.
- FIND — find specified string in Basic program.
- MEMORY — displays memory status.
- RENUMBER — full line renumber with GOSUBs and GOTOs.
- SCROLL — ON/OFF continuous scrolling.
- TRACE — ON/OFF slows program execution, displays line and statement currently executed.
- VARIABLES — displays variable names and contents.

48K Spectrum Extended Spectrum — £9.95

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Manic Miner Reincarnate

Any Spectrum owner struggling to get through Manic Miner may be interested to learn how to get more lives. The number of lives you start with is held in 34269, so first MERGE the Basic program and stop the tape. Then enter "25 POKE 34269, n" where n is the number of lives you would like. Then RUN this program and start the tape again.

It is recommended that n be no greater than 32 as it can corrupt the screen display and greatly reduce speed.

Brian Sheldon,
Morecambe, Lancs
Some would say, this isn't quite cricket . . . Ed

Gazing in hope toward Jupiter

I hope that the demise of Jupiter Cantab does not mean the end of the Ace. I think that lack of proper marketing was one reason why Jupiter Cantab did not survive. The Ace is a good machine (but could have been better) and has a well written user manual.

The supposed lack of software for the Ace is no problem to me. I have written a home accounts program, which I hope will be published shortly, and am working on a database with word processing facilities, which I will also put forward for commercial publication. The lack of hardware add-ons, however, is a problem.

A. Kashko
Hayes, Middlesex.

Keeping dealers in order

I think that something has got to be done about readers who advertise goods without having them in stock.

I ordered a disk drive on a return of service basis which was well advertised. Five weeks later this was still not received. And not a word from the supplier. So I sent a cancellation notice with proof of delivery, and I advised Access of my actions, as my account had not been debited up to this point.

However, two weeks later the disk drive arrived (the supplier had not accepted my cancellation).

In the meantime I had purchased elsewhere, and received my order within three days.

The only problem is that I ended up with two disk drives.

I believe I was justified in cancelling the first order and the supplier should have done the honourable thing and accepted this. Another point is Access should advertise that a credit card cannot be cancelled despite a two-week notice.

G S Dutton,
Harwich, Essex.

Commodore confusion

I have just been browsing over issues of PCN and . . . I'm staggered . . . I'm shocked I'm . . . words fail me.

I have just reread your advertisement for the Personal Computer News Sixty Programs publication for the BBC, Spectrum, Dragon and Oric. Good stuff! But . . . I quote, 'completely new collection of programs for each of the most popular and fast selling computers' Come, come, now *PCN*. Have you heard of the Vic 20 and the Commodore 64? According to your own publication the current second and third positions in the charts are respectively held by the Vic 20 and the 64, and at the time of publication the positions were second and fourth. What has Commodore done to you that you should so pointedly ignore its computers when publishing the Sixty Programs books?

The Vic 20 has been one of the most popular and high selling computers for donkeys years. But the above quote hardly seems fair on the Vic 20 and the 64 and you have misquoted the current 64 recommended price in *PCN* Charts, which is unforgiveable.

While I am having a good moan, would you assure me your Bee game shown at the PCW Show will be listed in ProgramCards for other computers apart from the Beeb, and don't forget the 64 and the Vic 20 this time! Let's face it, we Commodore owners have enough to put up with our user's manuals and can do without *PCN* ignoring us.

E Covell,
Billericay, Essex.

Ignore you . . . Heaven forbid! PCN's books of 60 programs for the Vic and 64 are due out next month (and we put the price problem straight too) — Ed.

High-rise idea for exhibitions

Reading the *PCN* Datelines (which are an ace idea) made me think of an exhibition to which I went.

The show was cramped into one hall of the Bingley Hall, Birmingham, with half the space taken up by a rest area and café. The stands were virtually inaccessible unless you were a sixteen stone giant, with experience of judo, karate and heavyweight boxing. The answer to this problem? Two monitors. If the exhibiting company put a second monitor high-level then people at the back of the crowd could see.

Of course this would not be very suitable for a company displaying hardware, but my observations showed that 50 people did not (or were not so likely, at any rate) to group around a ZX81 RAM, or some other wonderful piece of hardware.

Marc Clewer,
Bourneville,
Birmingham.

Complaining rhyme of wasted time

On Guy Fawkes' Day I went to see
the Brainwave show at NEC.
I'd seen it in UK Events,
and so the trip (it seemed) made sense.
But all the halls were bleak and bare,
no home computers found I there.
(It really wasn't very funny,
I'd wasted lots of time and money)
Next time you hear of shows in Birmingham;
before you publish, try confirmingham!

Mike Campbell Jones
Dinas Powys,
S. Glamorgan.

PCN £10 Star Letter

'Tis with regret I must admit
How Datelines sent you on a trip
That wasted time, and money too
And caused concern to more than a few.

But we did all within our power
To check the facts — the day, the hour
And spread the word in all good faith
That Brainwave was the trip to make.

(And since you complain in novel way
You win star prize and £10 we'll pay!) — Ed

Share your thoughts in the UK's liveliest micro weekly letters columns. Funny, feisty or fanciful, your letter could win you £10 if it's of star status.

WRITE TO: Random Access, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

ROUTINE INQUIRIES

Lost in a maze of bits and bytes, trapped in a forest of errors, bugged by Basic? Whatever the problem, CALL on us. Our panel of experts is at your command.

Write to: Routine Inquiries, *Personal Computer News*, VNU. Evelyn House, 62 Oxford Street, London W1A 2HG.

All about Videotex plus a little hack

Q I hear and read of Prestel and Teletext. What are they? What is the difference between them? How do I go about getting my micro rigged up to use them? How much does it cost to join and for the use of each page?

Also, I've seen War Games — is it possible for a person to link a private computer to an international network and pass all security measures?

Name and address supplied

A Prestel and Teletext are different versions of what is known as Videotex — the technology that hooks the humble domestic television up to remote computers. Videotex comes in two forms: Teletext, which broadcasts the information as part of the television signal; and Viewdata, which uses the telephone network.

Teletext is non-interactive. You can receive the information but you can't send messages back to the remote computer. To receive it, you will need a special adaptor which is usually built in to the television. To use Teletext services, such as Ceefax or Oracle, costs nothing and there are no subscription fees.

At the moment the only micro that can receive and process Teletext information is the BBC B equipped with a Teletext adaptor (£225).

Viewdata is better known by the name of the largest commercial Viewdata service — Prestel. There are others that can be accessed by members of the public as well as private viewdata services run by companies for their own internal purposes. Prestel is run by British Telecom, which sub-lets space on its computers to organisations known as information providers. These maintain their own databases which may be open to any Prestel user or restricted to what is called a closed user group.

From the micro user point of view the two most useful information providers are Micronet 800 and Viewfax 258, whose pages are packed full of information about micros, latest micro news and software you can download and run on you own machine.

To use Prestel and other viewdata services you will need to buy a modem which converts digital signals into analogue signals for transmission over the telephone system. You will also need the software that allows your micro to talk to the computer on the other end of the telephone line. It is now possible to buy for most makes of micro a hardware/software package of this kind of under £100.

On top of this you will have to pay a quarterly subscription of £5 to gain access to Prestel and a five pence per minute connection charge if you use Prestel during normal office hours (the rest of the time it is free). Most closed user groups on Prestel (like Micronet) charge an annual subscription (in Micronet's case it is £8 a quarter) to gain access to some or all of their pages. In fact, most of Micronet's pages are open to public access and it is only its electronic mail and telesoftware pages that are restricted to members. All of Viewfax's pages are open to public access.

In addition, some pages on Prestel carry a frame charge. This can be as little as 1p per frame or as much as 50p. Most pages on Prestel are free and you will only have to pay to look at or use those pages that carry a service or software. (Even this is not a hard and fast rule).

As for your final point: yes, in theory it is possible to use your micro with a suitable modem to gain access to mainframe computers. Believe it or not an American micro 'hacker' recently appeared in court because he managed to break into a Department of Defense computer.

To be able to do this yourself (which, of course, we do not recommend you trying) you would need to know the telephone number of the computer and the passwords that will allow you to log on.

Snow joking matter, on a 64

Q A couple of months ago I bought a Commodore 64 together with the relevant data cassette recorder.

I am using the 64 with the Texas Instruments colour monitor BGC370. This has a total of eight different channels. Channels 7 and 8 are the ones I'm using.

It has all been a little bit frustrating since on both channels the message Ready For Use lasts only a short period before the screen becomes snowy.

After a couple of minutes the screen is all right again, but when I've typed in a program listing the screen has become snowy again.

Could you please advise me on what is going wrong with this colour monitor. The trouble does not occur when I use my other monitor, a 12in Zenith green screen model.

KH Tjoa,
Amsterdam, The Netherlands

A With Christmas on the way this is a topical and picturesque problem, but that won't be much consolation to you as you peer through a blizzard at your coding. How can the snow be thawed?

The answer probably lies in the Commodore 64 rather than in the monitor. The fact that you have no trouble with the monochrome monitor doesn't necessarily indicate that it is a fault in the Texas Instruments unit — but there is also the fact that some users of Commodore 64s in the USA have experienced just the kind of trouble you describe.

You could first check that the TI monitor is blameless by running the 64 with a colour television or two. If the snow continues to fall across the screen you can be reasonably sure that the problems lies in the 64; if, on the other hand, the screen displays are clear you should take the monitor and the problem to your nearest dealer.

You don't say where you bought the 64 or where it was manufactured, but the snow phenomenon has been a problem on some US machines.

The answer, if you can narrow down the source of the problems to the 64, is relatively simple but it isn't one that you'll be able to deal with yourself. The American experience has demonstrated that what is required is a capacitor in the video circuitry of the 64. You should take the system to a Commodore dealer and ask them to make this modification.

Legal thoughts from abroad

Q I bought a BBC Model B this summer, and have found that it is equipped with the 1981 Basic, not the 1982. On top of this, it is faulty. I have found out what the fault is, and have written to the dealer I bought it from, but they don't even answer my letters. What should I do?

Tonio Galea,
Poala, Malta

A First the bad news. Acorn says that the vast majority of machines currently being produced include the new chip, but this depends on availability of chips, and therefore it's still possible to buy a Model B with the old chip. The company sees this as a gradual changeover, and as the spex advertised are for the old chip, Acorn is perfectly within its rights to carry on selling it.

There should only be a very few cases of this, but this doesn't really help you. It should be possible to upgrade, as you just need to switch the chips, but your being in Malta might make this expensive. Check with Acorn first.

doesn't realy help you. It should be possible to upgrade, as you just need to switch the chips, but your being in Malta might make this expensive. Check with Acorn first.

As regards your defective micro, your living in Malta should not affect your rights under UK consumer legislation, if you bought from a British company. You should write to the company, recorded delivery if you can, saying that you have been sold defective goods, and that you want your money back.

In the UK you would also say that you intended to take legal action against them for the recovery of your money unless the company replied with a reasonable period — say seven to 14 days — but as you do live in Malta, this may not impress anyone much.

But do write again and try to get some means of proving that the letter was actually delivered. Then you've got to find some way of enforcing your rights in this country. If you have a relative who could do this for you, that would help.

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from SPECTRUM

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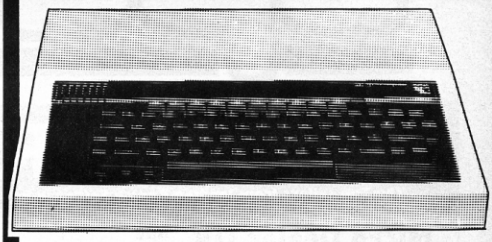

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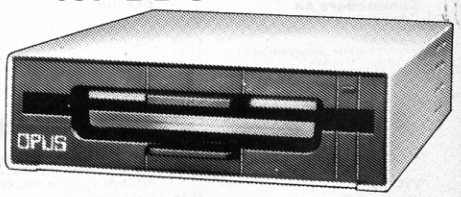

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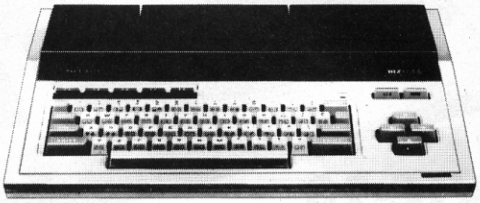

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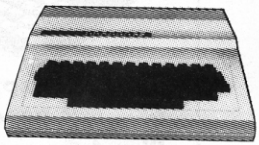

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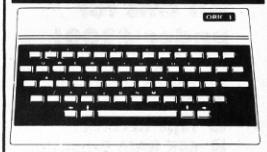

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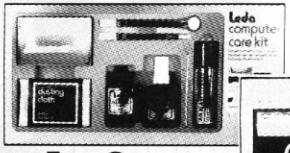

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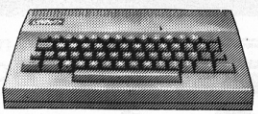

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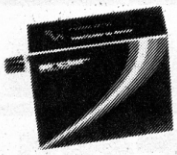

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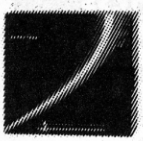

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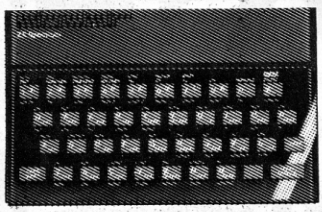

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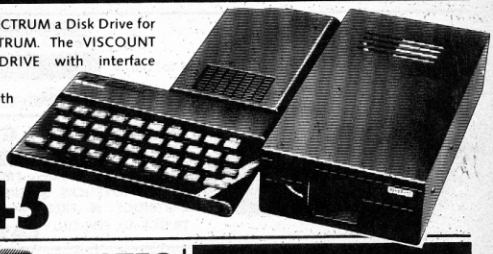

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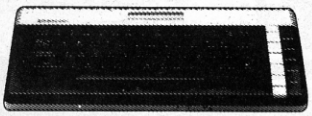

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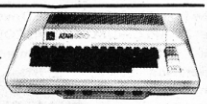

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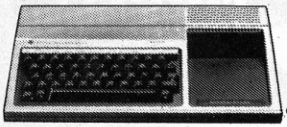

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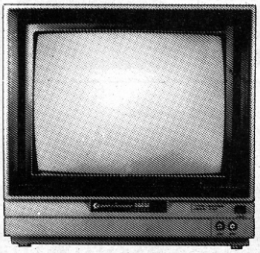

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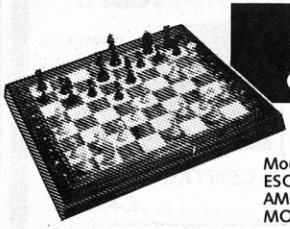

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BBC Basic values and function

If you've ever wanted to pass more than two values out of a function in BBC basic, here is one method. FNMLT is the example function out of which the values are to be passed. FNLFT and FNRT produce the values.

```
10PRINT FNLFT
(FNMLT)+FNRT(FNMLT)
20END
100DEFFNLFT (A$)
110LOCAL T,L$
120FOR T=1 TO LEN(A$)
130IF MID$(A$, T,1)="
"THEN
L$=LEFT$(A$, T):T=LEN
(A$):GOTO 140
140NEXT
150=VAL(L$)
160DEFFNRT (A$)
170LOCAL T,L$
180FOR T=1 TO LEN(A$)
190IF MID$(A$, T, 1)="
"THEN L$=RIGHT$
(A$,LEN(A$)—T):T=LEN
(A$): GOTO 200
200NEXT
210=VAL(A$)
1000DEFFNMLT
1010A=10
1020B=20
1030=STR$(A)+""+STR$(B)
```

Note that the program is only an example and because of this appears inefficient. If numerous functions need to pass multiple variables then the above process becomes more attractive.

Julie Dayton,
Birkenhead, Wirral.

Shortest BBC game on record?

Here is my entry for the 'shortest game' for the BBC micro. It uses the now well known FX calls
*FX 202,16 and *FX 202,32

The game is a form of heads and tails and is played by pressing a key. The capslock and shiftlock light emiting diodes will flash at high speed. When the key is released one of the lights will remain lit, you have to guess which one. They should flash so fast that you will not be able to predict the outcome giving a sort of pseudo-random chance.

The game is as follows:

```
10*FX 202,16
20*FX 202,32
30GOTO 10
```

Sarah Smythe,
St Andrews,
Scotland.

Vic 20 machine code routine update

May I suggest the following addition to the Vic-20 routines published in Microwaves (Issue 36).

The third routine, which converted the contents of the floating point accumulator into an ASCII string starting at location &0100, can be used with the following routine which will print the number.

```
LDY#&01
LDA#&00
JSR &CB1E
RTS
```

A call to &CB1E will, in fact, print an ASCII string from memory, starting at the location pointed to by the Y and A registers, (High and low bytes respectively) and ending with a zero byte.

Richard Harper,
Aigburth,
Liverpool.

A fast sort for the Dragon 32

Writing a program on the Dragon to use files, I needed a very fast way of sorting. Everyone knows about the speed-up poke (POKE &HFFD7,0), but I needed an even faster means of searching. After a short while I found the following method:

```
10POKE &HFFD7,0
20POKE &HFFD9,0
30, program sort etc
60POKE &HFFD8,0
70POKE &HFFD6,0
80 END
```

This is very efficient and should work on all Dragons.

G Kenney,
West Knighton,
Leics.

Simon's Basic and the printer

Those who have managed to obtain a Simon's Basic cartridge for their Commodore 64, may have difficulty when using the standard Commodore printer as an output device.

A command such as:

```
OPEN 3, 4
CMD 3
LIST
```

will produce a series of blank lines on the printer.

The command must be re-written as

```
OPEN 3, 4:CMD3:LIST
```

(ie a faster multistatement line) for the printer to work correctly.

L Upchurch,
Brentwood,
Essex.

BBC B Model B screen dump

The program shown is a screen dump for the BBC Model B microcomputer, with a Seikosha GP250A. It takes just over one minute to give a dump in mode 4 and, with the following changes will give a dump in mode 0.

```
3040 FOR B%=79 TO 0 STEP-1:FOR A%=0 TO 31
3050 C%=HIMEM+B%*8+A%*80*8
```

M K Spamer, Hull, N. Humberside.

```
3000DEF PROC_dump
3010REM **********************
3011REM *  SCREEN  DUMP    *
3012REM **********************
3020REM **********************
3030VDU2,1,13,1,27,1,76,1,2
3040FORB%=39TO0 STEP-1:FORA%=0TO31
3050C%=HIMEM+B%*8+A%*40*8
3060VDU1,27,1,71,1,0,1,12:FORT%=0TO7
3070N%=?(C%+T%):VDU1,N%
3080IFT%MOD2=0 VDU1,N%
3090NEXT:NEXT:VDU1,13:NEXT
3100ENDPROC
```

Multi-dimensional arrays on Dragon

The Dragon can have multi-dimensional arrays, rather than the two dimensions stated in the manual. The only limit imposed it that of available memory. For example it is possible, at switch on to

```
DIM A(2,2,2,2,2,2,2,).
```

T D Copsey,
Benfleet, Essex.

POKEing around on your Vic 20

While using my Vic-20, I have found some useful Pokes. Here is a list of some of them. I hope they are of use to somebody.

POKE 808,127 Disables the RUN/STOP key.
POKE 808,112 Re-enables the RUN/STOP key.
POKE 650,255 Makes every key repeat.
POKE 650,0 Sets repeat function to normal.
POKE 649,0 Disables the keyboard.
POKE 649,10 Re-enable the keyboard.
Also SYS 64802 returns the screen back to what it was like when the computer was turned on. This also NEWs any program in memory.

J C Chasey,
Cheshunt,
Herts.

Commodore cursor change

Commodore 64 owners may find the following a novelty, but I am sure that they could find some use for it. The following short routine allows you to change the cursor from a flashing square to any symbol you like, depending on the background character. The new cursor is activated with POKE 789,192 and returned to normal with POKE 789,234.

Pokeing the location 49245 with a value in the range 0 to 255 will produce a range of new cursors.

A flashing pound sign is a good prompt for an amount of money to be entered.

You can also change the rate at which the cursor flashes, by altering the value of location 49213 from its normal value of 20 (1 is very fast flashing).

David Gristwood,
Sunderland,
Tyne and Wear.

HERE COMES HORACE!

Just when you thought microcomputer games had nothing more to offer, here comes Horace!
It has been said that Horace games are in a class of their own: in fact, Horace is almost a legend.
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Our hero attempts winter sports: First of all he must get to the ski shop, then lumbered with a pair of skis, he has to dodge the traffic once again to reach the snow. Skiing is complete with slalom flags, trees and moguls. So watch out, Horace!

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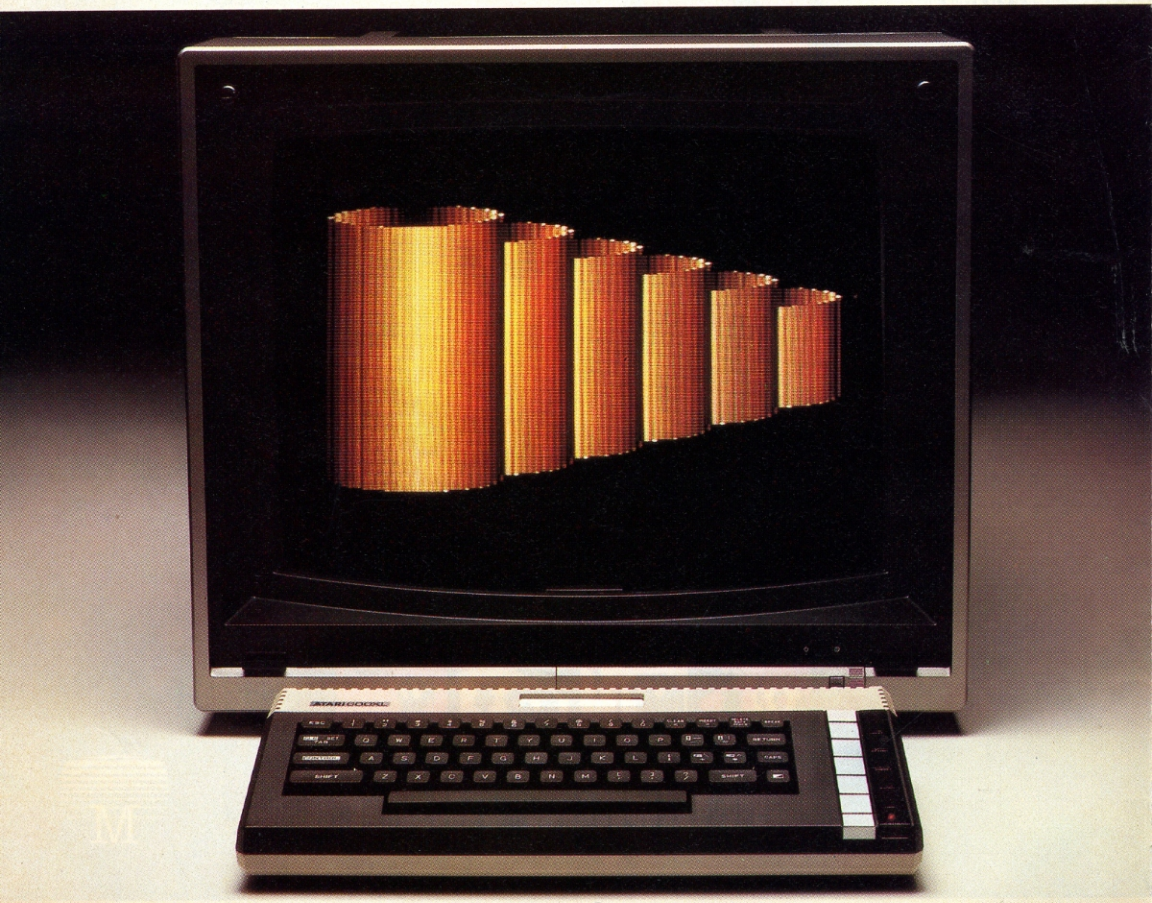

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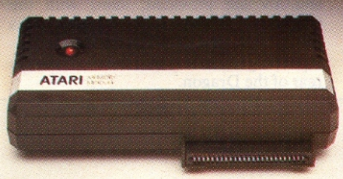
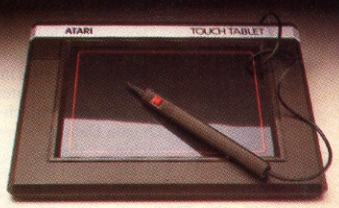


2. 64K Memory Module.



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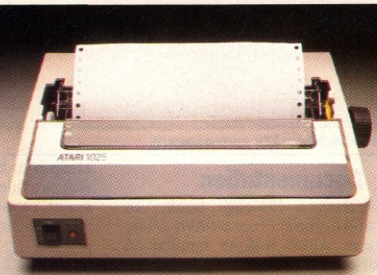
5. Super Joysticks.

6. Colour Printer.

7. Disk Drive.



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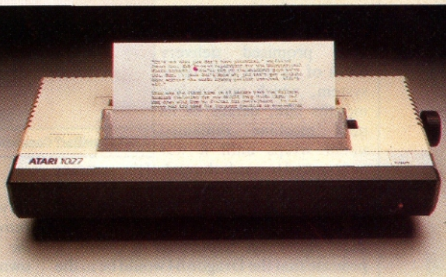

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The well-known Dragon 32 has acquired a larger sibling — Mike Gerrard checks the difference.

Enter the Dragon 64

When the Dragon 32 roared into life just over a year ago it generated a great deal of interest, not least because it partly reflected the dramatic change in leisure habits that had been taking place in the seventies and eighties. Where, a generation ago, ten-year-olds were playing with model cars and marbles, now they were demanding their own Vics and Spectrums. Toy company Mettoy tried to halt its falling sales by moving into the potentially lucrative home computer market by forming a subsidiary which eventually became Dragon Data.

Its first machine, the Dragon 32, was an instant success and immediately put its name up there alongside the big ones of Sinclair, Commodore, Acorn and Atari. It was ironic, then, that the sales success of the Dragon 32 only created more problems for Mettoy in that it was unable to find funds to back the company's necessary expansion and was obliged to sell a large part of its interest in Dragon Data.

Coinciding with the arrival of Dragon Data's second computer, the Dragon 64, Mettoy went into liquidation, having in the end only a 15.5% shareholding in the Welsh company.

Although the Dragon got a little egg on its face over promised delivery dates of its own disk drive system, which was a few months late, details of its next machine remained under wraps until it was announced towards the end of the summer that a 64K computer would be ready by the end of September. Indeed the machine was ready on time, just, making its debut at the PCW show on September 29, with a promise that the Dragon 64 would be in the shops by the end of November.

One pitfall the company was trying to avoid was that of upward incompatibility, as suffered by ZX users who bought a Spectrum or Vic-20 owners moving up to a Commodore 64. Loyalty was obviously to be catered for, and this has been done by making the new machine work in different modes. One of them is a 32K mode which allows the use of all existing software. This means that inside every Dragon 64 lurks a Dragon 32.

Presentation

Anyone who is colour blind would have to look extremely closely to distinguish the Dragon 64 from its predecessor, as the casing and keyboard are identical except that the new machine is in a rather more official-looking grey colour, perhaps hinting that it is going to be aimed slightly more at the business market than before.

The usual connecting leads for cassette and TV are provided, along with the exceedingly heavy mains adaptor. This comes with several feet of wire, and its 9-pin plug fits solidly into the socket at the rear of the Dragon.

Looks familiar? Compatibility with the Dragon 32 is a prime concern.

John Price Studios

Documentation

Buyers receive a 176-page book, *An Introduction to Basic Programming Using the Dragon*, which will be familiar to owners of the earlier machine as it is the same. Strangely enough, some references to 'Dragon 32' in the text have been changed to 'Dragon', but not all of them. The drawing at the front of the book is still of the 32, not showing the additional interface that the 64 possesses.

The editing commands and error codes are still incomplete. The latter omits to explain UF and DN errors for instance, and the space battle program listed will still have your opponent's ship firing when you press your own joystick's fire button. In view of the flak that the manual received when the 32 was first reviewed, it seems rather penny-pinching not to provide 64 buyers with, if not a brand new book, at least an error-free one.

The manual does have an eight-page *Dragon 64 Supplement* which explains the differences between the two machines, these being just three items: the additional memory, an RS232 (serial) interface, and auto-repeating keys.

Construction

The design and build of the Dragon has its fans and critics, but my own 32 has been receiving heavy use for over a year now and remains clean and unmarked, with no problems from the keyboard or any of the sockets.

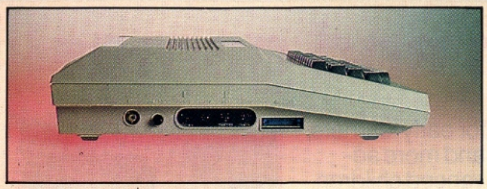
The Dragon's connections to the outside world are, on the left-hand side, a TV socket, reset button (not 100 per cent reliable as it will on occasion wipe the memory rather than merely reset), 5-pin DIN sockets for left and right joysticks and cassette recorder, a parallel printer port for Centronics-type printers, and the new serial interface.

The rear of the machine has the mains socket, a monitor socket and the push-button on-off switch, with the right-hand side having the cartridge slot, which holds things firmly. The mains button could be improved, it is hidden away where you can't see it in normal use. With the average human having considerably less memory capacity than the machine it is possible for the Dragon to be on when you think it's off. But provided you also switch off at the mains, as you should, there ought not to be any problems.

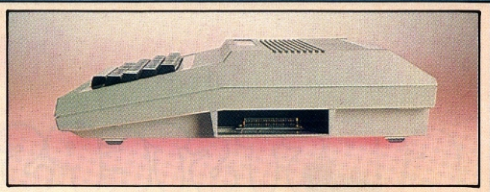
Keyboard

There's a fairly conventional qwerty-style keyboard which has a satisfying typewriter feel to it, and the introduction of auto-repeat keys in 64K mode seems also to have done away with a noticeable problem on the 32, caused by the keyboard scanning routine. In checking to see if a key was pressed, the keyboard was scanned a block of keys at a time, and speedy typists found that if they hit two consecutive keys in the same block then the second would frequently not register, a considerable drawback to a machine with business and word processing potential.

Though not referring to this in the 25▶



Side view of the Dragon 64 – you can see the extra serial interface, which is the major difference from the 32, clearly.



The games port side remains 32ish. Only the more business-like colour scheme distinguishes it from its predecessor.

Much of the interior lay-out has been re-designed, though to the user, of course, the computer appears to be doing all the same things.

TV Interfaces – one for RGB and one for UHF giving you access to TV and professional colour monitors.

The Joystick Interfaces – two din sockets for two joysticks.

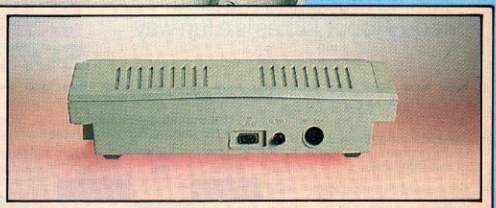
Cassette Interface – This provides relatively sophisticated file handling, including the manipulation of ASCII files.

Basic ROM – the Basic has been deposited on two 8K Eproms on the review model. It's likely that Dragon will squeeze the whole lot on a 16K production ROM eventually.

Interface Adaptor chips – these handle the I/O for the screen, keyboard, printer and expansion bus signals.

RAM – the varying configurations of the 32 have been replaced by a single line of eight 64K RAMs.

6809 Processor – the same as the chip in the Tandy Colour Computer so it is easy to convert programs for the Dragon. The 6809 has a close resemblance to the 6502, so it's possible to convert code from this processor as well.



The rear of the 64 reveals sockets for the power, a monitor and the push-button on/off switch.

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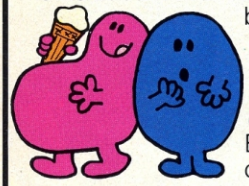

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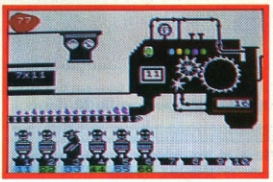

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by Andromeda Software

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supplement, the Dragon 64 has no such problems and could keep up perfectly with the fastest typing. The keys also seem to offer slightly more of a bounce-back to them, presumably to discourage lingering and getting auto-repeat, but this also serves to increase the user's typing speed. In view of this improvement it's a pity that the 64 still doesn't offer lower case letters on the screen. These are represented in reverse video (*ie* green against a black block) but do print out as lower case on printers.

Display

On switching on you are presented with the Dragon Data/Microsoft copyright notice in black against a green background, this being the standard printing layout. Green against black is also possible using completely lower case, and black against orange can be improvised if you know how. Although the machine offers nine colours (buff being the closest you'll get to white) your printing on the screen is limited to these upper case options unless you get a word-processing package or define your own characters using high-res graphics.

This is also the only way to mix text with graphics.

Screen layout is 32 x 16, rather limiting for the text, so for serious word processing a commercial package will be essential.

Storage

Initially the Dragon 64 is automatically in 32K mode, and a test of several cassettes and cartridges produced no problems with software designed for the 32. To switch to 64K mode you type EXEC (or EXEC 48000 if a previous EXEC address needs to be over-written) when the copyright notice changes from 1982 to 1983 and the cursor flashes blue instead of black.

What happens is that the Basic interpreter is copied into the top of the 64K RAM space and you now have 41,241 bytes available for Basic programming, though this can be increased to 45849 by freeing some of the memory reserved for graphics pages, and of course the full 64K remains available for machine code only programs.

One advantage the Dragon has is that almost any cassette recorder can be used to SAVE and LOAD programs, with disk drives also now available if you require them. Dragon Data is opting for the OS9 operating system, but FLEX will also be available from independent suppliers Microcare.

Expansion

If your interest doesn't begin and end with the computer itself, the fact that the Dragon 32 has now been around for a year means that expansion is already available. Dragon's own disk drives have appeared at last, and there are also rival drives from Cumana and Premier Microsystems. A range of products is available from companies like Premier and Compusense: screen dumpers, light pens, assemblers, monitors, Forth and so on.

The parallel interface is the essential Centronics-one, allowing you to connect the Dragon up to most of the best printers around, with the serial interface adding a few more, notably micro manufacturers' 'own brand' printers.

Basic

The Microsoft Basic chosen by Dragon has attracted a generally favourable response as being one of the better Basic dialects around, both logical and easy to learn, while for speed of response tests show it to be roughly on a par with its obvious rival, the Commodore 64. As well as being reasonably powerful when it comes to graphics commands, it is also fairly close to Basics on one or two other machines, particularly the Tandy Colour Computer.

In use

The machine received for test couldn't be tuned in properly for sound, the volume of the TV needing to be turned up so high that the buzzing from the set drowned the sound being made.

There is one voice channel covering a range of five octaves, with two Basic sound commands: SOUND and PLAY. SOUND needs to be followed by two numbers representing pitch and duration, both being in the range of 1 to 255, with a pitch setting of 89 producing middle C. The actual noise produced is an organ-like note, and these can be arranged into tunes using the PLAY command.

There are four more useful sound commands, AUDIO ON and AUDIO OFF, which control the output of the cassette recorder to the TV speaker, and MOTOR ON and MOTOR OFF, governing the cassette motor.

In terms of graphics, the maximum resolution is a comparatively meagre 256 × 192, much less than the Commodore 64, Electron or Atari, but commercial software shows that the Dragon is quite capable of emulating arcade-standard graphics.

Though the Dragon boasts eight colours there's the usual proviso which applies to most machines: not all colours are available at the same time in high resolution. In the Dragon there's a kind of sliding scale between the detail available and the colours to go with it. There are five PMODE settings to choose from (there are in fact others not covered by the manual), and at the maximum 256 × 192 resolution, PMODE4, you can only use black and green or black and buff.

Two extremely useful and versatile commands have proved to be GET and PUT. With GET you can take a large or small chunk of the screen and store it in an array, and PUT allows you to retrieve and place it anywhere on the screen.

Software

A recent list of Dragon software contained over 160 items, these being mostly on the games side and even then the list was far from complete. One advantage the Dragon 64 will have, then, is that the software is tried and tested.

One reason for the large amounts of good software available is that Tandy software converts easily, and many games and adventures have been brought over from the US and adapted.

On the more serious side there are also several word processing packages as well as other business-oriented softwares.

Support

The only fly in the ointment as regards support for the 64 seems to be the uncertain financial state of the microcomputer industry generally, and to what extent Dragon Data is being affected by that. There will undoubtedly be a lot of back-up for the machine from the manufacturers, from the chain stores who stock the Dragon in their range, from the service agents that Dragon Data has been appointing now that initial guarantees on the 32 are running out, and from the software houses and small dealers, many of whom produce only Dragon products.

Verdict

Viewed in isolation the Dragon 64 is without doubt an impressive micro which can cater for a wide variety of users: the games player, the small business or the person wanting to learn programming. In terms of Dragon Data's own products, too, the 64 could be seen as a good deal, costing only £50 more than the Dragon 32 yet offering twice the memory.

Unfortunately it doesn't offer much more that is new. The Dragon 32 is probably a little too pricey to compete with its rivals and the 64 is competing with the likes of the Commodore 64 for roughly the same price, and the new Electron will be out in force soon.

It's hard, therefore to see the Dragon 64 emulating the early success of its one-year-old predecessor.

SPECIFICATION

Price	£225
Keyboard	Typewriter-style, 50 keys plus two shifts and space bar
Processor	M6809
RAM	64K
ROM	24K
Text screen	32×16
Graphics screen	Several resolutions available, from 128×96 to 256×192
Storage	Any cassette recorder, several disk drives available
Interfaces	Two joystick ports, cartridge port, serial and parallel interfaces
Language	Microsoft Basic
Distributor	Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot SA13 2PE

Chris Rust continues his word processing program with routines to manipulate text, print it and save it

Words and actions

Last week we persuaded the Newbrain to give us a number of pages to type on. Now we want to move text about between pages, printer and tape. Once you've got this under control, you should be well on the way to producing your own word processor.

The Newbrain doesn't care what device you have attached to one of its streams. It will print or read data regardless of source or destination. So one routine can handle all text transfer. Routing is set by specifying two variable stream numbers, so (SOURCE) and tg (TARGET). A third stream, pg (PAGE) specifies the text screen in use, be it TARGET or SOURCE.

The master routine is called PUMP. It controls a number of subroutines to read and print text.

The active ingredients of PUMP are the commands: LINPUT#so (read string from device on stream No so); ?#tg (print string to stream No tg) and control code 5 (send line at cursor) which makes a string available to LINPUT. If you go back to the setting-up listing you will find that this code has been given the variable name rd (READ).

Trapstring

Use the set-up listing and appendix 3 of the Newbrain manual to unravel the variable names used in the PUT commands. Once mastered, the use of these mnemonic forms makes the program much easier to read.

The routine which elevates PUMP from mindless slave to intelligent servant is TRAPSTRING. TRAPSTRING allows you to define flag strings or characters which, inserted in a line of text, will modify the behaviour of PUMP by setting the routing flag m3.

This basic version of the program has three simple TRAPSTRING functions:
"endend" marks the end of the text and halts execution of PUMP.
"endendend" marks the end of a tape file and stops PUMP from trying to read past the end of file. It is needed when LOADing text prepared on a differently configured version of PAGE EDITOR.
"remrem" allows insertion of remarks on the screen display. A line including "remrem" will SAVE but not PRINT.

If you want to define your own functions, the flag should be a word or character which will not occur in normal text. For your own use single graphics characters are more compact. I use the cumbersome flag words to help casual or first-time users.

You may notice that PUMP ignores the bottom line of the PAGE. Unfortunately, LINPUT always forces a line feed so it will not read the bottom line without losing the top one. If you are worried about this you can always write your own version of LINPUT along the lines of the READ NUMBER routine described later.

Stream numbers

Three stream numbers are constants, these are:

KEYBOARD stream	ky = 105
PRINTER stream	pr = 108
TAPE stream	tp = 101

Three variable names are used by the text handling routines:

TARGET stream	tg
SOURCE stream	so
PAGE stream	pg

TARGET and SOURCE are the destination and origin of text being transferred. PAGE is the screen on which the cursor position is set and monitored.

These stream number variables are set at the start of each operation and control a number of multi-purpose routines.

Next week we will look at routines which use PUMP to route text. To get going in the meantime you can output a page to a printer as follows:
tg = pr: pg = 1: so = 1: GOSUB 22000 where 1 is the page number.

The first part of this article appeared in *PCN* issue 38. Back issues of *PCN* are available from the *PCN* Back Issue Service, 53-55 Frith Street, London W1A 2HC. The series will be concluded next week.

Text handling routines

```
PUMP
Place cursor on top text line of PAGE
Check pen position with PEN
Read line of text from SOURCE with READ
Check line for special functions with
 TRAPSTRING
Print text to TARGET or execute special
 function
                                        21999 REM PUMP
                                        22000 yy=3:xx=1:GOSUB22600
                                        22010 GOSUB22500:GOSUB22200:GOSUB22300
                                        22020 ONm3GOSUB22400,23000,23100,23200,2
                                        3300:IFyy=ll-1THEN RET
                                        22030 GOTO22010

READ TITLE
Place cursor at top left of PAGE
Read page title pg$(pg)
                                        22099 REM READ TITLE
                                        22100 PUT#pg,hm,rd:LINPUT#pg,pg$(pg):RET

READ LINE
If SOURCE is a screen then PUT control
 code rd (5:send line) to source
Read PUMPSTRING pm$ from SOURCE
                                        22199 REM READ LINE
                                        22200 IFso<=ssTHENPUT#so,rd
                                        22210 LINPUT#so,pm$:RET

TRAPSTRING
Check PUMPSTRING for special function
 indicator tp$()
If indicator present set flag m3 to
 special function number (same as tp$()
 array subscript
                                        22299 REM TRAP STRING
                                        22300 m3=1:FORa=1TOtt:IFINSTR(pm$,tr$(a)
                                        )>FALSETHENm3=a+1:a=tt
                                        22310 NEXTa:RET

WRITE
Print PUMPSTRING to TARGET
                                        22399 REM WRITE
                                        22400 ?#tg,pm$:RET

PEN
PUT control code yx (21: send cursor
 position) to PAGE
GET cursor position as character No xx
 on line yy
                                        22499 REM PEN
                                        22500 PUT#pg,yx:GET#pg,xx,yy:RET

PLACE
PUT control code xy (22: place cursor)
 to PAGE
Which will place cursor at character No
 xx on line yy
                                        22599 REM PLACE
                                        22600 PUT#pg,xy,xx,yy:RET

READ CHARACTER
PUT control code rc (20: send cursor
 character) to SOURCE
GET ASC No of character at cursor posit-
 ion as ch
RET
                                        22699 REM READ CHARACTER
                                        22700 PUT#so,rc:GETch:RET

DON'T PRINT
If TARGET is not a printer then WRITE
 PUMPSTRING to TARGET
 Otherwise ignore this PUMPSTRING
                                        22999 REM DON'T PRINT
                                        23000 IFtg<>prTHENGOSUB22400
                                        23010 RET

END OF TAPEFILE
Set line number yy to appear to PUMP as
 if bottom of PAGE has been reached
This will prevent PUMP from attempting
 to read past the end of the tape file.
                                        23099 REM END OF TAPEFILE
                                        23100 yy=ll-1:RET

END OF TEXT
If TARGET is not a printer then WRITE
 PUMPSTRING (which contains the flag
                                        23199 REM END OF TEXT
                                        23200 IFtg<>prTHENGOSUB22400
                                        23210 yy=ll-1:RET
```

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PCN 1-12-20

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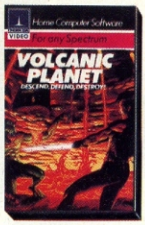
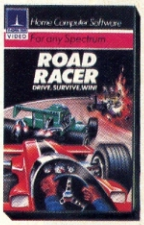


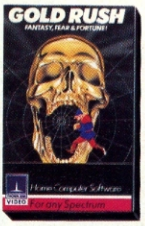
Unless you happen to be a genius, it could take forever to master them all.

So for around £6.95, you will really be getting your money's worth.

"Volcanic Planet" (on 16k) is a real scorcher. Plant a bomb on the volcanic plug in the evil Zeron underground Metropolis, and escape before red hot lava floods the city. Watch out for the Zeron's bone crushing slaves, they want to tear you apart. If your oxygen or power supplies run out, you're dead.



In "Road Racer" (on 16k) you'll find out if you're skilful enough to drive round a terrifying track at death defying speeds, and reach the black and white flag in one piece.



"Gold Rush" (on 16k) is no walk-over either. Underneath the eerie planet of Oron is a vast cavern full of gold and demons.

You have to get the gold and the deadly demons have to get you.

In "Blockade Runner" (on 16k) the earth is under siege and you must get life-saving supplies through.

When you've avoided the dense meteor shower, the moving laser barriers, the space mines, the tractor beam units and the alien warships, you'll be good enough to try the other 5 skill levels.

"River Rescue" (on 48k) is a runaway success on other formats. It's now available on Spectrum. You'll have to navigate the wildest and most dangerous river on earth in a powerful patrol-boat. But keep a sharp look-out for the killer crocodiles. They haven't eaten all day.

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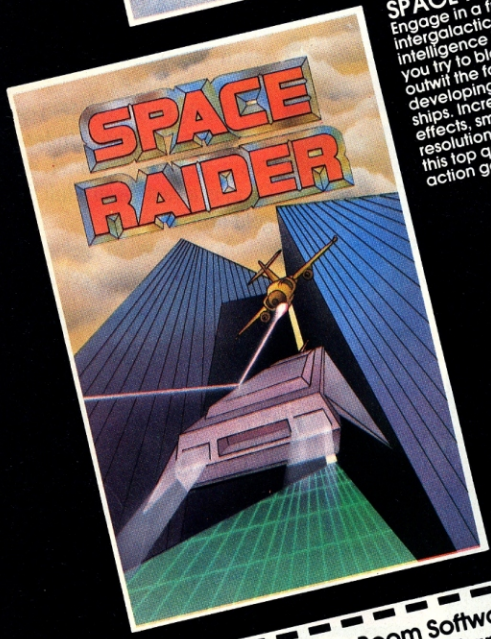

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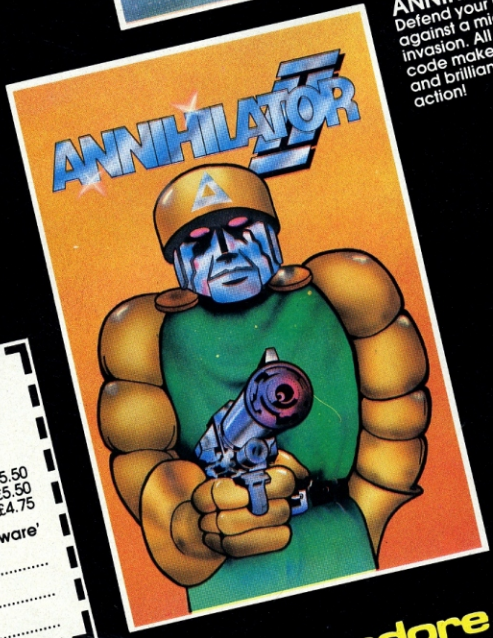

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Killer caverns

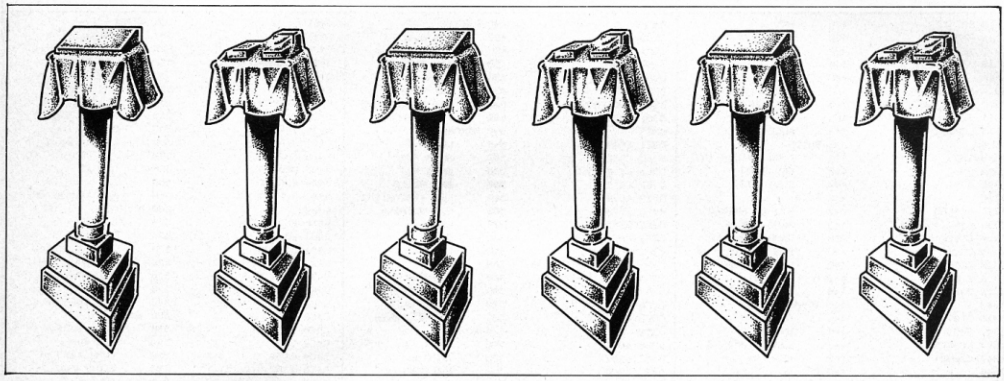
In last week's *PCN* we began the listing of SS Ram, Darren Eteo's Scramble-type game for the Dragon. If your fingers haven't worn out, this week's instalment might change that for you. But persevere, because the game's well worth having, and will give you hours of amusement once you've finished.

Remember that you have to be particularly accurate when you're typing in machine code, because it's very difficult to debug it once you've made the mistakes. If you don't have the first part of the article, which appeared in Issue 38, you can get back issues from the *PCN* Back Issues Service, 53-55 Frith Street, London W1A.

```
0313 3A          430      ABX
0314 7A6FCF      430      DEC @PLAYER-1
0317 26EC        430      BNE @IOOP
0319 39          430      RTS
031A             440 @CHECK
031A FC6FCD      440      LDD @PLAYER-3
031D 10830740    440      CMPD #$600+320
0321 2403        440      BHS @HIGH
0323 C30021      440      ADDD #33
0326             440 @HIGH
0326 10831D3F    440      CMPD #$1DFF-192
032A 2303        440      BLS @LOW
032C 930021      440      SUBD #33
032F             440 @LOW
032F FD6FCD      440      STD @PLAYER-3
0332 C41F        440      ANDB #31
0334 C11C        440      CMPB #28
0336 2308        440      BLS @OKAY
0338 FC6FCD      440      LDD @PLAYER-3
033B 830001      440      SUBD #1
033E 200A        440      BRA @STORE
0340             440 @OKAY
0340 C102        440      CMPB #2
0342 2409        440      BHS @RTO
0344 FC6FCD      440      LDD @PLAYER-3
0347 C30001      440      ADDD #1
034A             440 @STORE
034A FD6FCD      440      STD @PLAYER-3
034D             440 @RTO
034D 39          440      RTS
034E             450 @XJOY
034E BE6FCD      450      LDX @PLAYER-3
0351 B6015B      450      LDA 347
0354 9110        450      CMPA #16
0356 2407        450      BHS @YOREATER1
0358 1E01        450      EXG D,X
035A 830060      450      SUBD #96
035D 200D        450      BRA @DONE1
035F             450 @YOREATER1
035F 8130        450      CMPA #48
0361 2307        450      BLS @SAME1
0363 1E01        450      EXG D,X
0365 C30060      450      ADDD #96
0368 2002        450      BRA @DONE1
036A             450 @SAME1
036A 1E01        450      EXG D,X
036C             450 @DONE1
036C FD6FCD      450      STD @PLAYER-3
036F 39          450      RTS
0370             460 @PUT
0370 10BE6FCA    460      LDY @PLAYER-6
0374 A6A0        460      LDA ,Y+
0376 B76FCF      460      STA @PLAYER-1
0379 9E061F      460      LDX #$600+31
037C C620        460      LDB #32
037E 8655        460      LDA #$55
0380             460 @FLOOP
0380 A784        460      STA ,X
0382 3A          460      ABX
0383 7A6FCF      460      DEC @PLAYER-1
0386 26F8        460      BNE @FLOOP
0388 8600        460      LDA #00
038A A784        460      STA ,X
038C 3A          460      ABX
038D A6A0        460      LDA ,Y+
038F B76FCF      460      STA @PLAYER-1
0392 86AA        460      LDA #$AA
0394             460 @SLOOP
0394 A784        460      STA ,X
0396 3A          460      ABX
0397 7A6FCF      460      DEC @PLAYER-1
039A 26F8        460      BNE @SLOOP
039C 8600        460      LDA  #00
039E A784        460      STA ,X
03A0 3A          460      ABX
03A1 8655        460      LDA #$55
03A3             460 @TLOOP
03A3 A784        470      STA ,X
03A5 3A          470      ABX
03A6 8C1DE0      470      CMPX ##1DE0
03A9 23F8        470      BLS @TLOOP
03AB 108C2104    470      CMPY ##SCREENT+32
03AF 2304        470      BLS @ST
03B1 108E70E6    470      LDY ##SCREENT+2
03B5             470 @ST
03B5 10BF6FCA    470      STY @PLAYER-6
03B9 39          470      RTS
03BA             480 @SCROLL
03BA 8E072C      480      LDX #$600+300
03BD             480 @AGAIN
03BD A681        480      LDA 1,X
03BF A780        480      STA ,X+
03C1 8C1D00      480      CMPX ##1DFF-255
03C4 23F7        480      BLS @AGAIN
03C6 10EE704F    490      LDY ##MTABLE+1
03CA B6704E      490      LDA @MTABLE
03CD 2601        490      BNE @NEXT2
03CF 39          490      RTS
03D0             490 @NEXT2
03D0 AEA6        490      LDX A,Y
03D2 301F        490      LEAX -1,X
03D4 AFA6        490      STX A,Y
03D6 8002        490      SUBA #2
03D8 2EF6        490      BGT @NEXT2
03DA 10BE7030    500      LDY #@MTABLE+2
03DE B6704E      500      LDA @MTABLE
03E1             500 @REPEAT
03E1 E6A6        500      LDB A,Y
03E3 C41F        500      ANDB #31
03E5 C11F        500      CMPB #31
03E7 2615        500      BNE @OKED
03E9 8E704F      500      LDX #@MTABLE+1
03EC F6704E      500      LDB @MTABLE
03EF AE85        500      LDX B,X
03F1 4A          500      DECA
03F2 AFA6        500      STX A,Y
03F4 4C          500      INCA
03F5 C002        500      SUBB #2
03F7 F7704E      500      STB @MTABLE
03FA 54          500      LSRB
03FB F7708A      500      STB @MTABLE1
03FE             500 @OKED
03FE 8002        500      SUBA #2
0400 8101        500      CMPA #1
0402 22DD        500      BHI @REPEAT
0404 39          500      RTS
0405             510 @MPUT
0405 10BE6FCA    510      LDY @PLAYER-6
0409 A63F        510      LDA -1,Y
040B AB3E        510      ADDA -2,Y
040D C620        510      LDB #32
040F 3D          510      MUL
0410 C3057E      510      ADDD ##5FF-129
0413 FD6FC8      510      STD @PLAYER-8
0416 1F02        510      TFR D,Y
0418 B6704E      520      LDA @MTABLE
041B 8132        520      CMPA #50
041D 230A        520      BLS @OKAYT
041F 8630        520      LDA #48
0421 B7704E      520      STA @MTABLE
0424 44          520      LSRA
0425 B7708A      520      STA @MTABLE1
0428 39          520      RTS
0429             520 @OKAYT
0429 9802        520      ADDA #2
042B 8E704F      520      LDX ##MTABLE+1
042E 10AF86      520      STY A,X
0431 B7704E      520      STA @MTABLE
0434 44          522      LSRA
0435 8E708B      520      LDX #@MTABLE1+1
0438 C601        520      LDB #1
043A E786        520      STB A,X
043C B7708A      520      STA @MTABLE1
043F 8603        520      LDA #3
0441 B76FCF      520      STA @PLAYER-1
0444 8E7012      520      LDX #@MPICTURE
0447             520 @NEXT3
0447 EC81        520      LDD ,X++
0449 ED4A        520      STD ,Y
044B 31A820      520      LEAY 32,Y
044E 7A6FCF      530      DEC @PLAYER-1
0451 26F4        530      BNE @NEXT3
0453 39          530      RTS
0454             540 @MOVING
0454 8E708B      540      LDX #@MTABLE1+1
0457 B6708A      540      LDA @MTABLE1
045A 2601        540      BNE @LOOPA
045C 39          540      RTS
045D             540 @LOOPA
045D E686        540      LDB A,X
045F 2604        540      BNE @UP
0461             540 @RETURN
0461 4A          540      DECA
0462 26F9        540      BNE @LOOPA
0464 39          540      RTS
0465             550 @UP
0465 3412        550      PSHS A,X
0467 8119        550      CMPA #25
0469 230D        550      BLS @OKA
046B 8618        550      LDA #24
046D B7708A      550      STA @MTABLE1
0470 8630        550      LDA #48
0472 B7704E      550      STA @MTABLE
0475 3512        550      PULS A,X
0477 39          550      RTS
0478             560 @OKA
0478 48          560      LSLA
0479 8E704F      560      LDX #@MTABLE+1
047C 3086        560      LEAX A,X
047E 10AE84      560      LDY ,X
0481 31A8C0      560      LEAY -64,Y
0484 10AF84      560      STY ,X
0487 ECA4        560      LDD ,Y
0489 1083AAAA    560      CMPD #$AAAA
048D 2631        560      BNE @WHAT
048F             560 @RTS1
048F 860C        560      LDA #12
0491 B76FCF      560      STA @PLAYER-1
0494 CCAAAA      560      LDD ##AAAA
0497             560 @BLANKED
0497 ED4A        560      STD ,Y
0499 31A820      560      LEAY 32,Y
049C 7A6FCF      560      DEC @PLAYER-1
049F 26F6        560      BNE @BLANKED
04A1 31A9FE80    560      LEAY -384,Y
04A5 8E7012      560      LDX #@MPICTURE
04A8 8604        560      LDA #4
04AA B76FCF      560      STA @PLAYER-1
04AD 8E7012      560      LDX #@MPICTURE
04B0             560 @PUTMI
04B0 EC81        570      LDD ,X++
04B2 ED4A        570      STD ,Y
04B4 31A820      570      LEAY 32,Y
04B7 7A6FCF      570      DEC @PLAYER-1
04BA 26F4        570      BNE @PUTMI
04BC 3512        570      PULS A,X
04BE 20A1        570      BRA @RETURN
04C0             580 @WHAT
04C0 8155        580      CMPA #$55
04C2 2706        580      BEQ @WALL
04C4 C155        580      CMPB #$55
04C6 2702        580      BEQ @WALL
04C8 20C5        580      BRA @RTS1
04CA             590 @WALL
04CA 860C        590      LDA #12
04CC B76FC6      590      STA @PLAYER-10
04CF CCAAAA      590      LDD ##AAAA
04D2             590 @CLS1
04D2 ED4A        590      STD ,Y
04D4 31A820      590      LEAY 32,Y
04D7 7A6FC6      590      DEC @PLAYER-10
04DA 26F6        590      BNE @CLS1
04DC 10EE704F    590      LDY #@MTABLE+1
04E0 B6704E      590      LDA @MTABLE
04E3 31A6        590      LEAY A,Y
04E5 10AEA4      590      LDY ,Y
04E8 10AFB4      590      STY ,X
04EB B6704E      590      LDA @MTABLE
04EE 8802        590      SUBA #2
04F0 B7704E      590      STA @MTABLE
04F3 44          590      LSRA
04F4 B7708A      590      STA @MTABLE1
04F7 3512        590      PULS A,X
04F9 16FF65      590      LBRA @RETURN
04FC             600 @PMETOR
04FC 860113      600      LDA  275
04FF 10BE6FCA    600      LDY @PLAYER-6
0503 843F        600      ANDA #63
0505             600 @PRINTAGAIN
0505 A13F        600      CMPA -1,Y
0507 2303        600      BLS @SURE
0509 44          600      LSRA
050A 20F3        600      BRA @PRINTAGAIN
050C             600 @SURE
050C C620        600      LDB #32
050E AB3E        600      ADDA -2,Y
0510 3D          600      MUL
0511 C3061E      600      ADDD ##61E
0514 1F01        600      TFR D,X
0516 8609        600      LDA #9
0518 B76FCF      600      STA @PLAYER-1
051B 10BE7030    600      LDY #@METOR
051F             600 @LOOP5
051F ECA1        600      LDD ,Y++
0521 ED84        600      STD ,X
0523 308820      600      LEAX 32,X
0526 7A6FCF      600      DEC @PLAYER-1
0529 26F4        600      BNE @LOOP5
052B 39          600      RTS
052C             610 @PDUMP
052C 10BE6FCA    610      LDY @PLAYER-6
0530 A63F        610      LDA -1,Y
0532 AB3E        610      ADDA -2,Y
0534 C620        610      LDB #32
0536 3D          610      MUL
0537 C3061E      610      ADDD ##600+#1E
053A 1F01        610      TFR D,X
053C 10BE7024    610      LDY #@DUMP
0540 8606        610      LDA #6
0542 B76FCF      610      STA @PLAYER-1
0545             610 @DUMPLOOP
0545 ECA1        610      LDD ,Y++
0547 ED84        610      STD ,X
0549 308820      610      LEAX 32,X
054C 7A6FCF      610      DEC @PLAYER-1
054F 26F4        610      BNE @DUMPLOOP
0551 39          610      RTS
0552             620 @HITS
0552 BE6FCD      620      LDX @PLAYER-3
0555 8606        620      LDA #6
0557             620 @LOOPQ
0557 E684        620      LDB ,X
0559 308820      620      LEAX 32,X
```

"BRITISH MICROCOMPUTING AWARDS 1984"
THE SUNDAY TIMES

Glittering prizes



PERSONAL COMPUTER
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THE SUNDAY TIMES

Vote for the best in microcomputing and you could win a micro and software. As part of the 1984 British Microcomputer Awards, *PCN* is offering all readers the chance to vote for the products that you think are outstanding.

BMA 1984 will be the most important event in the microcomputing calendar. It is organised by The Sunday Times and VNU, publishers of *Personal Computer News*, and *PCN* is hosting two of the awards — Peripheral of the Year, and the Home Software Award.

But because *PCN* readers are involved in all aspects of microcomputing, *PCN* is going to nominate for all ten categories. So if you want to put your favourite product in the limelight, let us know about it. A panel of *PCN* judges will consider the nominations and forward a selection to a central judging panel of experts in the micro field. They will have the task of deciding the top three nominations in each category and of choosing the winners.

On these pages you'll find a complete list of categories and the criteria on which the products will be judged. Send us your nominations on the form opposite — remembering to include the reasons for your choice. The awards will be presented at a ceremony in London in March — and you could be a winner too.

All correctly completed nomination forms will enter a free draw with two Oric micros and software as the prizes.

Categories

1 Business Micro This award will be presented to the maker of the machine which, in the opinion of the judges, offers the best value for money. Essential requirements are that the machine has a recommended price of less than £8,000 including operating system, CPU, keyboard, disks and monitor. It must be disk-based, come with at least a 90-day guarantee, and have a wide range of business software.

2 Business Software The business software award will be presented to the software house giving best value for money and optimum efficiency for general business use. The software should be disk-based with a recommended price of less than £1,500 per package or module.

3 Home Microcomputer This award will go to the maker of the machine giving the user ease of programming and displaying the best use of colour, sound and speed. Value for money is again important and the micro must not cost more than £500.

4 Home Software The software house winning this award will have published a product which does the most to aid efficiency in the home. The judges will look for flexibility, value and user friendliness. Top price is £50.

5 Creative Software The award for creative software will be presented to the inventor of a software concept which the judges rule has made the greatest use of and contribution to, microcomputing. The award will also recognise the manufacturer which first launched the concept as a marketable product.

6 Game of the Year Plenty to choose from here. Which game offers the greatest lasting appeal, playability and use of the machine? As always, value for money counts as well.

7 Consumer Award The consumer award will be presented to the company or individual judged to have done the most to advance consumer understanding and efficient use of microcomputers. The judges will look for an individual or group who have made an outstanding contribution to microcomputing to the benefit of users.

8 Peripheral of the Year This award will go to the most innovative peripheral which enhances the features and potential of a microcomputer. Good value is a key consideration.

9 Software of the Year The recipient of this award will be the software house judged to have published a product providing the simplest way of effectively solving a problem. The software will be judged as an aid so the judges will examine the way it carries out the task the user wants to complete. User friendliness, flexibility and value are of prime importance.

10 Microcomputer of the Year The micro will be the one which, in the opinion of the judges, is the best to have appeared on the market in the year to November 1. User friendliness, flexibility, software support, expandability, good design and price will be taken into consideration. Recommended price must be less than £8,000 and new versions of older models are eligible.

RULES

In categories 1-5 (business micro, business software, home micro, home software and creative software) manufacturers may nominate their own products which need not have been made in Britain but must have been available for purchase from retail outlets in the UK by November 1, 1983.

In categories 6, 8, 9, 10 (game, peripheral, software and micro of the year) manufacturers may nominate their own product which need not have been made in Britain but must have been available for purchase from retail outlets in the UK between November 1, 1982, and November 1, 1983.

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

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

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

Enter your nomination for each category and explain, in not more than 30 words, the reason for your choice, using another sheet of paper if necessary. You should consider the guidelines given in each category on the facing page.

Category 1: Business Micro .....
Reasons for choice .....
.....

Category 2: Business Software .....
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.....

Category 3: Home Micro .....
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Category 4: Home Software .....
Reasons for choice .....
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Category 5: Creative Software .....
Reasons for choice .....
.....

Category 6: Game of the Year .....
Reasons for choice .....
.....

Category 7: Consumer Award .....
Reasons for choice .....
.....

Category 8: Peripheral of the Year .....
Reasons for choice .....
.....

Category 9: Software of the Year .....
Reasons for choice .....
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Category 10: Micro of the Year .....
Reasons for choice .....
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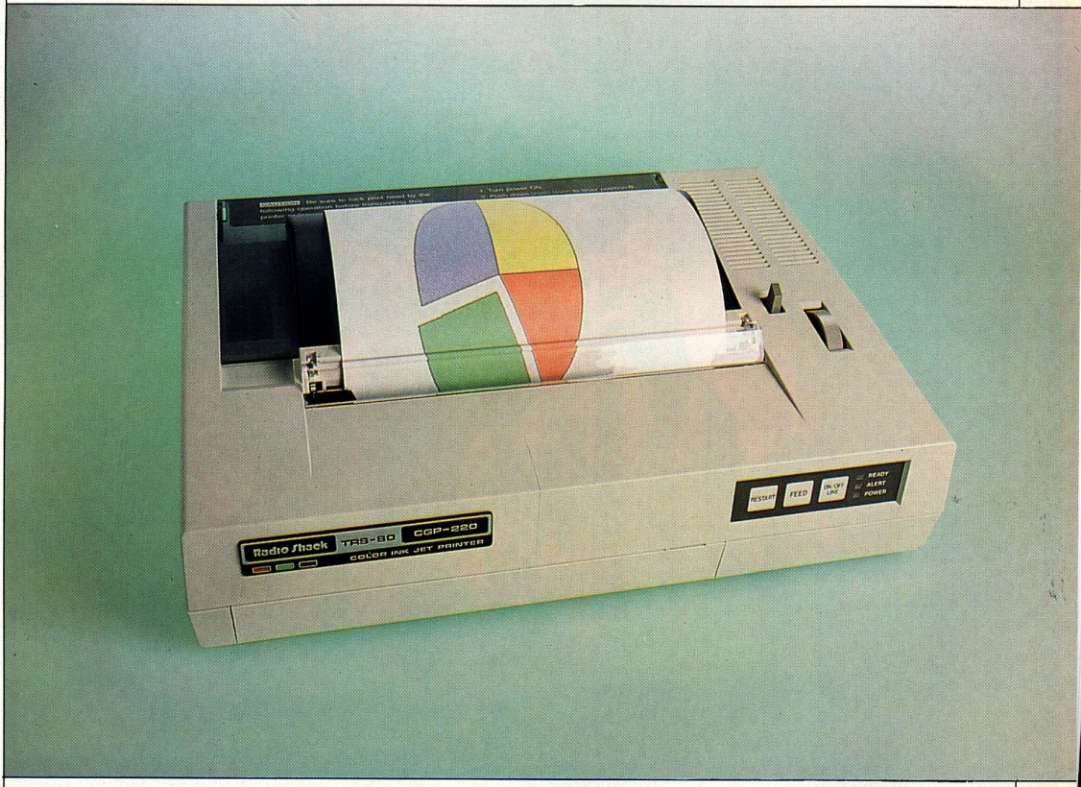


John Price Studios

Technicolour Tandy

A price breakthrough by Tandy is an event in itself, since Tandy watchers have always been aware that the Fort Worth-based computer/electronics company has never attempted to break into the cut-throat low cost market.

At £600 the new Tandy CGP-220 seven colour Ink Jet printer is very competitively priced.

First impressions

The printer comes in a substantially protected box with polystyrene and polythene covering. Opening the box the first surprise is the new colour scheme which has been adopted by Tandy for all the new product range. Instead of the traditional black and silver, the CGP-220 is housed in a cream plastic case.

Powering it up for use provided no problems either, since Tandy now ensures that all products are fitted with a three-pin 13amp plug to conform with British standards. Other manufacturers please note.

Documentation

Here I'm afraid Tandy let me down. In my experience Tandy computer manuals are generally some of the best on the market, but the manual with the CGP-220 is somewhat lacking to say the least. It's laid out and printed in the normal Tandy printer manual layout, but bearing in mind the revolutionary design/concept of the printer I was disappointed to find there was little in it that actually describes exactly what the printer is and does.

It took considerable time and effort to discover the method of printing. Briefly the printer is a form of spark jet printer. The ink is produced in minute quantities and transferred to the paper by means of a fast high ignition spark, each dot of the matrix requiring a separate function.

To understand how the colours are reproduced one has to step back into basic physics.

In television and monitors, colours are produced by mixing light rays. In this system — commonly known as the RGB method — red, green and blue light rays are projected on a surface and mixing these three colours generates all others.

A second method is based on the mixture of pigments such as ink or paint. In

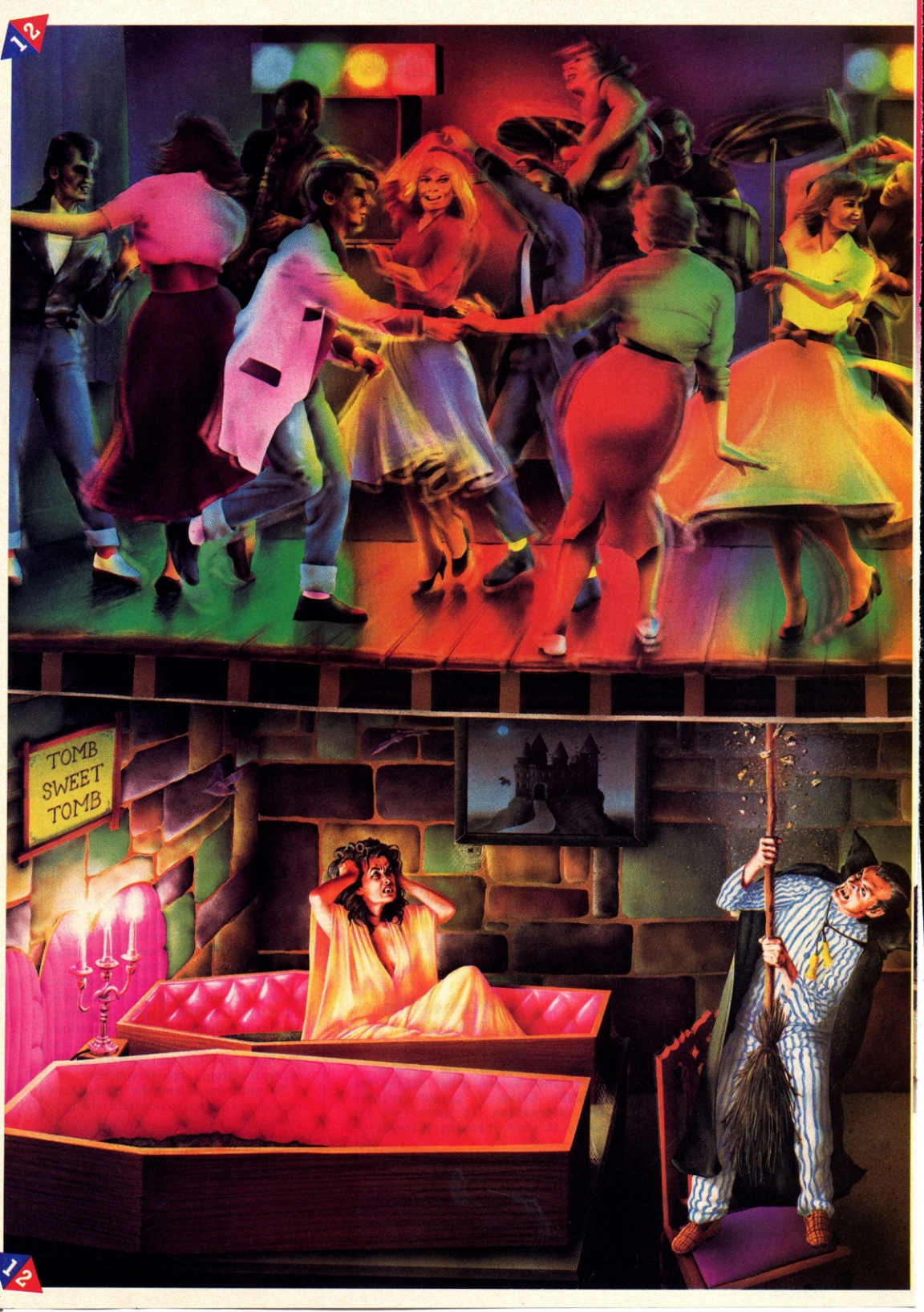
39 ▶

Normally one would send two sets of codes to the printer - "27", known as an ESCape code followed by two other digits for the actual function. The CGP-220, being a colour printer obviously requires slightly more information, so therefore one has to send three sets of digits to it when changing colours.

Each colour has been allocated its own number between 48 and 55:

BLACK	48	YELLOW	51	VIOLET	54
RED	49	BLUE	52	WHITE	55
GREEN	50	MAGENTA	53		

so to change the text from black to red for example you would have to send the code 27 (ESC), 84 (telling it you are changing colour), 49 (red). These codes can either be inserted into the text if you are using a word processing program or into the basic program if you are writing a program which requires colour changes.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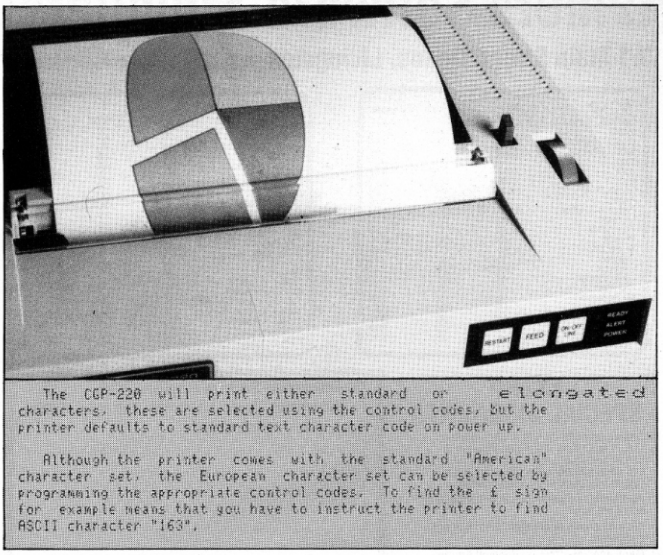

The CGP-220 will print either standard or elongated characters. These are selected using the control codes, but the printer defaults to standard text character code on power up.

Although the printer comes with the standard "American" character set, the European character set can be selected by programming the appropriate control codes. To find the £ sign for example means that you have to instruct the printer to find ASCII character "163".

◀ 35

this method, the colours yellow, magenta and cyan are mixed in different combinations to produce other colours.

The CGP-220 uses the second method. The built-in software in the printer converts what the monitor sees as RGB into mixtures of the coloured inks available. It does mean that you probably don't have the full range of colours available that you would expect to find on your television set, but it should be a close approximation.

Getting started

Familiarising yourself with the machine is the first thing to do. Although the ink packs should already be inserted when you get the machine, they don't really cause much of a problem. You should have two packs both the size of a packet of cigarettes. One contains black ink and the other has yellow, magenta and cyan. They are contained in rigid containers and the ink is sealed in airtight bags.

With the power off they are inserted into a small drawer located along the bottom front of the machine. After they are installed, you are warned not to take them out until they are exhausted. Being the inquisitive type, I did, with disastrous results — ink all over the place. To protect the ink supply during transportation and lengthy periods of inactivity there is a lever on the top of the printer which can be positioned to seal off the supply.

The printer takes either roll paper or single sheets — there is no tractor feed. Again inserting paper is no problem.

The controls for the printer are located on the front. They are touch sensitive for 'restart', 'feed' and 'on/off line'. Alongside are three LEDs — ready, alert and power.

When you turn the power on the red 'alert' light blinks for about ten seconds as the ink supply is made ready. The red alert light also comes on when you run out of paper or when the printer goes off-line for any reason. Once the situation has been rectified, pressing the restart key should set the printer off again.

On the top left of the printer alongside the paper platten is a green lever which provides three functions. Locking the carriage for transit, capping and uncapping the ink nozzle, and a pump to provide a better ink supply.

After loading the paper it is advisable to check the ink supply and ensure that all colours are working. Pressing the FEED button immediately after unlocking the carriage should produce a horizontal bar. There is also a self test function which prints out all the alphanumeric symbols. Each line is printed in a different colour.

The next step is to connect it up to the computer. The CGP-220 is provided with serial and parallel connections and there is a baud selection switch for 600 or 2400 baud rate for the serial interface. Since I already use a Tandy printer I had the necessary cable to hand, but it is necessary to watch the pin connections on the parallel cable, since the BBC and the Tandy system differ on the location of two pins. Numbers 10 and 11 have to be changed round, otherwise busy and acknowledge get mixed up.

'The printer is exceptionally quiet . . . but slow'

In use

The first thing you notice is that the printer is exceptionally quiet, although the print head appears to do an awful lot of work. Each row of dots is printed in a separate operation, which means that for one line of type the print head has to make seven passes over the paper to produce the text.

The computer communicates with the printer with a series of control codes. These codes are used to tell the printer exactly what you want it to do. As on most printers the information is sent as numbers between 0 and 255. A control code would be used to change the print size, or a linefeed or to change the colour of the text.

Normally you would send two sets of codes to the printer — 271, known as an ESCape code, followed by two other digits for the actual function. The CGP-220, being a colour printer, obviously requires slightly more information, so you have to send three sets of digits to it when changing colours.

Each colour has been allocated its own number between 48 and 55: black, red, green, yellow, blue, magenta, violet, white.

So to change the text from black to red, for example, you would have to send the code 27 (ESC), 84 (telling it you are changing colour), 49 (red). These codes can either be inserted into the text if you are using a word processing program or into the Basic program if you are writing a program which requires colour changes.

The CGP-220 will print either standard or elongated characters. These are selected using control codes, but the printer defaults to standard text character code on power up.

Although the printer comes with an American character set, the European character set can be selected by programming the appropriate control codes.

Tandy say the printer's biggest selling point will be its ability to provide colour printouts of graphics, bar charts, graph tables etc. I have no doubt that this is true — the machine is certainly capable of producing a variety of colours. But the manual is extraordinarily vague about the actual mechanics of it all. As you would expect, many of the instructions in the manual are aimed at the Tandy computer owner, and all the demonstration programs use the LPRINT instruction.

The print speed is very slow — claimed to be about 37 cps. This does mean that anyone wanting to use it to print text will have to wait a long time, and because there is no built-in buffer it will tie up the computer for really long periods while it is performing its tasks.

Verdict

This printer provides colour printing at a price that many people who may have shied away in the past could well afford. Like all Tandy printers it is fully compatible with most micros on the market, and I am sure will be of great use to educational establishments and businesses who want graphics work carried out, but feel that the very high cost of the other colour printers on the market is not worth it. But for the home user it is an expensive luxury, unless you are really keen on producing colourful graphics dumps.

There is also competition in the form of the Seikosha GP-700A which offers seven-colour print at a lower price — under £500.

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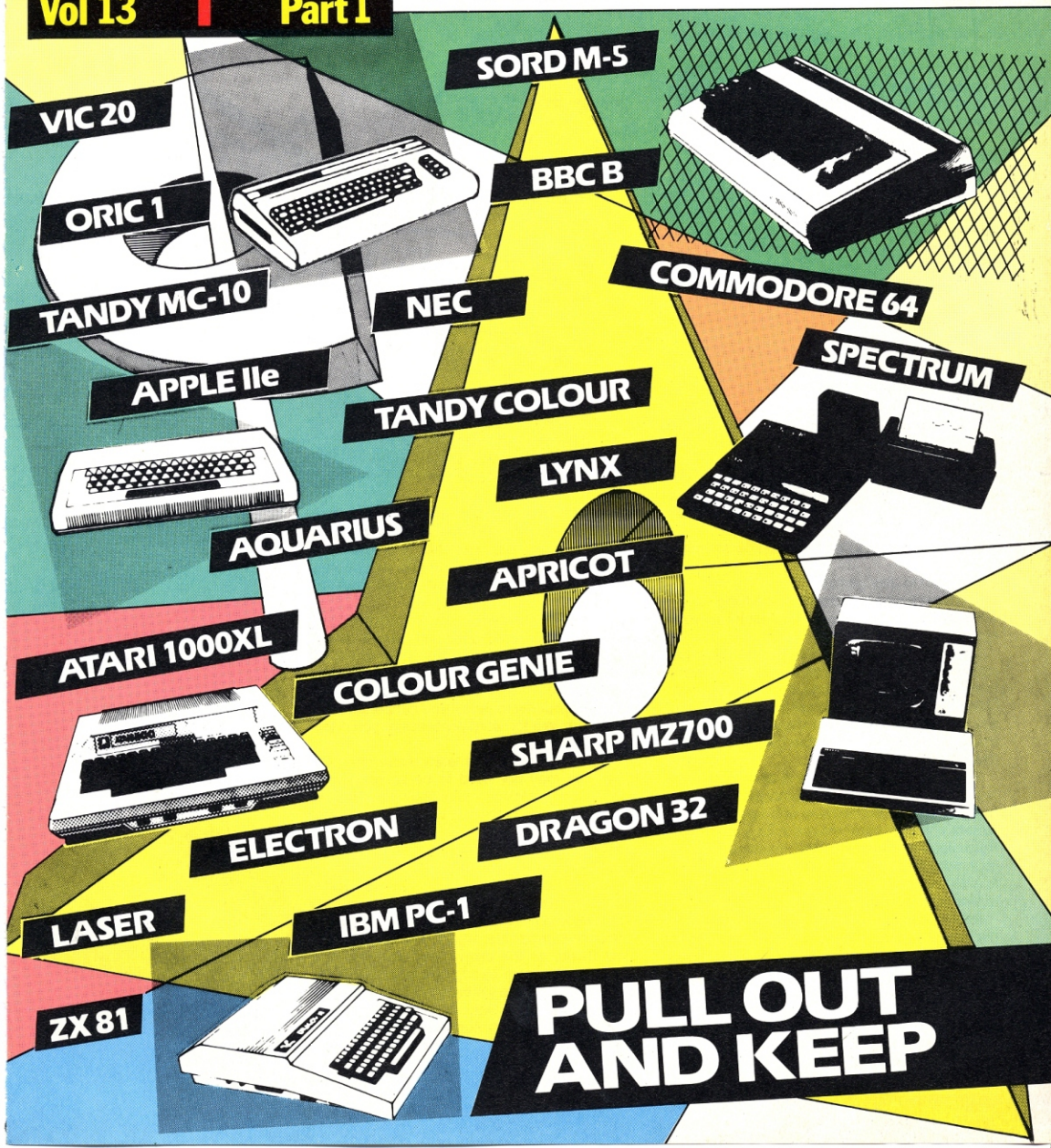
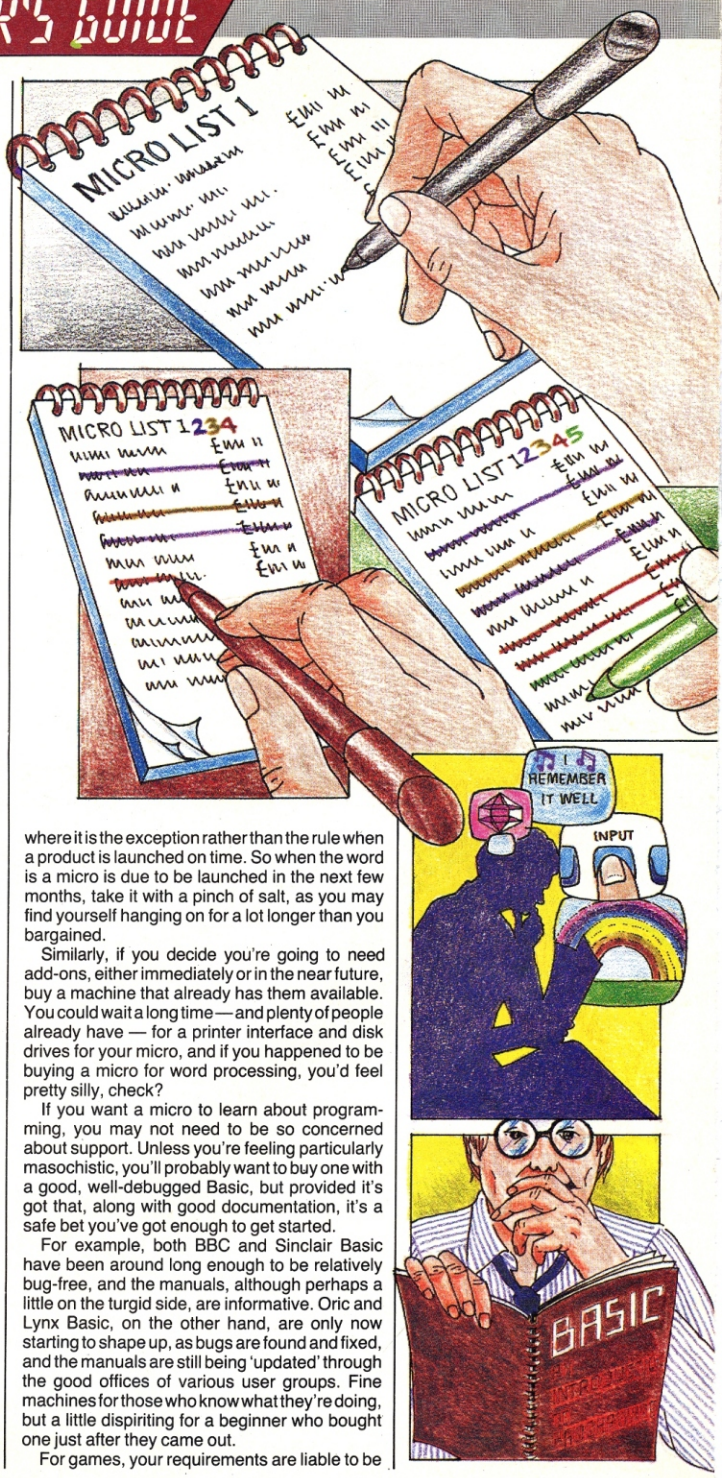


How to buy a micro



If you're thinking of buying a micro, you've probably already decided you need a guide. And if you've been looking for any length of time, contradictory advice from sales assistants may even have made you wonder if you need a guide to the guides.

But before you despair, remember that micros today are better and cheaper than they've ever been before, so if you choose wisely, you'll get a bargain. But equally, if you get it wrong, and buy a micro that doesn't suit you, you could end up putting yourself off the beasts for a very long time.

So how do you start? If you're new to micros, it's possibly best to stick to the more popular machines, because although you may find a gem just right for you somewhere in the micro jungle, you're much more likely to pick up a complete turkey.

Your first step should be to find out what you can afford — there's no point in spending your time salivating over a Sirius if your wallet will only fit a ZX81. So you should first list the micros that fall into your price range, and then decide between them on the basis of what you want from your micro.

Inevitably you're the one who's going to be best equipped to say why you want to buy a micro, but there are a number of common reasons:

1 You feel you want to learn about programming, or
2 You want to play games
3 You want to use a micro for home filing
4 You think a micro would be helpful in your business

It's likely that you'll fall into several of these categories, but bear in mind, the more you want from your micro, the more it's liable to cost. Naturally you'll still want to get the best deal that you can, and therefore you should be looking at the expansion potential of your choice, but again this will cost money.

The availability of software is also something that should concern you. For example, you could buy a dynamic new machine with specifications streets ahead of other micros in its price range. But unless you just want the machine to write your own programs, you'll almost inevitably have to wait, first for the machine, and then for people to start writing and selling the software.

In the case of some machines, the now deceased Jupiter Ace for example, this never happens, so if you decide on a new and untried machine you should either be quite straight in your mind that you're either going to write your own software, or that a wide body of software is guaranteed.

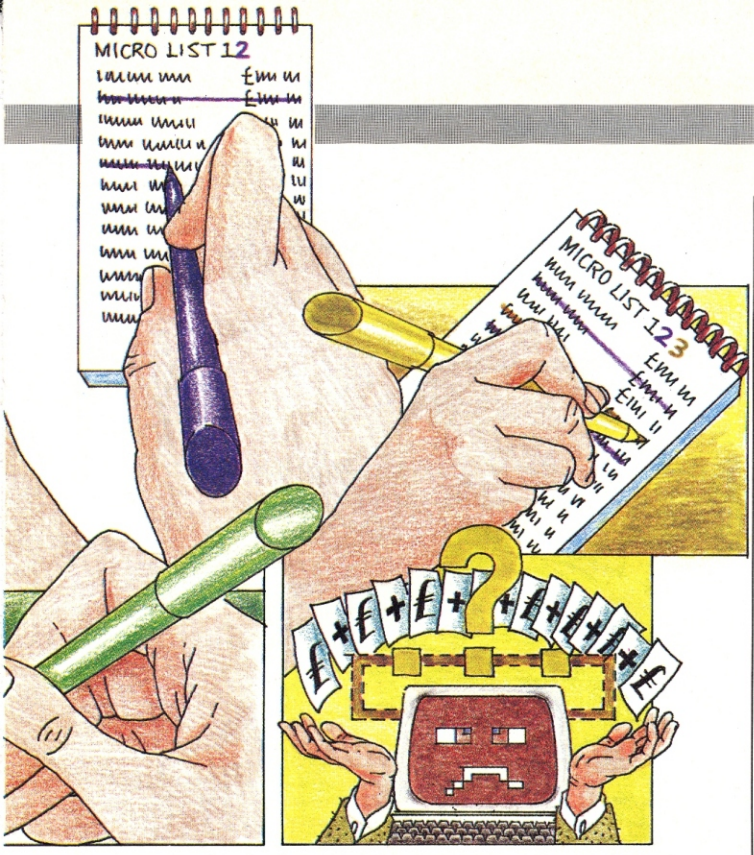
Perhaps a word about guarantees would be in order at this juncture. The micro industry has a sorry track record on promises, to the extent where it is the exception rather than the rule when a product is launched on time. So when the word is a micro is due to be launched in the next few months, take it with a pinch of salt, as you may find yourself hanging on for a lot longer than you bargained.

Similarly, if you decide you're going to need add-ons, either immediately or in the near future, buy a machine that already has them available. You could wait a long time — and plenty of people already have — for a printer interface and disk drives for your micro, and if you happened to be buying a micro for word processing, you'd feel pretty silly, check?

If you want a micro to learn about programming, you may not need to be so concerned about support. Unless you're feeling particularly masochistic, you'll probably want to buy one with a good, well-debugged Basic, but provided it's got that, along with good documentation, it's a safe bet you've got enough to get started.

For example, both BBC and Sinclair Basic have been around long enough to be relatively bug-free, and the manuals, although perhaps a little on the turgid side, are informative. Oric and Lynx Basic, on the other hand, are only now starting to shape up, as bugs are found and fixed, and the manuals are still being 'updated' through the good offices of various user groups. Fine machines for those who know what they're doing, but a little dispiriting for a beginner who bought one just after they came out.

For games, your requirements are liable to be



1 List all the micros you can afford.
2 If you have any specific tasks to perform, such as word processing eliminate any micros where this will be impossible/inconvenient.
3 Look at the software available for the micros left on the list, and cross off any which are poorly served, or which do not have the software you're liable to need for specialist tasks.
4 Look at the peripherals available, and cross off any with problems similar to those under software, above.
5 If you've let any micros through on the grounds that software and peripherals are 'coming soon' go back to 3 and 4 and cross them off.
6 Ask yourself if there's anything non-standard about the micros still on the list. For example, you need an interface if you want to run any printer but the ZX Printer off the Spectrum, and Commodore machines tend to lock you into Commodore peripherals. Add any extra cost you're liable to incur.
7 Now — and only now — look at the specifications of the machines on your shortlist. How many colours do they have? How much memory? What is the screen resolution? Do they have user defined graphics? Do they have sprites?
8 Look at the supporting literature.
9 If you're still not down to one micro, or if one on your list hasn't turned out to be miles ahead of the others, buy the cheapest.

a little different. The first thing you should look at here, naturally, is the games available for the micros on your shortlist. You might also like to bear in mind that it isn't just a question of what's available — you've also got to think about what is available near where you live, unless you want to trust mail order companies.

There are other things you'll need to consider. Does your choice have a built-in joystick interface, and if not, can you buy one for it? You may want to be able just to plug games in, rather than having to wait for them to load from tape, so you must also ask whether or not your machine will take cartridge software.

Finally, ask yourself how much the games cost for the various machines. You may find yourself buying a machine that costs less initially, but in the long run costs you a lot more because of the price of the software.

Using a micro for home filing or for work is again a question of software, but you're also likely to want to use a printer, and if the jobs you intend to do are big, then you may well want disk drives.

So first you should check to see what software is available, say in fields such as home accounts, word processing and filing. You should also check out a few reviews of these packages, because there's little point in buying a micro that only has third rate and/or inconvenient-to-use serious software supporting it.

For large files, disks will be a must, as slowly and laboriously saving information on tape will take up too much time, and may limit the size and versatility of your files. So make sure your choice of micro can be connected up to a disk system, and also to a printer, if you're going to want written output.

If you're going to spend a lot of time writing on your micro, you'll want a proper typewriter style keyboard. You may find yourself thinking that you could make do with one of the cheaper variants, such as the Oric, but resist this temptation. Keyboards do come in all shapes and sizes, but you can really only do professional word processing tasks on full sizes, full-travel keyboards.

And if you're still confused? Don't despair: as we said at the outset, micros today are incredibly cheap, and really the best way to learn about them is to get on. So, if you can't make up you mind, don't buy an expensive system — buy a cheaper, tried and tested one. Sure, in a year's time you'll probably be thinking of upgrading, but once you've been bitten by the bug, that goes for all of us . . .

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NEXT WEEK

Next week we continue our series of buyer's guides with a look at peripherals — printers, plotters, disk drives, monitors. Don't miss it.

HARDWARE BUYER'S GUIDE

Over the next 13 pages we'll give you not one, but two complete home micro buyer's guides. Each on its own would be valuable in helping you choose a micro for Christmas, but taken together they are an unparalleled complementary package for the discerning micro buyer.

The first eight pages of this guide consist of details of 17 home micros under £400 and four notable business micros over £900 — comparing similarly-priced machines and giving thumbnail sketches of what software and hardware is available for each machine.

The last six pages is our Databasics section, normally published at the back of the magazine. To make it easy to use with this special Micropaedia buyer's guide, we have put the two together as one quick reference package.

In the comparison charts the machines are compared for price, standard RAM offering, maximum RAM, and the maximum text and graphic resolutions.

Name ZX81
Price £45 (new ZX-81 starter pack)
Standard memory 16K with expansion pack included in starter pack.
Comments The original black-and-white soundless 'starter computer' from Sinclair costs £45. With the vast library of software established for the machine over the past few years, it's probably the best black and white first computer you can get. It's also one of the few black and white computers that has survived.
Interfaces Cassette, TV and expansion port. The ZX81 is by nature a simple beast, but so many people have felt challenged by its simplicity that a vast range of peripheral devices from 80-column printer interfaces to disk drive connectors have been developed for it by third party hardware manufacturers.
Software Given the machine's limited memory and graphics — and its lack of sound — some quite stunning packages have been produced for it, most of them games. But with the machine's flat keyboard it's perhaps surprising that a number of software houses have produced professional word processors and spreadsheets for it.

Lots of good games for this starter computer and a surprising number of serious computing utilities.

Name Aquarius
Price £59.95
Standard memory 4K expandable to 52K
Comments This micro started life as the Mattel Aquarius, but has been taken over by the machine's manufacturers Radifon Electronics. However, the market pressures that caused the switch to direct sales by Radifon also forced Mattel to drop the machine's price to £59.95 just before it made that switch. The new price makes the Aquarius one of the cheapest colour computers, although Radifon has indicated they will push the price back up after Christmas.
Interfaces The Aquarius currently offers expansion to run an own-brand cassette recorder, a small thermal printer, games paddles and cartridge games. The mini-expander unit also allows memory upgrade, initially with 16K memory pack.

The machine uses a Spectrum-style rubber keyboard and allows for overlays that help to assign specific tasks to different keys in both games and applications packages.
Software This has, until recently, been almost exclusively in the cartridge format. Radifon has promised, however, to have 50 cassette programs on the shelves by Christmas — releasing them at the rate of three a week.

Machine	Price	Standard RAM	Max RAM	Text	Graphics
ZX81	£45	1K	16K	32×24	64×42
Aquarius	£60	4K	52K	40×24	80×72
Laser 200	£70	4K	64K	32×16	128×64
Oric 1	£99	16K	48K	40×28	240×200
Spectrum	£99	16K	48K	32×24	256×192

Name Laser 200
Price £69.95
Standard memory 4K (immediately expandable to 20K, with the promise of future expansion to 64K)
Comments Until the Aquarius price drop, this machine wore the mantle of the cheapest colour computer in the UK. It is billed as a competitor to Sinclair's Spectrum colour computer and has a good deal in common with that machine: the same type of rubber keyboard, single-key Basic keyword entry and the same Z80 processor.
Interfaces The Laser offers the standard TV output, cassette I/O plug-ins, a memory expansion and the traditional cartridge expansion slot. The 16K RAM expansion — which brings the price of a 20K Laser up to the price of Sinclair's Spectrum (£99) — slots into the said memory expansion slot at the back of the machine.

Promised for the future are printer, joystick and disk drive interfaces.
Software This is perhaps the biggest question-mark surrounding the Laser. Although the machine sports a standard Microsoft Basic, it's early days yet to predict how much software will be written for it. Abbex software has committed itself to producing some packages, but it's a 'wait and see' situation.

Name Sinclair ZX Spectrum
Price £99 (for basic 16K model), £125 (for 48K model)
Standard memory 16K or 48K
Comments The best-selling colour computer in the UK, with arguably both the biggest third-party peripherals and software base of any machine bar the Apple II.

Although some may gripe about the Spectrum's 'spongy keys', they have kept the price of this machine consistently low. And enough third-party peripheral houses have made their own 'real' keyboard available to mean that this is no longer a major issue.
Interfaces Printers, disk drives, (Microdrives), joysticks, cartridge software, networking, memory expansion: you name it, it seems it can be plugged into the Spectrum. Sinclair itself offers the Microdrive, a cartridge software and joystick interface, an RS-232C, Microdrive and network interface and the ZX printer (which can also be used with the ZX81). But that's only a fraction of what's available from third-party peripheral developers.
Software Again, there are reams of it, including a lot of very good games.

Name Oric-1
Price £99 (£79.95 mail-order from Oric)
Standard memory 16K expandable to 48K
Comments There are actually two models of Oric, the 16K and the 48K, but for the purposes of this buyers guide they are more or less the same machine. After a difficult first year when the Oric was greeted with mixed reactions, and the company had considerable problems with its ROM, Oric has achieved considerable success in France and a good software base has developed for the machine here.
Interfaces It has a keyboard somewhat superior to its major competitor — Sinclair's Spectrum —and supports more standard interfaces, including a built-in parallel interface (to use standard 80-column dot-matrix printers) and Oric's own colour printer/plotter, a plug-in for RGB professional colour monitors and an expansion 'bus' that will soon take promised three inch disk drives.

Oric has also promised a modem for the machine which will use its built-in Teletext graphics facility to connect to Prestel.
Software Here again, Oric has recently found itself recovering from teething troubles. Word-processing, spreadsheet and machine language software is now available, in addition to a growing collection of both arcade and adventure games.

Name Sord/CGL M-5
Price £150
Standard memory 4K available RAM, 16K video memory (expandable to 32K)
Comments Since this machine arrived in the UK last spring, it has consistently been passed off as 'nice, but pricey' by reviewers — but Sord and CGL (Sord's major distributor in the UK) are hoping a drop from £190 to £150 will change all that.

The machine comes with only 4K of memory, but that memory is a good deal more useful than it might appear as the 16K video memory does a lot of work with the screen.

Interfaces The Sord comes with interfaces for motor-controlled cassette storage, joysticks, cartridge software (plug-in game and business packages) and colour television display. It also includes a plug-in for Centronics full 80-column printers like the Epson MX-80F/T.

Software Software development for such machines as the M-5 is a chicken and egg question. Well-built and high-quality machines like the M-5 always come with some software, but the availability of more depends greatly on whether the machine sells well enough to impress third-party software houses.

But sales of any machine always depend to some extent on the software available, so the whole thing is rather circular and you're probably going to have to decide whether or not to buy the machine on the basis of what it will do rather than on what it can do just now.

Name Commodore Vic-20
Price £139
Standard memory 5K (expandable to 32K)
Comments This old standard from Commodore rivals the Sinclair machines in popularity and—in its current 'starter pack' form—offers very good value. The starter pack includes the standard 3K RAM Vic-20, the dedicated Vic cassette recorder and a cassette including 20 programs.
Interfaces The standard Vic comes with joystick port, serial port, expansion slot and user port, and TV output modulator (both the picture and sound are output through the TV).
Software The standard Vic-20 comes with a cassette containing 20 programs including 'Type-a-tune', 'Blitz' and 'Hoppit', but that's only the briefest hint of the vast array of software that's been built up for this machine. Software on both cartridge and cassettes is available from Commodore and many other third party software houses.

Name Tandy MC-10
Price £99.00
Standard memory 4K (expandable to 20K)
Comments The MC-10 is Tandy's first entry in the under £100 computer sweepstakes and provides a low-cost counterpart to the company's more upmarket Colour Computer. The machine is small—not much larger than the ZX-81 — but supports hard-plastic keys, a printer interface and an RS-232C communications port.

The machine also allows single-key Basic keyword entry and a modified version of Microsoft Basic called Micro Colour Basic.

Interfaces Tandy offers a small thermal printer with the MC-10, as well as it's range of peripherals such as computer cassette recorders, dot matrix printers and plotters. Tandy is also expected to produce a cheap modem that would allow the machine to 'talk' to other computers over the telephone.
Software Given that it uses much the same Basic as the Colour Computer — and that Tandy is certainly capable of putting out lots of its own software—there should soon be a great deal of software available for this machine. But the operative words here are 'should' and 'soon'. Just how true that prediction is depends entirely on Tandy.

Name Atari 600XL
Price £160
Standard memory 16K (expandable to 64K)
Comments The Atari 600XL is not a great deal different from its predecessors, the Atari 400 and Atari 800. Like the 400, the 600 XL has 16K memory as standard kit — but unlike the 400, the price also includes a full travel keyboard, the Basic programming language built into the main board of the machine and expandability to 64K.

At £160, it represents very good value — particularly since it can run the whole range of existing Atari disk, cartridge and cassette software.

Interfaces The 600XL uses Atari's non-standard peripherals interface for disk drives, cassette recorders and printers. Using Atari's standard peripheral expansion interface, you can also hook up standard parallel printers in addition to the new range of Atari dot matrix and letter quality printers. There's also a parallel bus and even a planned Expander box that give you dual RS-232C connectors, a Centronics port and eight other expansion slots.

Software There's loads of it — although a surprising amount is still only available in the more expensive cartridge form. But a large range of applications are represented in the Atari software list, including an official implementation of Visicalc and a quite respectable cartridge word-processor called Atariwriter.

Name Colour Genie
Price £168
Standard memory 16K RAM (expandable to 32K)
Comments Also known as the EACA EG2000, the Colour Genie is distributed by Lowe of Matlock, which offers full support and service. One of the earlier contenders in the USA home micro marketplace, the Colour Genie is generally comparable to both the Vic and TRS-80/I moulds.

Interfaces Like other (more expensive) members of the Genie family, a healthy selection of plugs and sockets ensures that most kinds of add-on can be tailored for the Colour Genie. Serial, parallel, audio, video, cassette, television, and expansion connectors, as well as an internal speaker, are standard fixtures and fittings.

Software Supplied with the machine is a demo cassette, containing programs written in Basic. Unless you have some add-ons, you are pretty much limited to using the built-in (Microsoft-styled) ROM Basic language. The semi-high resolution graphics are great for games, but the text display is somewhat resistant to more serious applications.

Name Dragon 32
Price £175
Standard memory 32K
Comments The Dragon 32 has a common heritage with the Tandy Colour Computer, but has traditionally maintained a lower price than its chief (but much larger) rival. Most colour computer software will run on the Dragon, and in the year or so that it's been available the Dragon has built up a good software base of its own — mostly from third-party software houses. Dragon have also been no slouches in producing their own peripherals, releasing both joysticks and a disk drive.

Interfaces The Dragon comes with a standard parallel printer interface, plug-ins for joysticks, a composite video monitor socket, a cassette interface and its own expansion port. Dragon's recently released disk drive unit and disk controller round out the expansion options — with the disk controller containing an upgraded version of Microsoft Basic.

Software The Dragon's compatibility with the Tandy colour computer gave it a software advantage to start with, and with the large numbers of Dragon programs written and released in the past year, the machine is one of the better-equipped popular micros. In addition to a plethora of games, a number of both word-processing and spreadsheet programs have been developed for the machine.

Machine	Price	Standard RAM	Max RAM	Text	Graphics
Tandy MC10	£99	4K	20K	40×24	64×32
Vic 20	£139	3.5K	32K	22×23	160×176
Sord	£150	4K	32K	40×24	256×192
Atari 600XL	£160	16K	64K	40×24	320×192
Colour Genie	£168	16K	32K	40×24	160×102
Dragon 32	£175	32K	32K	32×16	256×192

Name Tandy Colour Computer
Price £179
Standard memory 16K (expandable to 32K)
Comments The Tandy Colour Computer was Tandy's first entry into the low-cost home colour computer market, and as it has been around for some time has developed a good software base and a wide range of peripherals. So far, the colour computer wins out in its contest with the Dragon on the basis of having more peripherals, software and a larger dealer network — but the Dragon still scores over the Tandy by having a better keyboard and more memory.
Interfaces Much the same as the Dragon, except that all Tandy peripherals will — of course — work without modification on the colour computer. And the Tandy-Dragon connection can sometimes work in Tandy's favour as many third-party peripherals for the Dragon will run without modification.
Software Cartridge software has always been the colour computer's forte, but with the recent rash of cassette programs for the Dragon that could change feature. Although these machines are in competition, Dragon, Tandy and the users of both machines will benefit from more sales of either machine.

Name Lynx
Price £225
Standard memory 48K RAM (expandable to 192K)
Comments The Lynx is perhaps less well-known than other micros produced in Cambridge, however it boasts many of the features found in machines costing 50% to 75% more. Including a 'real' keyboard, colour graphics, and loudspeaker, the design of the Lynx micro is of the lightweight desktop variety.
Interfaces As with many Z80 based micros, a comprehensive expansion connector allows you to bolt-on peripherals. This is where additional ROM and RAM get grafted on, as well as floppy disk equipment. As supplied, Lynx sports television, cassette, video, RGB, light pen, and serial interface connectors.
Software The Lynx contains ROM Basic as standard, although ROM Pascal, Forth and Comal languages are offered. With optional floppy disks fitted, the plethora of CP/M software is available.

Name Electron
Price £199
Standard memory 32K RAM
Comments This machine is the much-heralded offspring of the BBC Micro. As such, its principal features are a real keyboard, the BBC Basic language, and almost complete compatibility with existing BBC software. Due to great advance demand, it is presently difficult to find an Electron in stock, so you'd be well advised to check availability before setting your sights on this one for Christmas.
Interfaces To compete in the under £200 marketplace, the Electron contains only the barest minimum of built-in interfaces. Apart from cassette, television, video, and RGB connectors, all other peripherals (will) use the large expansion connector. Unfortunately, being yet another very young machine, not even a handful of Electron interfaces can presently be found off the shelf. However, there's a growing range of mail-order bolt-ons.
Software The shortage of interfaces means you are restricted in the usefulness of any of the existng BBC software which will run on an Electron. Also, until you can connect a printer, writing your own programs will be somewhat tedious. Content yourself with a few games for Christmas, however, then get serious in the New Year.

Name Sharp MZ700
Price £275
Standard memory 64K RAM
Comments Another young machine, the MZ700 offers complete compatibility with its predecessors, the Sharp MZ80 series. As such, the considerable number of school and business MZ80 users will find everything they know, plus more, within this latest machine from Sharp. With its lithe and stylish keyboard, the MZ700 approaches the realm of professional micros, although it is not very well known yet.
Interfaces The most prominent feature of the MZ700 is its ability to hold both its optional cassette recorder and colour printer/plotter within its cabinet. Included in the standard machine are both a real keyboard and internal loudspeaker. Standard connectors include cassette, printer, television, video monitor, RGB monitor, joysticks, and I/O.
Software Apart from the Sharp Basic language, a word processor and a few games, there are few MZ700-specific programs available. However, the standard 64K Z80A design and wide range of MZ80 software should be enough.

Name Commodore 64
Price £229
Standard memory 64K RAM
Comments The youngest member of the well-known Commodore family (remember the PET?) offers one of the better values for money in Santa's sackful. As well as a real keyboard, you get powerful colour graphics, sound generator, lots of RAM memory, ROM Basic, and a reliable expansion system.
Interfaces Like the Commodore Vic 20, the 64 offers serial (RS232), parallel, cassette (Commodore standard), joystick, and television (picture and sound) connectors. A cartridge/expansion connector allows games and peripherals to be fitted quickly and easily, notably Z80 processor, floppy disk, and 80-column screen expansions.
Software There's now much software to choose from for the 64 with word processors, databases, and some excellent games. Watch out for a software explosion with the announcement of the CP/M operating system interface for the 64, and if you can afford the prices. American import packages are exceptional.

Name BBC Model B
Price £399
Standard memory 32K RAM
Comments Here is the most expensive machine in our list, although by no means the most expensive home micro on the market! There is presently nothing to beat it at this price for versatility. Its very name reinforces its pedigree, as well as assuring additional acceptance by both education and business users. Also, the BBC Basic language is very likely to become a world-wide standard, if it isn't already.
Interfaces There are many products available, and countless more in the pipeline. The standard Model B has a full real keyboard, ROM Basic, colour graphics , and sound generator with built-in loudspeaker. Standard connectors include cassette, printer, television, video monitor, RGB monitor, and analog (includes voltage-measuring, light pen, and joysticks). Also provided, but requiring extra components to be fitted, are speech, network, floppy disk, and second-processor connectors.
Software Quite a lot of it and largely of very high quality. There's a wide choice for games players and, thanks to the machine's educational pedigree, a lot of packages in that area too. The majority of what's available comes on cassette although there are many utilities and business applications on plug-in ROMs. Surprisingly little disk software so far. Serious programmers are very well catered for with a number of language implementations.

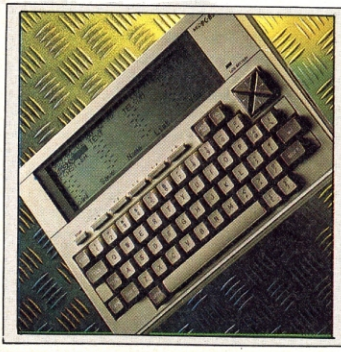
Machine	Price	Standard RAM	Max RAM	Text	Graphics
Tandy Color	£179	16K	32K	32×16	256×192
Electron	£199	32K	32K	80×32	640×256
Lynx	£275	48K	192K	40×24	256×248
Commodore 64	£229	64K	64K	40×24	320×200
BBC Micro	£399	32K	32K	80×32	640×256

Name Apricot
Price £1,890
Standard memory 256K RAM
Comments The newest addition to the blossoming tribe of true 16-bit micros, and portable as well. Only a very old-fashioned businessperson would not develop technological twinkles in the eyes at finding this marvel under the Christmas tree.
Interfaces In step with most business micros, the Apricot has most of the fundamentals included, such as video monitor and disk drives. Connectors provided are minimal but essential: Centronics parallel and RS232 D-type serial. Expansion is obtained through (only) two internal connectors, which may be used to implement the imminent new products.
Software Where the Apricot has staked much of its faith is in its built-in 3.5 inch microfloppy disk drives from Sony. Although the machine supports CP/M-86, MS-DOS, and Concurrent CP/M-86, it may be slightly difficult to keep it fed with new disks for a while.

Name Apple IIe (Europlus)
Price £972
Standard memory 64K RAM (expandable)
Comments Not to be confused with its (now retired) predecessor the Apple II, the IIe is the current version of 'The thing that started it all'.
Interfaces If it moves, it can be interfaced to an Apple. Although the basic machine carries only cassette, video, and games connectors, there is a plethora of interface cards which can be slotted into the internal expansion connectors. This is where the cost starts to mount, as a quick total of essential business add-ons will show. Some dealers may still sell older Apple cards which will not work in the current model, but the bulk of standard cards (printer interfaces, expansion RAM, floppy disk, winchester disk) will work without alteration.
Software It's doubtful if anyone actually knows how much there is. Languages, business, education, games. Should any of you feel slightly wary of having to actually write your own programs, no other micro can offer as wide a catalogue of existing software as Apple.

Name IBM PC-1
Price £2,392
Standard memory 64K RAM (expandable to 576K)
Comments At last we settle down to our well-earned Christmas rest with the famous IBM PC micro. Actually, the PC is currently available in two versions (three in the New Year), so here we describe the lowest-price model, the PC-1. The entire concept of using micros in business took a big jump when IBM revealed its idea of how to do it. A detached keyboard, a separate cabinet and a standard cabinet and a standard video monitor. All with the unmistakable air of legitimacy which only IBM can exude. Not the cheapest, not the fastest, but what better insurance can you get against micro obsolescence than those three little letters?
Interfaces The basic philosophy of the IBM PC is very simple: nothing more than you need. Standard facilities include serial and parallel interfaces and the requisite video monitor output, but like the Apple anything else is extra. The five internal expansion connectors have spawned a truly awesome range of

products, with RAM expansions, high-resolution RGB interfaces, second processors, video digitisers, speech recognition devices, fibre optic systems, and many more.
Software Even IBM is a relative newcomer to the micro marketplace, but the amount of software currently available for the PC is more than some other machines will ever see in their lifetimes. Most software for the PC is designed to run under MS-DOS or CP/M-86, the two most popular 16-bit operating systems. Why not come in from the snow, and gather round the nice warm glow of the mighty IBM software furnace.



Name NEC PC-8201A
Price £475
Standard memory 16K RAM (expandable to 128K)
Comments Perhaps unfairly, at the bottom of our business person's Christmas shopping list is a true battery-operated professional micro. The eagle-eyed shopper will notice more than a slight physical similarity to the Tandy Model 100, although the NEC is designed differently, has twice as much RAM and actually costs £24 less.
Interfaces With its own built-in 40-column screen display and plug-in RAM storage cartridges, the NEC doesn't really need (hence doesn't offer) either video display or disk drive facilities. The main machine memory can be expanded four-fold, although there is no limit to the number of slot-in 32K CMOS RAM storage cartridges which you may use to save your inscrutable data. Provision is made for either serial or parallel printers, a bar-code reader device, and RS232 gadgets (such as modems).
Software The NEC is supplied with both Microsoft Basic and a word processor as built-in ROMs, and additional Basic programs on standard cassette tape. The latter include a name & address book, an investment portfolio calculator, and of course some entertainment generators (games).

DATABASICS

This six-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE a microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (million cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS columns × lines The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price. **Tv** indicates that you can plug the computer into a television set **(M+)** indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOUR CAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy **(F)** or hard **(H)**

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£40	Powertran Cortrex	£454	Osborne I	£1,581	Country Com'ters C3000	£2,242	Britannia Baby	£2,657	Cifer Series 1	£3,214	Altos 800/15	£5,663
Casio PB100	£50	Epson HX20	£472	Signet 10025	£1,599	Kemitron K2000E	£2,242	Adler Alphatronic P3	£2,696	Samurai	£3,214	Durango F85	£5,744
TRS-80 PC4	£50	Tandy TRS 80 Model 100	£499	APL Signet	£1,610	Rair Black Box 320S	£2,242	Corona PC1	£2,697	Tiger	£3,214	Triton 4	£5,744
Aquarius	£50	Nascom 3	£549	Basis 108	£1,683	Sanyo MBC 2000	£2,242	Eagle II	£2,702	Torch	£3,214	Marin Chip M9900	£5,750
Laser 200	£70	Commodore 4016	£632	Commodore Spr. Pet 9000	£1,719	Toshiba T-200	£2,242	Almarc 801	£2,708	Sord M223	£3,277	SW Tech. Products S0/9	£5,750
Oric-1	£80	Research Machine 480Z	£650	Gemini Galaxy 2	£1,719	TMK 332	£2,242	DEC Rainbow 100	£2,714	Kontron RS180	£3,306	BASF 7100	£5,805
Sharp PC1251	£80	DAI PC	£684	ACT Apricot	£1,719	Merlin M2215	£2,742	ICL PC Model 10	£2,754	Kaypro 10	£3,340	Compustar	£5,837
Jupiter Ace	£90	Apple II	£776	Microsolution Brit. Genius	£1,840	Bonsai SM 3000	£2,294	Millbank SX10	£2,754	Columbia PC 1600-1	£3,392	Sord M243	£5,842
Casio FX702P	£90	Commodore 500	£799	Globe 101	£1,850	CAL PC	£2,294	Sirius I	£2,754	Digico Prince	£3,392	Sage IV	£5,962
Sinclair Spectrum	£99	Tandy Model 4	£861	Grundy 8200	£1,850	North Star Horizon	£2,294	Victor 9000	£2,754	OEM Orion	£3,392	Rair Business Computer	£6,037
Tandy TRS-80 Pocket 2	£130	HP 75C	£883	Genie III	£1,897	Sanyo MBC 1250	£2,294	North Star Advantage	£2,766	Barcellos AMT 100	£3,450	Digital Microsystems 4	£6,210
Commodore VIC 20	£140	Sharp MZ80B	£900	Toshiba T-100	£1,900	Casu Mini C2	£2,300	Apple III	£2,780	Kalamazoo 1050	£3,450	Superstar	£6,296
Atari 400	£149	Franklin Ace	£914	Sord M23	£1,932	Seed System I	£2,300	Sanyo MBC 4050	£2,817	Digital Microsystems 3	£3,576	Racal 6000	£6,327
Sord M5	£150	Apple IIe	£972	Kaypro II	£1,949	Sharp PC3201	£2,300	Bonsai SM 4000	£2,842	Televideo TS 1602-C	£3,714	Eagle 1600	£6,497
Atari 600XL	£160	Mupid 320 GB	£978	Krypton 800 range	£1,949	HP 85	£2,360	Logica VTS Vitesse	£2,863	Adds Multivision	£3,795	TI System 200-250	£6,695
Colour Genie	£168	Husky Hunter	£997	Kenilworth 83G	£1,953	HP Series 100, 120	£2,362	Decision-1 Computer O11	£2,869	Clenio Pronto	£3,795	Compucorp 675	£6,780
Sharp PC1500	£169	Commodore 8032	£1,129	Transam Truscan	£1,983	Sord M23P	£2,369	Olivetti M20	£2,869	Panasonic JD800M	£3,795	Wicat 150	£6,846
Dragon 32	£174	Commodore 710	£1,144	NCR Decision Mate V	£1,983	TI Prof. Computer	£2,386	DMS Fox	£2,875	Kemitron K3000	£3,795	Sundance I	£6,969
Texas CC40	£180	Microdecision	£1,144	Epson QX10	£1,995	IBM PC	£2,392	Eagle III	£2,950	DEC PC 350	£3,850	Pascal Mod. Microengine	£7,003
Tandy TRS 80 colour	£180	Tulip 1	£1,150	IDS Datamachine	£1,995	Xerox 820 Model II	£2,415	Zenith ZF-120-22	£2,978	Vector 4	£3,852	Diablo 3000	£7,250
Mattel Intellivision	£190	Fujitsu FM8	£1,150	Tandy TRS-80 Model II	£1,999	Haywood 3000	£2,439	Monroe EC 8800	£2,990	Cifer Club	£3,904	Onyx 5001 MU	£7,607
Electron	£199	Sanyo MBC 1000	£1,195	Kenilworth 83N	£2,012	LSM4	£2,472	Philips P3500	£3,000	Sage II	£4,019	Apple Lisa	£7,653
Camputers Lynx	£225	Pied Piper	£1,226	Caltext Micro	£2,019	Canon CX-1	£2,500	Tanberg EC10	£3,000	Tandy TRS-80 Model 16	£4,199	Sundance II	£8,205
Commodore 64	£229	Positron 900	£1,259	Minstrel	£2,059	Sirius 1	£2,525	Archives 1	£3,003	IBM PCXT	£4,258	Haywood Hinet	£9,550
Sharp MZ700	£250	Tandy TRS-80 Model III	£1,299	Portico Miracle Portable	£2,064	IO Tech Iona	£2,539	Cromemco System 1	£3,025	Hytech H4500	£4,310	Altos 856-10	£9,631
Atari 800XL	£250	Cromemco C10	£1,350	LSIM3	£2,064	HP 87XM	£2,571	Wang Professional	£3,076	BMC OK 11 F800, Model 20	£4,360	Micro Five 3000	£10,350
New Brain A	£269	Commodore 8096	£1,374	Haywood 9000 Composite	£2,064	Quantum 2000	£2,587	DEC PC 325	£3,080	ADS 42	£4,500	Sundance 16	£10,480
Genie II	£299	NEC PC 8001	£1,375	Positron 9000	£2,134	Ajile	£2,599	Direct 1000	£3,093	Televideo TS-80ZH	£4,533	Spectrum	£11,442
Atari 800	£300	Pasca 640	£1,437	Research Machines 380Z	£2,147	Canon AS100	£2,633	Equator	£3,099	Country Com'ters C1000	£4,542		
Nascom 2	£327	NEC PC8000	£1,454	Superbrain JR	£2,150	CP1100	£2,639	Hyperion	£3,100	Corvus Concept	£4,887		
Microtan 65	£389	Signet 2	£1,483	Future Computers FX-20	£2,156	Seed System 19	£2,600	Clenio Table-Tops 925	£3,105	Micro Five 1000	£5,175		
BBC Model B	£399	Magnum	£1,489	C/WP Cortex	£2,179	Enterprise 1000	£2,645	ITT 3030	£3,105	Fortune 32:16 System 2	£5,204		
Sharp MZ80A	£399	Televideo TS-800 Series	£1,495	Comart Communicator	£2,180	Facit 6520	£2,645	Monroe OC 8810	£3,162	Zeus 4	£5,400		
Datac Micro Controller	£431	HP86A	£1,570	Adler Alphatronic P2	£2,197	Olympia Boss Model A	£2,645	HP Series 200 Model 16A	£3,211	Molecular M200	£5,462		

ABBREVIATIONS

Ap: APL	Cm: Comal
As: Assembly	Fr: Forth
Ba: Basic	Fn: Fortran
Co: Cobol	Pa: Pascal

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
ACT Apricot	£1,719	8086A	5	256K	768K	80×25	LCD		800×400	W	8	●	1	1			2		2×315K3½F	MSDOS	Ba	●	A7	*PCN* issue 37
Adds Multivision	£3,795	8085A	5	64K	256K	80×25	M		640×240	W	28		1			1			1×350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80×24	M			W	6	●	2			1	3		2×320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×790K5¼F	CP/M		●	T1	16 bit option-promised
Ajile	£2,599	8088	4	256K		80×25	M		640×250	W	10	●	1	1		2			2×320K5¼F	MS-DOS	BaAs	●	A9	*PCN* issue 13
Almarc 801	£2,708	Z80	4	64K	512K	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb
Aquarius	£68	Z80A	4	4K	52K	40×24	TV	●	320×192	C							1	●		Cassette	Ba		M7	*PCN* issue 7
Altos 800/15	£5,663	Z80	4	192K	208K	80×24	M			W	8	●		1					1×450K5¼F	MP/M		●	L1	Multi user business machine
APL Signet	£1,610	Z80A	4	64K		80×25	Tv(M+)*	●		*			2						2×188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40×24	Tv(M+)	●	256×192	W							8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras
Apple IIe	£972	6502		64K	128K	80×24	(M+)	●	256×192	W					1		8			DOS	Ba	●	A8	Updated Apple II
Apple III	£2,780	6502	2	128K	256K	80×24	(M+)	●	560×192	W		●	1				4		1×140K5¼F	SOS, DOS		●	A8	Will emulate Apple II
Apple Lisa	£9,775	68000	8	1Mb		120×30	M		792×360	W		●	2	1			3		2×860K5¼F	Lisa		●	A8	*PCN* issue 1
Archives I	£3,003	Z80	4	64K		80×25	M	●	240×100	W	23	●	2	1		1	5		2×386K5¼F	CP/M		●	S1	Standard CP/M + graphics
Atari 400	£150	6502B	1.79	16K		40×24	Tv	●	320×192	T	3					7		●		Cassette	Ba	●	A5	Games computer
Atari 800	£300	6502	1.8	48K		40×24	Tv(M+)	●	320×192	W	3					7	4	●		Cassette	Ba	●	A5	Versatile, good graphics
Atari 600XL	£160	6502C	1.79	16K	64K	40×24	(M+)Tv	●	320×192	W	5					4	1	●	1×127K5¼F	DOS 2	Ba	●	A5	Dos 3 available 1984
Atari 800XL	£250	6502C	1.79	64K		40×24	(M+)TvM	●	320×192	W	5					4	1	●	1×127K5¼F	DOS 2	Ba	●	A5	256 colours, 128 at any one time
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80×24	TvM			W	8	●	1	1		2	3		2×500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80×24	M			W	26	●	1	1					3×163K5¼F	BOS	Ba	●	C1	Hard disk promised
Basis 108	£1,683	6502	1	64K	126K	80×24	TvM	●	820×168	W	15	●	1	1			6	●				●	C12	Apple bus, Z80, 80 columns
BBC Micro Model B	£399	6502	2	32K		80×30	Tv(M+)	●	640×256	W	10			1		5	3	●		MOS	BaAs	●	A1	*PCN* issue 3
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80×25	M	●	640×200	W	15	●	1					●	2×340K5¼F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80×24	M		80×24	W	14	●	1	1					2×350K5¼F	CP/M		●	B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80×24	M			W	14	●	1	1						CP/M, MP/M, MS-DOS		●	B2	Z80 for 8 bit software
Britannia Baby	£2,657	8085	6.14	64K		80×25	Tv(M+)		80×25	W	11	●	2	1					2×500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included
British Micro Mini 803	£1,490	Z80A	4	64K		80×25	(M+)		512×256	W	17	●	1	1		1			2×400K5¼F	OS/M		●	B4	This is CP/M compatible
CAL PC	£2,294	8088	5	128K	256K	80×25	TvM	●	256×512	W		●	2	1		1	5		2×400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor
C-Base 64A	£401	6502	1	64K	192K	40×24	Tv(M+)	●	256×192	W	51	●					8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	W3	Apple II compatible
Caltext Micro	£2,019	Z80A	4	64K	256K	80×24	TvM			W	36	●	1	1			3		2×400K5¼F	CP/M		●	C3	Range of software included
Camputers Lynx	£225	Z80A	4	48K	192K	40×24	Tv(M+)	●	248×256	W				1		1		●		CP/M	Ba	●	C5	Also 128K with CP/M
Canon AS100	£2,633	8088	4	128K	512K	80×25	M	●	640×400	W	12	●		1			4		2×640K5¼F			●	C4	Choice of CP/M86 or MS-DOS
Canon CX-1	£2,500	6809	4	128K	256K	80×24	M		80×25	W	15	●	3	1	1		2		2×320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20×1	LCD			C								●		Cassette	Ba		C6	Pocket computer
Casio PB100	£50	Cust.		0.7K	1.7K	60×1	LCD			C		●					1	●		Cassette	Ba		C6	Business pocket computer
Casu Mini C Mark 2	£2,300	Z80A	4	64K		*	(M+)		*	*			4	1			6		2×1Mb8F			●	C7	*Choose your own terminal
Cifer Series 1	£3,214	Z80	4	128K	320K	132×32	TvM			W	40	●	3	1					2×800K5¼F	CP/M		●	C17	Other models available
Cifer Club	£3,904	Z80A	4	64K	256K	80×24	M		1024×300 opt	W	20	●	3	1	1				1×800K 5¼F	CP/M, MP/M opt, UNIX opt		●	C17	Optional 68000 processor
Clenlo Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)		*	*			2	2			18		2×600K8F	CP/M	Ba	●	C8	*Choice of terminal
Clenlo Table-Top 925	£3,105	Z80A	4	64K	128K	80×25	M			W	11	●	2	2					2×600K8F	CP/M		●	C8	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80×24	M	●	640×200	W	10	●	2	1			8		2×320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£140	6502	1	5K	32K	22×23	Tv(M+)	●	176×158	W	8					3	1	●		Kernal	Ba	●	C9	Very popular home micro
Commodore 64	£229	6510	1	64K		40×25	Tv(M+)	●	320×200	W	8					3		●		Kernal	Ba	●	C9	*PCN* issue 24
Commodore 4016	£632	6502	1	16K	32K	40×25	TvM			W		●			1	1	3	●		Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 700	£1,144	6509	2	128K	896K	80×25	TvM			W	10	●	1		1	2	1	●		Kernal	Ba	●	C9	*PCN* issue 5

Commodore 8032	£1,129	6502	1	32K	96K	80×25	TvM				W		●			1	1		●			Cassette, PETDOS	Ba	●	C9	The 80-column PET
Commodore Super Pet 9000	£1,719	6502	2	96K		80×25	TvM				W		●	1		1	1	2	●			Cassette, PETDOS	Ba	●	C9	Top of the range
Compucorp 675	£6,780	Z80	4	64K	256K	80×20	M				W	20	●	1				4			2×655K5¼F	Compucorp		●	C10	Unusual O/S
Compustar	£5,837	Z80A	4	64K		80×25	M				W		●	2							1×10Mb8H+1×350K5¼F	CP/M	Ba	●	I10	Networking system
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80×24	M				W		●	2	1			10			2×390K5¼F	CP/M		●	C13	Business CP/M micro
Corona PC1	£2,697	8088	5	256K	512K	80×24	M	●	640×320		W	1	●	1	1						2×144K5¼F	CP/M	Ba		N1	Price includes twin disk drive
Corvus Concept	£4,887	68000	8	256K	1Mb	120×60	M		720×560		W	10	●	2			1	4				Merlin	Pa	●	K1	A4 shaped screen
Country Computers C1000	£4,542	6502	1	64K	128K	80×24	M		280×192		W	12	●	1				3			1×10Mb5¼H+1×140K5¼F	DOS, CP/M	Ba	●	C16	Runs all Apple software
Country Computers C3000	£2,242	Z80A	4	64K	256K	*	*				*			1	1						1×5Mb5¼H+1×500K5¼F	CP/M		●	C16	*Terminal own choice
CP1100	£2,639	8086	6	128K	1Mb	*	(M+)*				*			2	1			7			2×390K5¼F	CP/M 86		●	C13	Choose your own terminal
Cromemco System 1	£3,025	Z80	4	64K		80×24	(M+)	●	450×735		W	20	●	1				8			2×390K5¼F	CDOS, Crom		●	C13	Upgrades available
Cromemco C10	£1,350	Z80	4	64K		80×25	M		80×25		W			2	1						1×390K5¼F	CP/M	Ba	●	C18	Low cost CP/M machine
C/WP Cortex	£2,179	Z80		64K		80×25	M		600×240		W	10	●	1	1						2×360K5¼F	CP/M	Ba	●	C20	Z80 plus 6502
DAI PC	£684	8080	2	48K		60×24	Tv(M+)	●	255×335		W			1					●			Cassette	Ba		D9	Optional maths chip
Datac Micro Controller	£431	Z80	2	16K		40×24	Tv(M+)		80×60		W			1			1	1	●				Ba	●	D1	Mainly used in labs
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132×24	M	●	960×240		W	20	●	2				3			2×400K5¼F	CP/M		●	D2	Versatile business machine
DEC PC 325	£3,080	PDP11/23	N/A	256K		132×24	M	●	960×240		W	20	●	2				1			2×400K5¼F	P/OS		●	D2	Mini in micro clothing
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*				*			3	1		1				2×400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal
Diablo 3000	£7,250	8085	3	32K	64K	80×24	M				W	8	●	1				4			2×1.8Mb8F	DACL	Ba	●	B5	Unusual O/S
Digico Prince	£3,392	Z80A	4	64K		80×25	M				W	50	●	2				7			2×400K5¼F	CP/M		●	D3	Unusual keyboard
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*				*			3			1				2×512K8F	CP/M		●	D4	*Choice of terminal
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*				*			4							2×512K8F	MP/M		●	D4	*Depends on terminal chosen
Direct 1000	£3,093	Z80	4	64K		80×25	M		132×28		W			2							2×300K5¼F	CP/M		●	D5	Standard CP/M machine
DMS Fox	£2,875	Z80A	4	64K		80×24	M				W	16	●	3	1		1				1.2Mb5¼F	CP/M		●	D4	Portable machine
Dragon 32	£174	6809E	1	32K	64K	32×16	Tv(M+)	●	256×192		W				1		4	1	●			Cassette	Ba		D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80×64	Tv(M+)				W		●	4			1	12			2×1Mb5¼F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80×24	M		80×24		W		●	2	1		1				2×500K5¼F	CP/M	Ba	●	M3	Upgrades available
Eagle 1600	£6,497	8086	8	128K	512K	80×25	M	●	720×352		W	24	●	2	1		1	8			1×1Mb5¼F+1×12.5Mb5¼H	MS-DOS, CP/M 86		●	M3	High speed IBM copy
Electron	£199	6502	2	32K		80×32	TV(M+)	●	640×256		W	10							●			MOS	BaAs	●	A1	Excellent beginners' machine
Enterprise 1000	£2,645	*	8	64K			M				W	10	●	2			2				2×358K5¼F	Enterprise		●	D7	Micro Nova 16-bit
Epson HX20	£472	6301	1	16K	32K	20×4	LCD		120×32		W	13	●	2				2	●			Cassette	Ba		E2	Powerful portable
Epson QX10	£1,995	Z80	4	192K	256K	80×25	M		640×400		W	18	●	1	1			5			2×320K5¼F	CP/M	Ba	●	E2	Expansion required for Valdocs
Equator	£6,842	Z80A	4	64K	448K	80×24	M		255×560		W	14	●	7	1		1	8			1×5Mb5¼F+1×750K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available
Facit 6520	£2,645	Z80	4	64K	128K	80×24	M		80×24		W	8	●	2							2×320K5¼F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80×24	M	●	1024×1024		W	16	●	1				20			2×800K5¼F	Unix		●	I3	Genuine 16-bit
Franklin Ace 1000	£914	6502	1	64K	128K	40×24	M, Tv	●	256×192		W		●		1		4	1	●		2×140K5¼F	opt CP/M	Ba	●	C15	Apple IIe compatible
Fujitsu FM8	£1,150	6809	1	64K		80×25	(M+)	●	640×200		W	10	●	1	1		4	1	●			Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80×25	M		800×400		W	20	●	2			2				2×800K5¼F	CP/M 86, MS-DOS		●	E1	Business micro, runs CP/M
Genie II	£299	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48		W	4	●	1				1	●			Cassette	Ba	●	L2	Speeded-up Genie I
Genie III	£1,897	Z80A	3.2	64K		80×24	M		160×72		W	8	●	1	1		1	3			2×700K5¼F	New DOS	Ba	●	L2	CP/M costs extra
Colour Genie	£168	Z80	2.2	32K		40×24	Tv(M+)	●	160×96		W	8		1	1		2	1	●			Cassette	Ba		L2	Home games machine
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80×25	M		160×75		W	10	●	1	1		1	5	●		2×400K5¼F	CP/M		●	G1	Low cost British system
Globe 101	£1,850	8085	3	64K		80×24	M				W	20	●	3							2×325K5¼F	CP/M		●	G4	Wordstar plus Mail Merge inc.
Grundy 8200	£1,850	Z80	4	64K	256K	80×24	M		160×70		W	10	●	1	1						2×390K5¼F	CP/M		●	C19	Software included
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80×25	M		64×255		W	34	●	2				8			2×320K5¼F	CP/M	As	●	H1	Designed for network
HP 75C	£883	Cust.	N/A	16K	24K	32×1	(M+)				C						1	4	●		1.3K card reader	HP	Ba		H2	Calculator/computer
HP 85	£2,360	Cust.	N/A	16K	32K	32×20	M		255×191		W	8	●	1			4	4	●			Cassette	Ba	●	H2	Engineers' machine
HP 86A	£1,570	Cust.	N/A	64K	512K	80×24	M		544×240		W			1	1		2	4				HP	Ba	●	H2	CP/M optional
HP 87XM	£2,571	Cust.	N/A	128K	640K	80×24	M		544×240		W	14	●	1	1	1	3	4				HP DOS	Ba	●	H2	Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80×24	M		80×24		W	8	●	2			1					CP/M	Ba	●	H2	Top end HP business system
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80×25	M				W	5		1		1		2				HP		●	H2	Genuine 16-bit
Husky Hunter	£997	NSC800	4	80K	208K	40×8	LCD		240×64		C	8		1								CP/M	Ba	●	D10	Waterproof, with metal case
Hyperion	£3,100	8088	4.7	256K		80×25	M		320×200		W	10	●	1	1			1			1×320K5¼F	MS, DOS, CP/M 86	BaAs	●	G5	Same as Ajile
Hytech H4500	£4,310	Z80	4	64K	208K	80×25	M		80×25		W	26	●	1				3			2×403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80×25	(M+)	●	640×200		W	10	●		1			5			1×360K5¼F	MS-DOS	Ba	●	I9	Slow but reliable
IBM PCXT	£4,258	8088	4.77	128K	640K	80×25	(M+)	●	350×720		W	12	●					8			1×10Mb5¼H	DOS 2	Ba	●	I9	8087 co-processor possible

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
ICL PC Model 15	£2,702	8085A	5	64K	512K	80×25	M	●		W		●	8						1×13.3Mb5¼H	CP/M, MP/M	Ba	●	I4	Suitable for small business
IDS Datamachine	£1,995	Z80	4	64K	1Mb	*	Tv(M+)		*				2				15		2×400K5¼F	CP/M	Ba	●	I8	*Depends on terminal
IO Tech Iona	£2,539	Z80	4	69K	960K	80×24	M	●	160×75	W	12	●	1	1			8	●	2×400K5¼F	CP/M		●	I5	Good colour versatility
Intellivision + micro adaptor	£189.90	CP1610	2.4	5K		20×12	Tv	●	160×96	C						1		●	Cassette		Ba		M7	Computer adaptor is £89.95
ITT 3030	£3,105	Z80A	4	64K	256K	80×24	Tv(M+)		80×24	W	8	●	1			1	1		2×280K5¼F	CP/M, BOS		●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32×24	Tv(M+)		64×46	C		●					1	●			Fr		J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80×24	Tv(M+)		80×24	W	10		1						2×250K5¼F	Kalamazoo		●	K3	Only Kabol language
Kaypro II	£1,949	Z80	4	64K		80×24	M			W		●	1	1					2×200K5¼F	CP/M	Ba	●	C15	*PCN* issue 35
Kaypro 10	£3,340	Z80A	4	64K		80×24	M		100×160	W		●		1			2		1×10Mb5¼H	CP/M	Ba	●	C15	*PCN* issue 35
Kemitron K2000E	£2,242	Z80	4	64K		80×24	(M+)		80×24	W			2	1			11		1×300K5¼F	CP/M		●	K4	Scientific Keyboard
Kemitron K3000	£3,795	Z80	4	64K	256K	80×24	(M+)		80×24	W		●	2				14		2×1Mb8F	CP/M, MP/M		●	K4	For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M		●	K5	British portable
Kontron RSI 80	£3,306	Z80	4	64K	128K	80×25	M		256×512	W	16	●	2	1			8		2×303K5¼F	Kontron	Ba	●	K6	O/S CP/M based
Krypton 800 range	£1,949	Z80A	4	64K	256K	80×24	M		80×24	W	13	●	2	1			8		2×386K5¼F	CP/M		●	T8	Fully definable characters
Laser 200	£70	Z80A	3.6	4K	64K	32×16	TV	●	32×16	C			1			1		●			Ba		C14	Cheap colour computer
LSI M3	£2,064	Z80	2.5	64K		80×24	M		80×24	W	31	●	1	1					2×200K5¼F	CP/M		●	L3	Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80×24	M		160×72	W	31	●	2	1			1		2×400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80×24	M	●	640×288	W	12	●	1	1			4		2×1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics
Magnum	£1,489	Z80	4	64K		80×25	M			W		●	2						2×400K5¼F	CP/M		●	I6	Inexpensive CP/M machine
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24×80	M		24×80	W	8	●	4				12		2×1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Merlin M2215	£2,742	8085	5	64K		24×80	M			W	22	●	2			2			2×780K5¼F	CP/M	Ba	●	B7	Business computer
Micro Five 1000	£5,175	8088	8	128K	512K	25×80	TvM		512×512	W	20	●	10				2		2×1Mb5¼F+2×6.3Mb5¼H	*		●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25×80	TvM		512×512	W	20	●	5				3	●	1×10Mb8F	*		●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80×24	(M+)			*			2						1×200K5¼F	CP/M	Ba,Pilot	●	M9	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80×24	TvM		80×24	W	21	●	1	1					2×160K5¼F	CP/M		●	M4	'Genius' by nature?
Microtan 65	£389	6502	1	8K	48K	25×64	(TvM+)			W		●	1	2				●		Tanbug	Ba	●	M8	*PCN* issue 26
Millbank SX10	£2,754	Z80A	4	65K	256K	80×25	M		80×25	W	10	●	2			1			2×350K5¼F	CP/M	As	●	M5	Scientific applications
Minstrel	£2,059	Z80	4	64K	352K								2	1					2×400K5¼F	CP/M opt		●	H4	Choose your terminal
Molecular M200	£5,462	Z80	4	64K	320K		(M+)*			*			2			1	16		1×10Mb8H+1×500K8F	CP/M	BaAs	●	G2	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40×24	M		240×240	W	32	●	3			3			1×320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80×24	M		80×24	W	32	●	3			2	1		1×320K5¼F	Monroe	BaPa	●	F3	Bigger model available
Mupid 320-GB	£978	Z80A	4	64K	128K	40×24	Tv(M+)	●	320×240	W	55	●			1	2	1	●		CP/M+	BaAs		P6	*PCN* issue 22
Nascom 2/3	£327	Z80A	4	2K	64K	16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Old reliable
NCR Decision Mate V	£1,983	Z80A	4	64K	512K	24×80	M	●	640×400	W	20	●					7		2×320K5¼F	CP/M 80	As	●	N3	*PCN* issue 8
NEC PC8000	£1,454	Z80	4	32K	64K	80×25	M	●	160×100	W	10	●	2	1					2×300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
NEC PC8001	£1,375	Z80A	4	64K		80×24	M	●	100×200	W	10	●		1				●	2×144K5¼F	CP/M	Ba		N1	Price includes twin disk drive
New Brain A	£269	Z80A	4	32K	512K	80×30	Tv(M+)		640×220	C			2				1	●		Cassette	Ba		G3	A lot of promise
North Star Advantage	£2,766	Z80	4	64K		80×24	M		640×240	W	15		1				6		2×360K5¼F	CP/M		●	T9	16-bit option
North Star Horizon	£2,294	Z80	4	64K	512K		*		*	*			2	1		1	9		2×360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal
OEM Orion	£3,392	8086	8	128K	896K	80×25	TvM		800×400	W	13	●	11				6		2×500K5¼F	CP/M 86	BaCo	●	O5	*Full communications machine
Olivetti M20	£2,869	Z8000	3	160K	512K	80×25	M	●	512×256	W		●	1	1			5		2×320K5¼F	PCOS	Ba	●	B6	Real 16-bitter
Olympia Boss Model A	£2,645	Z80A	4	64K		80×28	M	●	80×28	W	10	●	1				4		2×140K5¼F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K	*			*	*			5	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	*Terminal extra; other models
Oric 1	£80	6502A	1	16K	48K	40×28	Tv(M+)	●	240×200	C				1		1		●		Cassette	Ba		O2	4-colour printer opt

Osborne 1	£1,581	Z80	4	64K		104×24	M		104×24	W	10	●	1		1				2×185K5¼F	CP/M	Ba	●	O3	Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K		80×24	M		80×24	W	21	●	3						2×250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80×24	M			W		●	1	1					2×250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K		*	*		*	*			4				8		2×1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra
Pied Piper	£1,226	Z80A	4	64K		80×24	Tv(M+)			W	36				1		1		1×780K5¼F	CP/M			S11	*PCN* issue 4
Philips P3500	£3,000	Z80A	4	64K	320K	80×25	M			W	11	●	2						2×0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard
Portico Miracle Portable	£2,064	Z80A	4	128K	256K	80×25	M		640×250	W	10	●	2	1			5		2×400K5¼F	CP/M		●	P7	*PCN* issue 28
Positron 900	£1,259	6809	1	64K	256K	*	(M+)		*	*			4		1		3			O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80×24	TvM	●	480×240	W	12	●	4		1		3			O/S 9	Ba	●	P4	Multi-user version
Powertran Cortex	£454	9995	12	64K	1Mb	40×24	Tv(M+)	●	256×192	W	12	●	1					●			BaAs		M2	Mainly sold as £340 kit
Quantum 2000	£2,587	Z80A	4	64K	192K	80×25	M		160×75	W	18	●	1	1			5	●	3×860K5¼F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	256K	80×24	(M+)			*			2				8		2×1Mb5¼F	CP/M	Ba	●	R1	*VDU extra; many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80×25	M	●		W	10	●	2			4	8		1×19Mb5¼H+1×1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80×26	M		80×26	W	21	●	1	1					1×600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40×24	Tv(M+)			W			1	1			4	●	2×144K5¼F	CP/M	Ba	●	R3	Widely used in schools
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40×24	Tv(M+)			W	4		2	1		1	2	●		Cassette	Ba		R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K	*	(M+)		*	*			2	1	1				2×640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra
Sage IV	£5,962	68000	8	128K	1Mb	*	(M+)	●		*			6	1	1				2×640K5F+1×6MbH5¼	UCSD-P System	PaBaFn	●	T10	*Terminal own choice
Samurai	£2,754	8086	4.6	128K	768K	80×25	M	●	720×400	W	12	●	3	1			3		2×1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80×25	M		80×25	W	17	●	1	1					1×320K5¼F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80×40	M		640×400	W		●	1	1					2×640K5¼F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80×24	M		80×24	W	24	●	2	1			2		2×328K5¼F	CP/M	Ba		L1	Big disk model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80×24	M		80×24	W			1	1					2×640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80×24	M		80×24	W	3	●	2				8		2×160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M			W	3	●	2				8		2×160K5¼F	OS-9		●	S3	Latest from Seed
Sharp MZ80A	£347	Z80	2	48K		40×25	M		80×50	W		●						●		Sharp Basic	Ba	●	S4	CP/M facility extra
Sharp MZ80B	£900	Z80A	4	64K		80×25	M		320×200	C	10	●						●		Sharp Basic	Ba	●	S4	Unusual keyboard
Sharp MZ700	£250	Z80A	4	64K	68K	40×25	Tv(M+)	●	80×50	W	5			1		2	1	●		Sharp	Ba	●	S4	*PCN* issue 27
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24×1	C	18	●					1	●		Sharp Basic	Ba		S4	Pocket computer
Sharp PC1500	£169	Cust.	1.3	3.5K	11.5K	26×1	LCD		156×7	C	6	●	1	1			2	●		Cassette	Ba		S4	Optional 4-pen plotter
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M		160×50	W	10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic
Signet 10025	£1,599	Z80B	6	64K		80×24	M	●	512×512	W		●	2	1			1		2×200K5¼F	CP/M, Macnos		●	S9	Choice of keyboards
Signet 2	£1,483	Z80	4	64K		80×24	(M+)	●	512×256	W	18	●	2						2×200K5¼F	CP/M			S9	Multi-user system
Sinclair ZX81	£40	Z80A		16K	16K	32×24	Tv		64×44	C							1	●		Cassette	Ba		S5	Sold a million
Sinclair Spectrum	£99	Z80A	3.5	16K	48K	32×24	Tv	●	256×192	C							1	●		Cassette	Ba	●	S5	*PCN* issue 14
Sirius I	£2,525	8088	5	128K	896K	80×25	M		800×400	W	7	●	2		1		4		2×600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£150	Z80A	4	4K	16K	40×24	Tv(M+)	●	256×196	C				1		2		●		Cassette	Ba		S6	*PCN* issue 12
Sord M23	£1,932	Z80A	4	128K		80×25	M	●		W	14	●	2	1		2	3		2×330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	●	640×200	W	14	●	2	1		2	2		2×290K3½F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80×25	M			W		●	2			4			2×350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80×25	M	●	640×400	W	15	●	4	1		4			2×1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SWTP SO9	£5,750	6809	2	256K	1.2Mb	80×24	M			W	15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex		●	S7	Top end SWTP
Spectrum	£11,442	68000	8	256K	4Mb	*	(M+)		*	*			4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M			W		●	5	1				●	1×14Mb5¼H	BOS		●	T2	Tape backup for hard disk
Superbrain JR	£2,127	Z80A	4	64K		80×24	M		560×240	W		●	2				1		2×160K5¼F	CP/M	Ba	●	I10	Bigger models available
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)		80×24				1	1			8		1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk
Tandberg EC10	£3,000	8080A	2	64K		80×25	M			W		●	7						1×250K8F	CP/M, TOS	Ba	●	T3	Very early machine
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M		80×24	W	2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T4	Big business machine
Tandy TRS-80 Model III	£1,299	Z80A	2	48K		64×16	M		128×48	W		●	1	1		1		●	2×184K5¼F	TRS-DOS	Ba	●	T4	Standard TRS 80
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M			W	2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit
Tandy TRS-80 Colour Computer	£180	6809E	1	16K	32K	32×16	Tv	●	256×192	W			1					●		Cassette	Ba	●	T4	Related to Dragon 32
Tandy TRS-80 PC4	£50	Cust.	N/A	½K	1½K	12×1	LCD		12×1	C	9	●				1	1			Cassette	Ba		T4	Low-cost pocket computer
Tandy Model 4	£861	Z80A	2	16K	128K	80×24	M		80×24	W	10		1	1				●	1×187K5¼F	TRS DOS	Ba	●	T4	Floppies versions available

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Tandy Model 100	£499	8085	2.4	8K	32K	40×8	LCD		240×62	W			1					●			Ba		T4	Software built in
Tandy TRS-80 PC2	£130	Cust.	1.3	2.6K	16K	26×1	LCD		156×7	C	6	●						●		Cassette	Ba		T4	Plotter available
Televideo TS-80ZH	£4,533	Z80	4	64K		80×24	M		80×24	W	15	●	2			1			1×256K5¼F+1×7Mb5¼H	CP/M		●	C11	Recently upgraded
Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M		80×24	W	15	●	2			1				CP/M		●	C11	Standard CP/M machine
Televideo TS 1602-C	£1,323	8088	5	128K	256K	80×24	M		576×424	W	15	●	2			1			2×256K5¼F	CP/M-86		●	C11	Graphics, but no colour
Tiger	£3,214	Z80	4	62K	256K	80×24	M	●	512×512	W	10	●	1	1	1	3	2	●	2×1Mb5¼F	CP/M-86		●	H5	*PCN* issue 36
TI Professional Computer	£2,386	8088	5	64K	256K	80×25	M			W	12	●		1					1×320K5¼F			●	T5	*PCN* issue 3
Texas CC40	£180	Cust.		6K	18K	31×1	LCD		31×1	C	4							●			Ba	●	T5	Cartridge software available
TI System 200-250	£6,695	9900	4	64K		80×24	M		80×24	W	12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T5	Bigger version available
TMK 332	£2,242	8085A	5	64K		80×24	M		190×96	W	22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	●	640×256	W	15	●	1	1		4		●	2×400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	●	640×200	W	8	●	1	1	1		2		2×256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M		80×24	W	15	●	1		1				2×256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM		640×288	W		●	2	1		1	5		2×190K5¼F	CP/M		●	T7	S-100 machine
Triton 4	£5,744	Z80A	4	64K	160K	80×24	M			W	8	●	1	1			3		2×1.2Mb8F	MPSL-BOS		●	T11	Upgradable to Winchester disk
Tulip 1	£1,150	8086	8	128K	896K	80×24	M	●	760×288	W	16	●	1	1		6	1		1×5.25K5¼F	CP/M	Ba	●	N2	IBM PC software compatible
Vector 4	£3,852	8088	5	128K	256K	80×24	M	●	640×312	W	15	●	1	1		1	2		2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wang Professional	£3,076	8086	8	128K	256K	80×25	M		800×300	W	16	●	1	1					2×360K5¼F	MSDOS,CP/M80,USCDP	Ba	●	W4	8087 co-processor optiional
Wicat 150	£6,846	68000	8	256K	1.5Mb	80×25	M		400×300	W	20			2	1		1		2×616K5F	MCS	Ba	●	S10	Upgradable to 32 user system
Wilkes YD8110	£4,025	8086	5	128K	896K	80×24	M	●	960×624	W	21	●			1		6		2×1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
Xerox 820 Model II	£2,415	Z80A	4	64K		80×24	M		1024×512	W		●	2	2			2		2×160K5¼F	CP/M		●	R4	Powerful graphics
Zenith ZF-120-22	£2,978	8088	5	128K	192K	80×25	M		640×225	W	18	●	2	1	1	1	5		2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	*PCN* issue 28
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)		80×25	W	11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

A1 Acorn Computers, Cambridge 245200 **A2** Adds (UK) Ltd, 01-949 1272 **A3** Ads Ltd, 01-947 4881 **A4** Almarc Data, Nottingham 52657 **A5** Atari International (UK), Slough 33344 **A7** ACT, 021-454 8585 **A8** Apple Computers, Hemel Hempstead 60244 **A9** Anderson Jacobson Ltd, Slough 25172
B1 Barcellos Ltd, Leicester 541574 **B2** Bonsai, 01-580 0902 **B3** Britannia Computer Ltd, Dudley 233433 **B4** British Micro, Watford 48222 **B5** Business Computers Ltd, 01-207 3344 **B6** British Olivetti, 01-785 6666 **B7** Bromley Computer Consultancy, 01-697 8933 **B8** British Telecom Merlin, 01-840 4567
C1 Computer Pheripherals Ltd, 01-278 7837 **C2** Country Computers Ltd, Redditch 29826 **C3** Computer Ancillaries, Egham 36455 **C4** Canon (UK) Ltd, 01-680 7700 **C5** Camputers Lynx, Cambridge 315063 **C6** Casio, 01-450 9131 **C7** Casu Electronics Ltd, Uxbridge 72511 **C8** Clenlo Computing Systems, 01-670 4202 **C9** Commodore Business Machines, Slough 79292 **C10** Compucorp, 01-907 0198 **C11** Colt Computer Systems, 01-577 2686 **C12** Community Computers, Petersfield 87567 **C13** Comart, Huntingdon 215005 **C14** Computers For All, Basildon 418414 **C15** CK Computer, Plymouth 780311 **C16** Country Computers, Redditch 29826 **C17** Cifer, Melksham 706361 **C18** Comart, St. Neots 215005 **C19** Ceedata, 01-941 4889 **C20** C/WP Computers, 01-828 9000
D1 Datac, 061-941 2361 **D2** Dec Ltd, Basingstoke 59200 **D3** Digico, Letchworth 78172 **D4** Digital Microsystems, Reading 343885 **D5** Direct (UK), Warrington 814072 **D6** Dragon Data Ltd, Kenfig Hill 744700 **D7** Data General, 01-572 7455 **D8** DRG, Weston-super-Mare 415398 **D9** Data Applications, Cirencester 61828 **D10** DVW Electronics, 0203-668181
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F1 Facit Addo Ltd, Medway 401721 **F2** Five Technology, Lichfield 57701 **F3** FI Cord, 061-445 7716 **F4** Flight Electronics, Southampton 27721
G1 Gemini Micros, Amersham 28321 **G2** Gecas, 01-629 3758 **G3** Grundy Business Systems, 01-943 1901 **G4** Globe Business Machines, Weston-super-Mare 83522 **G5** Gulfstream, 040 26 4926
H1 Haywood Electronic Asoc Ltd, 01-428 0111 **H2** Hewlett Packard, Bracknell 63100 **H3** Hytech Microsystems, Oxford 726644 **H4** Hotel Microsystems, 01-328 8737 **H5** HH Electronics, 0954-81140
I1 Icarus Computer Systems, 01-485 5574 **I2** Interam Computer Systems, 01-675 5325 **I3** IBR Microcomputers, Reading 664111 **I4** ICL, Slough 31111 **I5** IO Technology, 01-248 4876 **I6** Irvine Business Systems Ltd, Irvine 75000 **I7** ITT Consumer Products, Basildon 3040 **I8** Interactive Data Systems, Milton Keynes 313997 **I9** IBM UK Product Sales Ltd, 01-578 4399 **I10** Intertec Data Systems, 01-840 1599

J1 Jupiter Cantab, Cambridge 313479
K1 Keen Computers, Nottingham 412777 **K2** KGB Micros, Slough 38581 **K3** Kalamazoo Business Systems, 021-475 2191 **K4** Kemitron, Chester 21817 **K5** Kenilworth Computers, Kenilworth 512127 **K6** Kontron Computers, St Albans 66222
L1 Logitek, Standish 426644 **L2** Lowe Electronics, Matlock 4995 **L3** LSI Computers Ltd, Woking 23411 **L4** Logica VTS, 01-637 5171 **L5** Lucas Logic, Kenilworth 59412 **L6** Leicester Micro Systems, Leicester 551869
M1 Micro APL Ltd, 01-834 2687 **M2** Microprocessor Engineering, Southampton 775482 **M3** Mediatech, 01-903 4372 **M4** Microsolution, Chipping Norton 3256 **M5** Millbank Computer, 01-891 4691 **M6** Micro Networks Ltd, 01-602 7405 **M7** Mattel, 01-900 0311 **M8** Microtanic Computer Systems, 01-693 1137 **M9** Midlectron, Derby 6811
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O1 Olympia Boss Systems, 01-262 6788 **O2** Oric Products International, Ascot 27686 **O3** Osborne Computer, Milton Keynes 615274 **O4** Office International, Sunbury-on-Thames 85666 **O5** OEM, 01-407 3191
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Q1 Quantum Computer Systems, Leeds 458877
R1 Rair Ltd, 01-836 6921 **R2** Racal, Reading 782158 **R3** Research Machines Ltd, Oxford 249866 **R4** Rank Xerox, Uxbridge 51137
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W1 Westrex Ltd, 01-578 0957 **W2** Wilkes Computers, Bristol 277399 **W3** Wolfcrown, 01-930 1991 **W4** Wang UK, 01-560 4151
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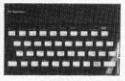

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You buy an attractive, discounted little machine so that you and the children can learn about computers.

Instead, you learn about its limitations: the dull graphics. The plugs that fall out. The cheap power supply. The unalterable "beginners" language. The stiff, fragile keys. No provision for future developments. If only you'd looked around a bit in the beginning... *"Quality costs a little more, but it's usually worth paying for"* (Personal Computer News – CGL M5 Review, June '83.)

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

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

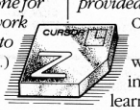
Second, to be rugged enough to last through hours and hours of operation.

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

Built to learn

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

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



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

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

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

Built to last

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

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

Built to grow

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

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

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

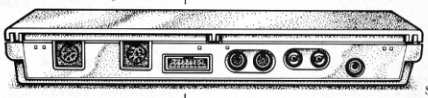
The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

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

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

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

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



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

Even the language cartridge socket has hidden potential:

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

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

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

I'd like to know more about the CGL M5. Please send me a brochure and a list of dealers. PCN 4

Name_____

Address_____

CGL M5 HOME COMPUTER

BUILT TO LEARN. BUILT TO LAST. BUILT TO GROW.

David Janda checks out a chess program and decides the White Knight has earnt his chevrons.

Going on board

White Knight MKII, by Martin Bryant, has been developed in several stages over a period of years. This is important because one major prerequisite of a good chess program is an experienced chess programmer.

Although dramatically changed since its early days, a similar version was entered at the 1982 PCW Show and won second prize for best amateur program. Since then, it has been tidied up, boxed up, and is made available for the BBC model B by BBC Soft.

Features

White Knight offers a number of facilities for playing ordinary and tournament chess, as well as for solving chess problems.

The commands allow you to set up the board for problem-solving, self play and so on. Two time clocks give the elapsed time for each player, which can be set.

White Knight gives you an idea of the mechanics of computer chess. When White Knight is thinking of its move, the lookahead depth of its search is displayed below the board. Also, to the right of the board the best line (move) is displayed and this can give you an idea of how the computer is going to play. Unfortunately, you can't turn off this part of the display.

Finally, after the computer's move, the number of positions examined is displayed. Pressing any key while the computer is thinking will abort the search and the best move so far will be played.

The game operates in one of four modes; equality, problem, tournament and average. In equality mode, the program tries to keep its elapsed-time-clock closely matched to the player's. This means that the program will play at a similar speed to the player, though unlike humans the machine doesn't get distracted.

Problem mode is used to solve chess problems. The problem is set up using the alter command and mating combinations of up to five moves can be found. Once a solution is found, you can play the move or tell the computer to go off and try to find an alternative.

Tournament mode offers the more advanced player first and second time controls, the duration of which are decided by the player. The program will not claim a win on time.

Finally, the fourth mode is the one which will be used more frequently than most. In average mode, the only limit is the time for each move with zero seconds being the fastest response time. The longer the time White Knight has, the better it plays so this effectively gives you thousands of levels of play.

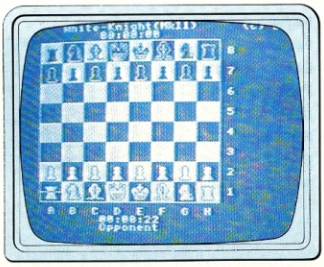
Two facilities which are missing from White Knight are the ability to save a game to disk or tape and the ability to get a hard copy printout of the game's progress. Maybe these essential features will be included in later versions.

Presentation

White Knight MKII comes in a plastic and cardboard affair with the cassette and manual.

The instructions are brief and to the point. Everything is there that should be, but a few readings are required before running the program.

First comes the BBC Soft logo, then the Basic loader and finally the object code itself. If you wish to change the foreground or background colours of the display, then you will have to LOAD the Basic loader and change some VDU 19 statements. This is messy, and it should have been taken care of by the program rather than you having to fiddle about with the code.



Pick your gambit

In play

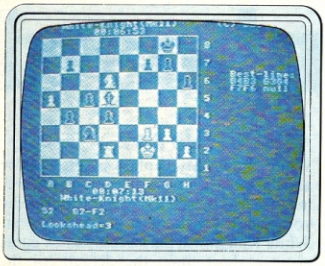
White Knight MKII plays by brute force and then follows up the high scoring moves in more detail, which is why the more time you give it, the better it plays. However, White Knight will play a reasonable game given a short time; the default for the average mode is ten seconds a move, which also gave a reasonable game. Still on average mode, specifying a longer time per move makes the game harder, and you can go as far as you wish. This is the mode for beginners who wish to 'work their way up' through the levels.

With tournament mode, the 'book' players are going to be disappointed; there are no book openings in White Knight MKII. This isn't surprising as the game was written in only 20K. And whether this affects the whole outcome of the game can be left to the purists to argue. The game was a bit weak in the opening moves, but I don't think this is due to the lack of book openings. Indeed, after the initial moves, White Knight settles down to give you a good run for your money.

If you use a chess board to design and tackle chess problems, White Knight is for

60▶

Adam Peters



White Knight vs White Knight

◀ 59

you. The speed at which it finds mating combinations is very impressive. From a collection of Meredith's chess problems, not one needed more than eight seconds before White Knight came up with one.

There were difficulties with the problem mode though. First, when seeking out a route to mate, White Knight would do its best to avoid a route which involved en-passant for either side, even though en-passant is supported. This may be related to a couple of problems which White Knight refused to answer. To one below is a good example:

Mrs T B Rowland, 1889.
WHITE Ra5,Rc2,Pe2,Sf2,Pf7,Kf8,Qg4
BLACK Pd4,Kd6,Re6,Pf4,Pf6

When set up, you can see that the key move is Pe4. After that, black can capture en-passant from the D or F ranks. Alternatively, the King can retreat, or the Rook can move about. But it doesn't seem to matter because White Knight doesn't want to know.

Verdict

White Knight MKII plays a very strong game — especially mid-game — which will suit most people's tastes.

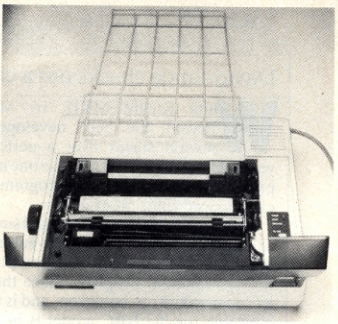
The flexibility in setting up tournament time parameters is a blessing for those wishing to play a more disciplined game, but for those who wish to play at 'levels' the average mode will suit them very well.

I hope the problem mode's difficulties are sorted out, because it is one of the game's strongest selling points. Apart from this, White Knight MKII is very highly recommended.

RATING

Features	
Documentation	
Performance	
Usability	
Reliability	
Overall value	

Name White Knight II **Application** Chess-playing program **System** BBC **Price** £11.50 **Publisher** BBC Publications, 35 Marylebone High Street, London W1M 4AA **Format** Cassette **Other Versions** None **Outlets** Mail Order/Retail.



Specifications of the new Walters WM80

Printing method: Impact dot matrix.

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

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

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

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

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

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

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

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

Paper feed: Adjustable sprocket feed and friction feed.

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

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

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

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

Weight: 5.3Kg approx.

Power requirement: 240 v ac.

Data transfer rate: 4,000 CPS max.

Synchronization: By external supplied STROBE pulses.

Handshaking: By ACKNLG or BUSY signals.

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Impressive performance

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Programmable functions

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

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

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

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

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Address

Postcode

Telephone

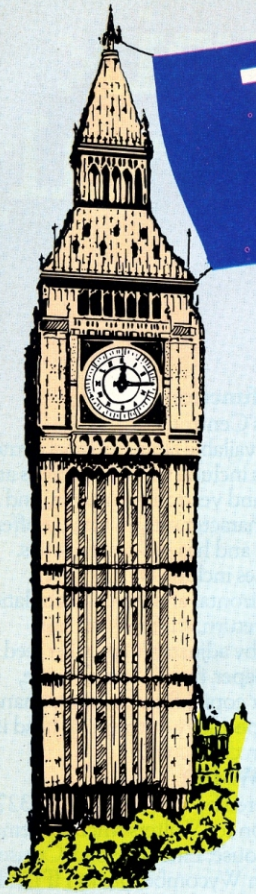
Tick box for details of optional serial interface ☐

I enclose my cheque no. for £

Please charge my Access/Amex/Barclaycard Card No.

Signature

WALTERS MICROSYSTEMS INTERNATIONAL



THE BBC MICRO USER SHOW

The show that attracted record attendances in Manchester and Nottingham now comes to the heart of London – with a fabulous pre-Christmas bonanza of all that's best for the BBC Micro. There are lots more exhibitors, who will be using the show as a launching-pad for the very latest software, plus many hardware devices that are rapidly making the BBC Micro one of the most versatile computers of them all.

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PCN

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10am - 4pm, Sunday, December 11

Westminster Exhibition Centre, Greycoat Street, London SW1.

PCN

Bryan Skinner feels Basic programmers need more programming aids — does CRF have enough?

Basic helpmate

CRF (Cross Reference Utility) is a programming aid for use with programs written in Basic on the IBM PC. It doesn't do much and is rather expensive, but it does show there are possibilities which have not yet been explored, which is surprising since there are so many Basic programmers.

Features

CRF will plough through your Basic program and make up disk files which you can view on the screen or send to a printer. The 'analytical' functions are related to references to variables in your program. One of these will compile a cross-reference list, by line number, of every variable used in the program.

It also provides a breakdown of the number of lines, number of unique variables and explicit variable definitions (such as single precision). It will also pick out miscellaneous definitions such as DEF FN (Figure 1).

The second function gives the same information in alphabetical order of variables (Figure 2). This was more useful since you can see at a glance the line numbers where a variable is used.

The third process allows you to assign comments to variables in order to make your cross reference print out more readable (Figure 3).

Presentation

CRF comes in a large binder which looks like a book. The colourful, glossy, hard cover is a bit of an oversell for the slim volume and disk inside, and while the cover would be difficult to misplace, the manual might well slip away.

In use

CRF couldn't be easier to use. The hardest part is making sense of the manual which manages to make the simplest operations sound complex. There's even a TRANSFER file which allows you to copy all two necessary files your working disk without having to use the IBM's COPY command. The nicest thing about CRF is that it's set up to use the function keys, so when you get the main menu you just hit the keys you want, then F10 to have them all executed.

I entered a very simple program to test CRF initially (Figure 4), though I needn't have bothered as a sample file is provided which lets you see how it works. Your Basic file has to have been saved in ASCII format, as in SAVE "PROG",A. If no extension is given, CRF defaults to .ASC. If you don't specify an extension for the cross-reference files, the extension CRF is provided.

There are one or two limitations that caused problems during review. The most important of these is that CRF will only tackle programs up to about 450 lines long or using a maximum of 850 variable references. These figures are not exact; they will be determined by such factors as the length of variable names etc. This won't be a problem for many users, but reflects badly on the claim that CRF 'enables a programmer to . . . achieve maximum capability from a computer system'.

Another problem was that you have to make sure there is at least a 38.5K of free space on your working disk for CRF's files.

CRF is fully error trapped. Error 25 occurs if you turn off the printer during printout, returning you to the main menu. CRF will not accept a file in non-ASCII format and will report the problem if there is a lack of space either on the disk or in the disk directory. There's simply nothing else to go wrong.

Verdict

CRF is a moderately useful piece of software. It is, however, overpriced given its limited scope. Although it's a step in the right direction in terms of Basic debugging and optimising, it would have been nice to have seen rather more facilities included.

The program used to test CRF — Fig 4

```
10 REM SIMPLE PROGRAM
20 REM CIRCLE CIRCUMFERENCE AND AREA FROM RADIUS
40 PI=22/7
50 DEF FNC(RA)=2*PI*RA
60 DEF FNA(RA)=(RA*RA)*2*PI
70 CLS
80 PRINT "ENTER RADIUS ";
90 INPUT RA$
100 RA = VAL(RA$)
110 IF RA < 0 THEN CLS:PRINT RA$;" IS INVALID, PLEASE RE-ENTER":GOTO 80
120 CLS
130 PRINT "CIRCLE OF RADIUS ";RA
140 PRINT "CIRCUMFERENCE    =";FNC(RA)
150 PRINT "AREA             =";FNA(RA);" SQUARE UNITS"
160 PRINT:PRINT:PRINT
170 PRINT"PRESS SPACE TO CONTINUE, OTHER KEY TO EXIT"
180 A$ = INKEY$:IF A$="" THEN GOTO 180
190 IF A$=CHR$(32) THEN GOTO 70
200 CLS
210 END
```

RATING

Features	
Documentation	
Performance	
Usability	
Reliability	
Overall value	

Name Cross Reference Utility (CRF)
Application Programming aid **System** IBM PC
Price £29.27 **Publisher** Sumar Corporation
Format Cassette **Outlets** Mail Order
Prentice-Hall Inc., 66 Wood Lane End, Hemel Hempstead, Herts. Spectrum Books (ISBN 0-13-194746-X).

Variables by Line Number — Fig 1

```
40      PI
50      PI RA
60      RA RA PI
90      RA$
100     RA RA$
110     RA RA$
130     RA
140     FNC() RA
150     FNA() RA
180     A$ A$
190     A$
```

Statistics on CIRCLE.ASC

```
Total Line Count          20
Lines with Variables      11
Variable References       19
Unique Variables           6

Explicit Variable Definitions:
            None

Misc. Explicit Definitions:
          50 FNC(RA)
          60 FNA(RA)

Elapsed Time:        0 Min  23 Sec
```

Variables Alphabetically — Fig 2

```
A$      180  180  190
FNA()   150
FNC()   140
PI      40   50   60
RA      50   60   60   100  110  130
        140  150
RA$     90   100  110
```

Statistics on CIRCLE.ASC

```
Total Line Count          20
Lines with Variables      11
Variable References       19
Unique Variables           6

Explicit Variable Definitions:
            None

Misc. Explicit Definitions:
          50 FNC(RA)
          60 FNA(RA)

Elapsed Time:        0 Min  15 Sec
```

Statistics on CIRCLE.ASC — Fig 3

```
Total Line Count          20
Lines with Variables      11
Variable References       19
Unique Variables           6

Explicit Variable Definitions:
            None

Misc. Explicit Definitions:
          50 FNC(RA)
          60 FNA(RA)

Elapsed Time:        0 Min  14 Sec
```

Commented Variables for CIRCLE.ASC

```
A$      Continue yes/no
FNA()   Area of circle
FNC()   Circumference of circle
PI      PI
RA      Radius (user-defined)
RA$     To trap input errors
```

ADMAN ELECTRONICS

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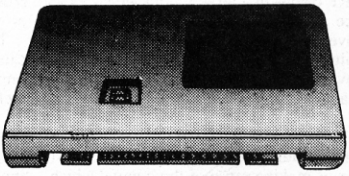

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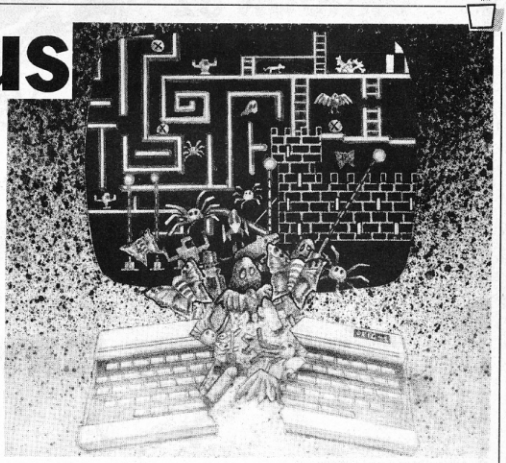
Bob Chappell casts an eye over six Oric games and decides some are more ordinary than others.

Oric omnibus



ZORGON'S REVENGE

More like several games in one, this latest from IJK has you attempting to rescue the Princess Roz from the evil clutches of Zorgon. The only way to get into Zorgon's castle is by crossing the moat, which has first to be bridged by dropping magic stones into it. Each of the four stones can only be won by completing a mission.

In Bird Mission, you must catch hold of a flying bird which will transport you to higher levels and Light Bridges where you will find a stone. Beware falling rocks! Space Mission sets you zapping alien craft — the freighter carries a stone. In Spider Mission, you must avoid quicksand, leap for a dangling rope, dodge the spider, and watch out for an unhygienic bird. Quadnog Mission has hydra-headed beasties spitting venom at you.

After each successful mission, you get the chance to drop the stone into the moat. When all four stones are in place, you can enter the castle where a further challenge awaits.

With its excellent graphics and concept, this is sure to be a big seller. Undoubtedly one of the best Oric games on the market.

DRACULA'S REVENGE

Another enemy seeking vengeance is our old fiend, Dracula.

Although you are not the Lone Ranger, you do happen to possess a gun and a plentiful supply of silver bullets. You have therefore been elected to clear the various Transylvanian castles of their unpleasant contents.

What you see on the screen is a cross-sectional view of the castle interior; ladders join the various floors. Pretty soon werewolves will scurry up the ladders to greet you on the top floor — a silver bullet is the antidote. Ghosts can only be disposed of by exposing them to daylight; a leap to a window at either end of a floor does the trick. Vampires are treated similarly but only when it is mid-day and they never venture onto your floor unless it is safe.

A pleasant enough game with good animated graphics. It lacks variety, though — all you get for surviving is more of the same only faster.

HELL'S TEMPLE

I have mixed feelings about this one. The game itself is quite good. It's a maze game in which, using single key commands, you do battle against monsters as you search for treasure.

The cassette inlay is a different matter. It says the game is a state of the art adventure — it isn't anything of the sort. It is a standard, multi-level maze game in which nearly every room looks the same (three walls and doorways). The inlay has a grisly picture on the front which smacks more of sensationalism than artistic licence, and talks of hi-res colour graphics. The only interesting graphics come in the title/instruction sequence. Don't expect to see any monsters or objects — you only get to read their names (a small-print leaflet inside the case tells you there wasn't enough room in the program to use graphics to depict any of the monsters).

Finally the inlay says, in bold black lettering, 'parental guidance recommended for children under 16 years'. I can't imagine what they mean unless it's guidance on not believing everything you read since this game wouldn't frighten a timid tortoise.

The game itself is good value for money and is an enjoyable fantasy romp. I just hope Kenema does something about that cover — it could give the game a bad name, and that would be unfair.

ULTIMA ZONE

From Tansoft comes this shoot-em-down game. Stage 1 has mandarin-faced aliens dropping bombs down on your ship, which can only move left or right along the lower portion of the screen. If hit, the aliens release a fireball that breaks open a pen, releasing demented butterflies. You have a shield which affords temporary protection from the bombs, fireballs and butterflies.

Stage 2 has you firing at a device which, when hit, moves up or down and shoots sideways at stationary aliens. In Stage 3, you must manoeuvre your craft, frogger-like, through a steady flow of assorted spacecraft in an attempt to dock with a mother ship above. Completion of this gives you the mixture as before, but with faster and more numerous aliens.

Not tremendously varied or original. Nevertheless, the attractive graphics and sound plus sensibly placed control keys make it worth considering if you're looking for this type of game.

DIGGER

If you're familiar with Apple Panic, the arcade favourite then, Digger will ring bells. You scurry about a multi-level complex, shinning up and down ladders in your endeavours to transport bags of gold to the bank. Monsters try to catch you, but you can thwart them by digging holes, luring them in, and promptly refilling the hole.

You can take a shortcut to another floor by jumping down a freshly dug hole, if you like, as you have only a limited amount of time to complete your objective. Four skill levels are available and full on-screen instructions are provided.

The animation is rather jerky and the controls could be better placed. The monsters only differ in colour. Not a bad version of the game, though there are likely to be better ones around eventually.

DIG DOG

Max the Mutt has to recover his buried bones (before the rats get them) by digging underground tunnels. Max can munch the rats if he has enough strength, otherwise they will munch him. And that's about it, really.

A graphically respectable dog doesn't make up for what is not a very interesting game. With little else in it to stimulate, it soon palls, despite Max's joyful sprint across the screen at the start of every game.

Zorgon's Revenge (£8.50), IJK Software, Unit 3C Moorfields, Moorpark Avenue, Bispham, Blackpool
Dracula's Revenge (£6.95), Softek International, 12/13 Henrietta Street, Covent Garden, London WC2
Hell's Temple (£12), Kenema Associates, 1 Marlborough Drive, Worle, Avon SB22 0DQ
Ultima Zone (£8.35), Tansoft, 3 Club Mews, Ely, Cambs CB7 4NW
Digger (£6.95), Mercury Microware, 1 Duxford Walk, Moston, Manchester 10
Dig Dog (£6.90), Taskset, 13 High Street, Bridlington, YO16 4PR

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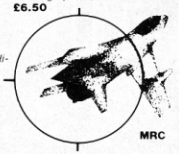

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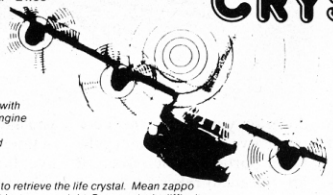

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SPECTRUM

Ghosts in 3-D

Name Haunted Hedges **System** Spectrum 16/48K **Price** £6.95 **Publisher** Micromega, 230-236 Lavender Hill, London SW11 1LE **Format** Cassette **Language** Machine code **Other versions** none **Outlets** Retail.

It did seem that every possible variation on Pac-Man short of Pac-Man on Ice had been tried, but here comes a new one — a 3D version.

Objectives

In this you're collecting gold coins which are scattered around a more limited version of the famous maze, all the while being pursued by four ghosts. You can pick up one of the ice-picks lying about and become the pursuer . . . until the ice-pick melts, that is. From time to time assorted treasures will appear, and if you can get these before they go again you earn extra points.

In play

The opening menu offers you several options: pressing I will get you the instructions; S will start the game; E will exit the game; H will hold a game, freezing the frame; pressing keys 1-5 will select the appropriate ghostly intelligence level, from moronic to Mensa; and K will enable you to choose which four keys you would like to use to control the movements.

What 3D means in effect is that instead of looking straight down onto the maze your viewpoint has been shifted slightly to one side to give the impression of depth, as if the characters were indeed running round a maze of hedges.

This 3D feeling is certainly effective, but although the graphics are impressive in this respect they're not quite matched by the movement of the man.

He does dart about quickly enough, though, and he will continue to run in a particular direction till you press another key, meaning that you can pre-program him to turn the next corner. If you're nippy enough with your three lives and can score 10,000 points you gain an extra life. There's a high-score record at the top of the screen, and each time you complete a screen you get a new one with more gold coins on it, as well as a general increase in speed, of course.

The game is definitely quick enough to be challenging, and four super-intelligent ghosts hurtling round proved too much for me. There's no sound apart from a sprinkling of plinks.

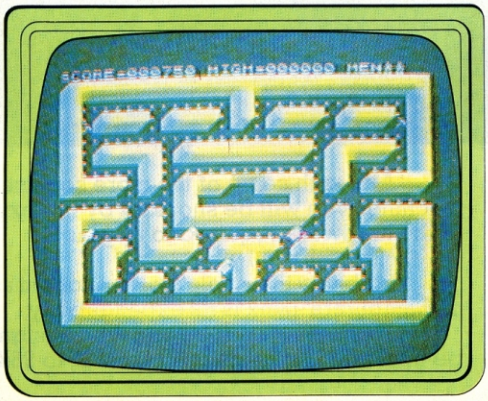
Verdict

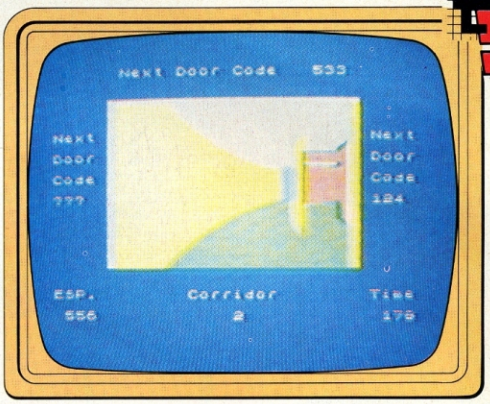
If you have a version of Pac-Man it's hardly worth getting another, but if you're hankering after one and don't insist on a carbon copy . . . well, 3D or not 3D, that is the question? My answer would be yes.

Mike Gerrard

RATING

Lasting appeal	
Playability	
Use of the machine	
Overall value	





Sci-fi maze

Name Corridors of Genon **System** 48K Spectrum **Price** £5.95 **Publisher** New Generation Software, The Brooklands, Sunnybank, Lyncombe Vale, Bath BA2 4NA, tel: (0225) 316924. **Format** Cassette **Language** Machine code **Other versions** None **Outlet** Mail order and Spectrum dealers.

Maze games, particularly the three dimensional variety, are becoming quite thick on the ground and authors are having to introduce new elements to tickle the customer's jaded palate. Here's one that has some novel features — circular corridors, sliding doors and code breaking.

Objectives

Genon is destroying the galactic system. One hope remains — to penetrate the inner sanctum of Genon's computer centre, destroy it, then get out again. A nasty creature called Bogul patrols the corridors and will try to stop you. Doors in front and to either side must be opened for access to the inner layers — they can only be unlocked by a unique code. You are in a race against time and the enemy.

In play

Supplied with the game is a neat, gold-numbered overlay which transforms the lefthand side of the Spectrum keyboard into an easily distinguishable numeric keypad.

The game starts by giving you an opportunity to practise your skills at code breaking. The screen displays a console surrounded by flashing lights. Rather like the old Mastermind game, you need to find a three-digit code — the console displays a histogram telling you if a number is correct and in the right sequence. When the histogram shows a pile of six black squares, you've cracked the code.

You then plunge into the corridors, a series of curving red and yellow tunnels. Blue squares ahead or to the side are closed doors which must be opened by typing in the appropriate code. To help you, the top of the screen shows the positions of three adjacent doors, the codes of which are displayed or left as question marks. Entering the correct code causes the door to slide up with a hiss, allowing you entrance.

The steady sound of plodding footsteps alerts you to the nearby presence of Bogul, a round bodied, long-limbed creature. Meeting it head-on is harmful to your health. If you bolt through a door with Bogul close behind, it's advisable to shut it again (with the code) to hinder the creature's progress. Meanwhile, the central computer is opening and closing doors by itself and there is always a chance that the door before you may open by itself and bring you face to face with you-know-who.

Verdict

An unusual game but the combination of maze-running and code-breaking may prove a bit too complicated for some tastes.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

After you've owned a micro for a while you begin to wish you'd invested in a bigger memory.

But when you want to upgrade you are suddenly faced with a number of problems the brochures didn't mention.

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BBC Model B

Germ of an idea

Name Microbe **System** BBC Model B **Price** £7.95 **Publisher** Virgin Games, 61/63 Portobello Rd., London, W11. **Format** Cassette **Language** Machine code, maybe a little Basic **Other versions** None **Outlet** Retailers/mail order.

Microbe is an excellent, and fast game. It is the first game from Virgin that I've been really impressed by, and I'm still spending far too much time playing it.

Objectives

You have managed to find your way inside a huge alien. You are the microbe of the title. Your aim is to destroy the alien from the inside. This is of course impossible as the defences of the alien's inner reaches and its various parasites are intent on destroying you, but I am addicted to trying . . .

In play

Playing the game depends to a certain extent on how fast you can keep pressing the spacebar. That's what you use for firing, and firing is the only way to stay alive.

The microbe appears as a large and brightly coloured hornet type figure. Not that I've ever seen a micro-organism this shape, but if it's fun — who cares? It is attacked by antibodies, red blood cells, amino acids and spores, and you control the microbe across the bottom of the screen with keyboard or joystick.

You do have the option of rising up into the middle of the screen, but it seems like suicide, since you can only fire forwards.

Although it's just another variant on the old space-invaders theme, it really did get me going. It's possibly partly to do with the speed of the game. The microbe fires as often as you press the spacebar, and there doesn't seem to be any limit to the game's speed.

One small criticism is that once you've got to about the 10,000 point mark (and that's not easy) the game just starts repeating. Even so it's never very long before you've been hit. And it certainly gets the adrenalin racing, and the wrist and fingers aching too. It strikes me that if the game was played too much then it might damage the keyboard, although I never had the opportunity to find out what it might do to a joystick.

The usual impeccable Virgin instructions, and an interesting biographical note on the programmer, accompany the program, and the usual 'Join the Virgin Games Gang' offer.

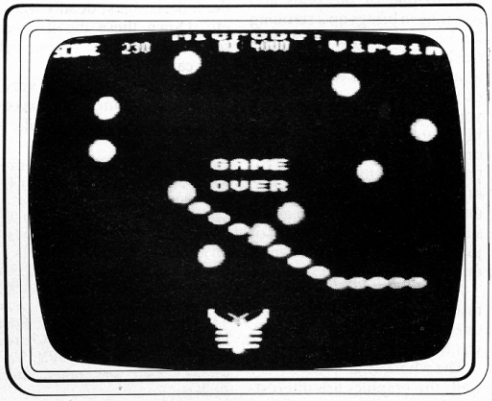
Verdict

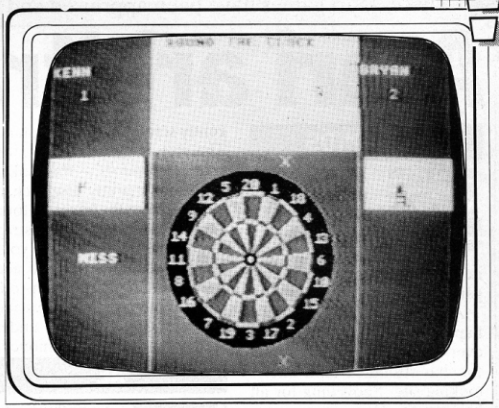
The game is wonderful. Apart from some initial loading difficulties (in the end I succeeded with the B side where I'd failed with the A), the game is a great example of what can be done on the BBC. I'm addicted.

Piers Letcher

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





Target practice

Name One Hundred & Eighty **System** BBC Model B **Price** £6.90 **Publisher** A & F Software 830 Hyde Road, Manchester, M18 7JD **Format** Cassette **Language** Basic **Other versions** None **Outlet** Mail order/retail.

This game comprises every version of 301 you'd like (even 101, 201 . . . 901), a noughts and crosses game, round the clock, and Shanghai. And the aim is, of course, to beat your opponent.

In play

It is difficult to come up with a really captivating game that emulates darts.

The feel of the dart in your hand, poised for flight, is missing for a start. It is possibly daft to try, in fact, as any attempt to recreate the atmosphere of live darts is lost the moment you touch the keyboard.

The game does call upon certain skills however. The ability to judge where you are in three dimensions is essential, and you have to guide your dart on its flight.

The screen is split into several sections. The dominant one is the darts board from a frontal view. The BBC's high resolution gives it a welcome clarity.

The next part is the throwing area seen from the side, and it's interesting to see that if you throw your dart a long way above the board it ends up in this area.

The screen also shows the two players, one sitting and the other standing. They don't seem to do anything else.

Talking of two players brings me to one of my most serious criticisms of the whole game: this is that you can't play against the computer.

If you don't happen to have a friend around, you can only use the game for target practice if you play for both people. And when each part of the game is finished you go back to the start. Not quite the start though, as it comes back asking for the second player's name only. ESCAPE will get you right back.

Other aspects are quite unusual too. The dart is lined up first of all in the horizontal plane, and then you loose it off. At that point you start controlling its up and down progress. Tricky, but more irritating than fun.

The horizontal control has a built in shake that is quite hard to master, and the skill level simply determines how bad your shake is. The glide is quite amusing in its own way.

Verdict

I'm a little bit disappointed with this game, particularly as the BBC has so much potential than is used here.

The graphics are not particularly wonderful and the resources of the machine aren't that well used.

To add to my own particular problems, I've got a disk operating system. To load the program type *TAPE, PAGE=&E00, CHAIN"", and the best of luck.

Piers Letcher

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

These Atari games have been appraised and applauded by Bob Chappell.

Atari arbitrator

DIAMONDS

English Software has brought out an excellent version of the tunnel-digging species of arcade game.

A prospector's lot is not a happy one. Digger Dan, an ever-hopeful diamond prospector, has stumbled on a likely-looking site. Shovelling for all he's worth, Dan carves out a series of underground tunnels, searching for the elusive carbon. He is not alone. A blob-like creature is after Dan. Not only that, a tidy soul called a Filler keeps running around filling in the freshly dug tunnels. Fireflies, snakes, ghosts and a demon also give Dan a hard time. The only way Dan can survive to enjoy the fruits of his labours is to undermine rocks so that they fall and impede the monsters — better still, make the cave-in squash the pursuers flat.

There are 16 levels, each of four screens. Finishing the fourth floor on level 16 reveals the Great Diamond — English Software is offering a more tangible reward (a trophy and free software) with an associated competition.

Diamonds is a compulsive game with attractive graphics and sound. A great excuse to skip digging the garden.

FIREFLEET

Another good one from English Software — which is beginning to produce games to compete with American software for the Atari. Firefleet also has you delving underground, but in a large spaceship. The ship descends through a tortuous maze of caves, bombing away for dear life. The bombs are required for two reasons. Firstly, there are enemy cannons and tanks taking potshots at you as you pass by. Secondly, you need to do a bit of gate-crashing, so to speak.

There are four sectors, of increasingly difficult. Altogether, there are an astonishing 34 different screens of gently scrolling, crisp graphics. The ship is just a fraction too wide for comfort — this makes the game a pretty tough challenge even on the lower sectors. Some of the twists and constrictions in the caves will have your jaw bouncing off the lino and your heart playing a drum-roll. All in all, a real test of nerve and co-ordination and, at under £10, very good value for money.

AE

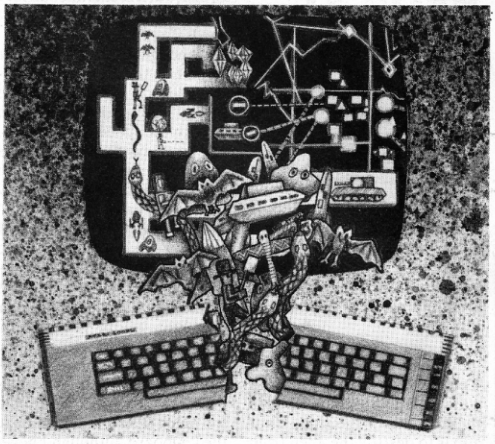
Something to do with the Japanese for Sting Ray, AE is aptly named. Although the theme is the familiar one of a space showdown, the aliens are a school of robots having every appearance of the aforesaid rays. The game has excellent 3D effects set against interesting backgrounds — the first is a futuristic city.

The robots (planetary vacuum cleaners gone homicidal) come swooping over the horizon in single file, swirling like a kite-tail. After threading their way round a couple of buildings, they are soon right overhead, dropping bombs. Because of the three dimensional effect, shooting back is not easy. You must judge the height and distance precisely.

Holding down the fire button and releasing it at the critical moment detonates an air bomb. You have to explode the missile right in the path of the leader — with luck, the leader and most of the followers will plough into it, going off like firecrackers. However, if just one of the wave escapes back over the horizon, your shooting is wasted as only complete destruction of a wave counts.

To progress to other levels, you have to knock out three waves. Higher levels have different backdrops and the AE use different flying formations, including splitting up to attack singly from every which way.

Due, I believe, to the program not being properly adapted for British TV systems, there is very little colour in the graphics. Nevertheless, the game has excellent 3D effects, good sound and a novel scenario which make it well worth having.



COMPUTER WAR

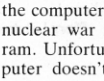
Thorn EMI's latest has a grim theme. Based on the film, War Games, Computer War puts you in charge of NORAD, the North American Air Defense System. On screen is a map of the USA and two banks of flashing lights. Approaching the nuclear bases marked on the map are several white blips — attacking missiles. Someone has broken into the computer and activated its nuclear war simulation program. Unfortunately, this computer doesn't know it's only make believe and unless you knock out the simulated attackers, it will start a global thermo-nuclear war.

Moving a sight across the map to one of the blips and zooming in brings up a scrolling landscape through which you track and shoot down the attacking missile. When a wave of missiles has been stopped, you must attempt a code breaking exercise (pattern matching on the banks of lights). This part is pretty feeble since you don't need to work it out: there are only 12 possibilities, and a simple sequential movement of joystick and fire button solves it quickly every time.

Any missile getting through to a US base brings war closer; if one reaches NORAD itself, war begins.

The whole affair is done very well; the graphics are interesting and it makes effective use of sound. I might have enjoyed it more were it not for the awful reality of the theme — nuclear war. It's not easy to forget this when the program hands out such messages as 'Global nuclear war initiated' as I felt this was one of those subjects too sensitive to be placed in an entertainment context. The program does have a moral, though. As it says, 'The only winning move is not to play'.

CAVERNS OF KHAFKA



A great title for a game and a pretty good game, at that. A vast complex of claustrophobic chambers is filled with all sorts of hazards and obstacles: acid pits, crushers, moving floors, boulders, darts, bats, deadly walls, etc. Down these mean caves someone must go — you, but very carefully.

Excellent graphics and very, very challenging — makes Kafha's nightmares look like a Disney feature.

Diamonds, Firefleet (disk and cassette £9.95) English Software, Box 43, Manchester M60 1BW
Computer War (cartridge £29.95) Thorn EMI Video, Upper St Martin's Lane, London WC2N 9ED
AE (disk £24.95) Broderbund, USA
Caverns of Khafka (cassette £14.95) Cosmi, USA.
The programs are available from Home Computers, 234 Church Street, Blackpool FY1 3PX. Tel: (0253) 22340 and other Atari dealers.

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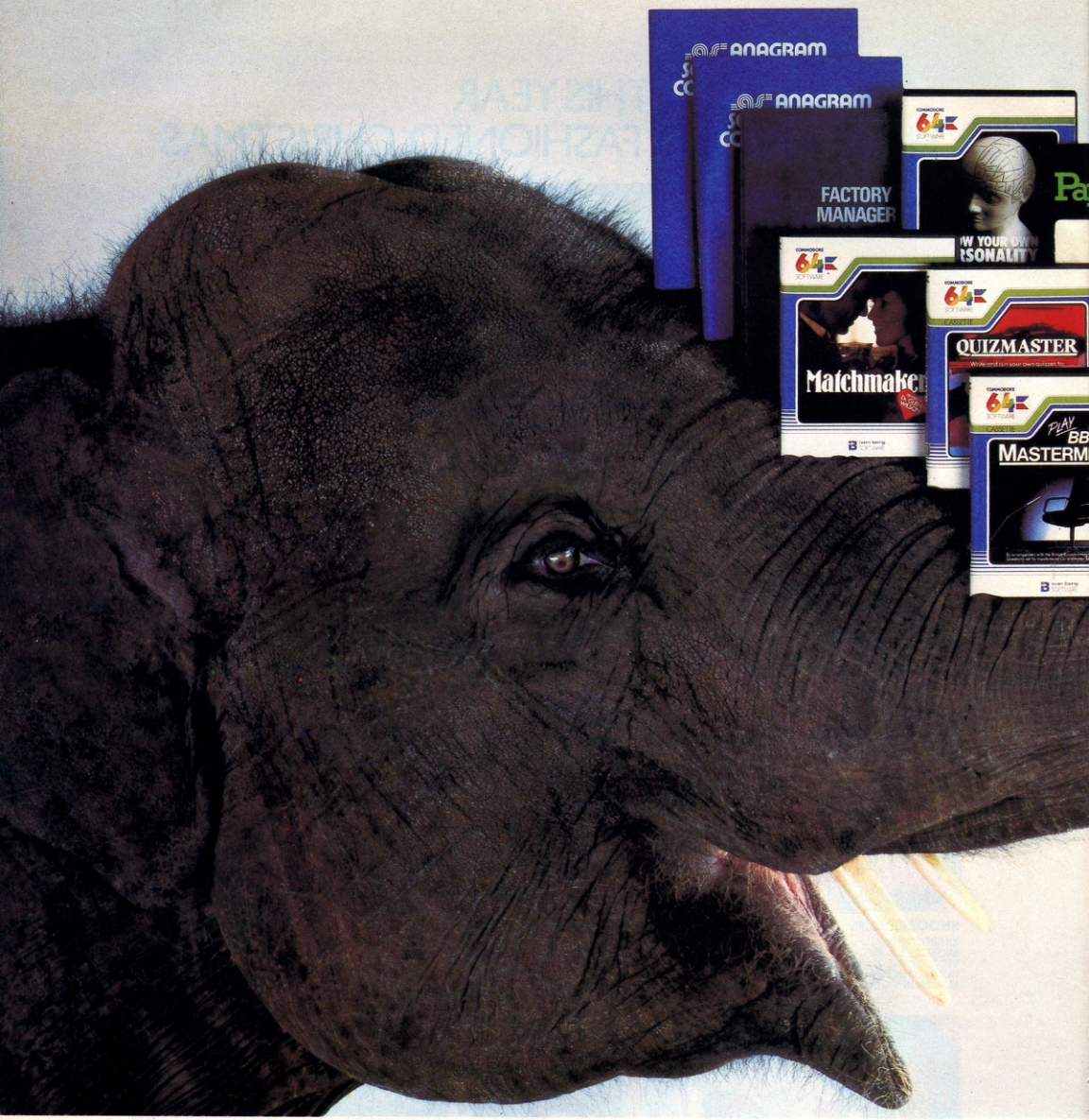

The problem with buying a home computer, as you may already have discovered, is there's often very little software to go with it. Or all that is available is games, games and more games.

There's no such problem, however, with the Commodore 64. It has a more extensive range of serious software than any other home computer.

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When all's said and done, however, we do have to admit that in one respect the Commodore 64 isn't up with the competition. It costs around £229, much less than any comparable machine.

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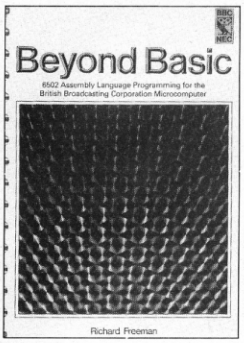


'Beyond Basic' by Richard Freeman, published by BBC Publications and National Extension College at £7.25 (paperback, spiral bound, 256 pages).

The daunting complexities of an assembler routine to someone used to a tolerant language like Basic can be very off-putting. One approach to teaching machine code is to combine a self assessment textbook with programs ready to load into the computer. This is what Richard Freeman has done for the BBC micro in 'Beyond Basic'.

It starts with an outline of aims, a brief description of assembly language and reasons for its use. A series of self assessment questions and assignments are intended to test the knowledge acquired from each part of the text. The questions all have solutions at the end of each chapter, and in themselves provide a good deal of useful information. Green text highlights new or important information.

The early units are fairly predictable. It is difficult to devise new ways of explaining binary and hexadecimal or the structure of registers and memory locations. The assembler statements LDA and STA are the first to be introduced and the author takes this opportunity to explain the procedures necessary to include an assembler routine within a Basic program.

The uses of labels and single-byte addition and subtraction are covered in Unit 2 and with Unit 3 describes the processor status register with its various flags, and outlines conditional and unconditional branches, subroutines and the use of the X and Y.

Unit 4 gets into the nitty-gritty of addressing modes, each of which is covered with examples of applications. This is true throughout the book; the reader is left feeling that the exercises do have practical application.

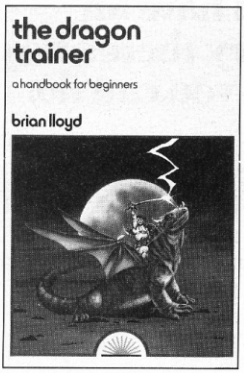
Multiplication and division are dealt with in Unit 5 and a discussion of lists and tables is well set out in Unit 6. The author begins here to use 400 built-in operating system routines offered by the BBC micro. Unit 7 describes use of the stack, one of the best explanations in the book, and masking, a complicated subject not completely demystified here.

Unit 8 is devoted to operating system calls, which is an area other assembler texts have fallen down on in the past.

Unit 9 covers 16 bit multiplication and division and sorting of strings, again illustrated by practical programs. Unit 10 rounds off the course with sections on common errors and programming style and appendices cover the BBC micro/ASCII character set and the 6502 instruction set.

The cassette to go with 'Beyond Basic' includes all example programs listed in the book. However, none of the programs are particularly long and none should be beyond even the one-fingered typist.

I rate the book very highly. It is exhaustive, not exhausting, and covers most of the subject exactly and clearly. **SW**

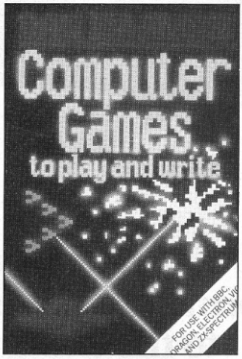


'The Dragon Trainer — A Handbook for Beginners' by Brian Lloyd, published by Sunshine at £5.95 (paperback 181 pages).

This is obviously written for first time micro owners which provides an immediate limitation to the book. This person could become a proficient Dragon user with its aid, without even needing recourse to the manual, but the problem is that few such people exist. Hardly anyone is methodical enough to pick a book off the shelf at the same time as buying a computer. Most of us are more likely to get it home, fiddle around with the leads and sockets until it works, and then start playing. By which time Chapter 1 (possibly more) is redundant.

The introduction itself limits the apparent scope of the book, by saying that it should be read from cover to cover, since this no longer allows the reader the freedom to use the book as a reference guide, for fear of missing something vital.

The book's other major problem is that it doesn't really cover much more than there is in the User Manual, though it is much clearer to read. Also the author has added a 40-page appendix of six programs, but most of these are not particularly inspiring. **PL**



'Computer Games to Play and Write' by Dan Isaaman, published by Sparrow Books at £1.50 (paperback, 126 pages).

For just £1.50, this book offers clear and concise help for programmers of the Spectrum, BBC, Dragon, Electron and Vic. Dan Isaaman does this by having most of each program the same for all machines, and then an additional few lines that are machine specific. Though this limits the scope of the games, it doesn't matter too much.

Far more important than their scope is how these games stimulate your creativity and encourage you to write your own computer games. There is even a game at the end of the book that takes you from a game's concept through to the finished work, explaining in detail what decisions are made and how they are implemented.

The book includes a chapter on Basic and its commands, though I think you would need a pretty good knowledge of Basic to find this useful. From 'Basic . . . isn't like English' to 'using the POKE instruction you can . . .' in just five pages is a little brief.

As a guide to how to write your own programs this is a good buy. Particularly useful are the author's program notes which enable you not only to understand his approach to each game, but also to learn how to change it yourself and gain experience through experimentation. **PL**

'Games, Graphics and Sounds by Susan Curran and Ray Curnow, published by Windward at £5.95 (paperback, 144 pages).

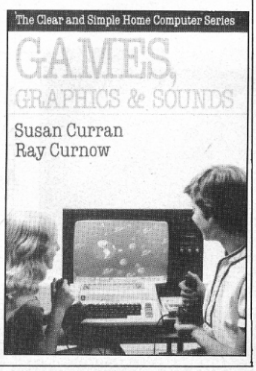
If you're interested in where games began, and what they'll be like in the future, you might find this book useful.

I've only seen one other book by these authors (First steps in Basic), and that also was lucid, and presented in such a way as to make the information it contained as accessible as possible.

It is a lucid and well-presented technical guide to computer games, graphics, sounds hardware and how to write games programs, all with excellent diagrams and summaries.

Half the book consists of programs, which, though not remarkable, give an understanding of how they work.

The programs are in Microsoft Basic and are, therefore, suitable for most machines. **PL**



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This week marks the end of ProgramCards (pause for silence, grief etc). However, all is not lost. Next week we will be changing the layout and your programs will be listed in a new format. The new style will allow us to pack in more programs, illustrations, photographs of the programs in action, and include more details on how to convert the programs listed, from one machine to another.

The privilege of being the last new program to be featured in ProgramCards goes to Mark Leaver, of Halifax in West Yorkshire. His utility for the Sinclair Spectrum is a machine code routine for clearing the lower third of the screen. This allows users to write programs to draw graphics pictures, and then use the lower part of the screen for text, as in the example.

The machine code routine (printed here) could be altered and then used to clear other sections of the screen, or fill sections with characters. Try experimenting with different techniques.

```
        5B04    21 00 50  LD HL,£5000H
        5B07    01 00 08  LD BC,£0800H
L:      5B0A    3E 00     LD A,£0
        5B0C    77        LD(HL),A
        5B0D    23        INC HL
        5B0E    0B        DEC BC
        tB0F    78        LD A,B
        5B10    B1        OR C
        5B11    20 7F     JR NZ F7
        5B13    C9        RET
```

The position in the display file of the beginning of the section to be blanked is placed in the HL registers at the beginning of the routine, and the number of places in the section is placed in the BC register pair. The character to be placed in the file is then put into the accumulator and the program is repeated from the L label (where the accumulator is loaded with zero) until BC reaches zero. Detecting when BC is zero, since no flags are set on the 16-bit register decrements, is done by taking the contents of B and ORing them with C. If both are zero, *ie* BC is zero, then the result of the OR will be zero.

Note that lines 5 to 30 and lines 9130 to 9100 are unnecessary to the routine itself: they are just there to give a demonstration of where the screen is cleared.

Even though we're changing the format, we will still require programs to put into our pages. In fact, we need even more, so if you have anything that you've written and is, in your opinion, any good at all, send it in.

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Lower CLS

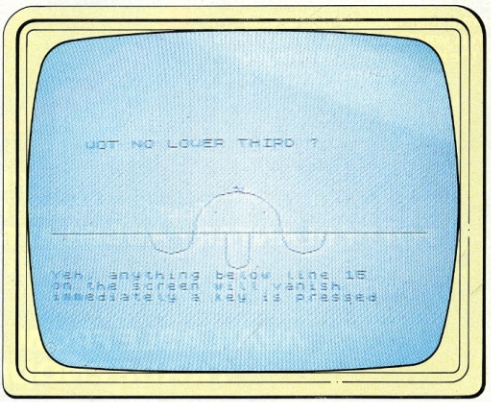
Card 1 of 1

8339LC1/1

```
   5 PAPER 7: INK 2
  10 CLS
  11 PLOT 98,50: DRAW 60,0,-PI
  12 PLOT 0,50: DRAW 255,0
  13 PLOT 66,50: DRAW 30,0,PI
  14 PLOT 158,50: DRAW 30,0,PI
  15 PLOT 128,80: DRAW 3,3,PI
  16 PLOT 128,80: DRAW -3,3,PI
  17 PLOT 128,80: DRAW 0,3
  20 PLOT 120,50: DRAW 0,-18: DR
AW 16,0,PI: DRAW 0,18
  21 PLOT 112,65: DRAW 1,0: PLOT
 145,65: DRAW 1,0
  22 PAUSE 100: INK 0
  23 PRINT AT 7,3;"WOT NO LOWER
THIRD ?"
  30 PRINT AT 19,0;"Yeh, anythin
g below line 15""""on the screen
will vanish""immediately a key
is pressed": PAUSE 0
9100 RESTORE : FOR n=23300 TO 23
315: READ a: POKE n,a: NEXT n
9110 DATA 33,0,80,1,0,8,62,0,119
,35,11,120,177,32,247,201
9120 RANDOMIZE USR 23300
9130 PLOT 110,65: DRAW 5,0,-PI:
PLOT 143,65: DRAW 5,0,-PI
9200 PRINT AT 16,0;"This is a sm
all subroutine which""is useful
 for drawings etc.""required to
 remain on screen""while a runn
ing text is executed": PAUSE 0:
RANDOMIZE USR 23300: GO TO 30
```

5	Set screen colours.
10	Clear screen.
11-23	Draw picture.
30	Print message.
9100	Reset data pointer and place code into memory.
9110	Data for machine code, note that numbers are in decimal.
9120	Call routine.
9200	Print another message, wait and then repeat program from 30.

ZX Spectrum 48K
Basic and Machine Code
Author: Mark Leaver
Application: Utility



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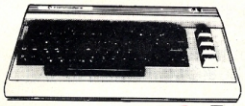

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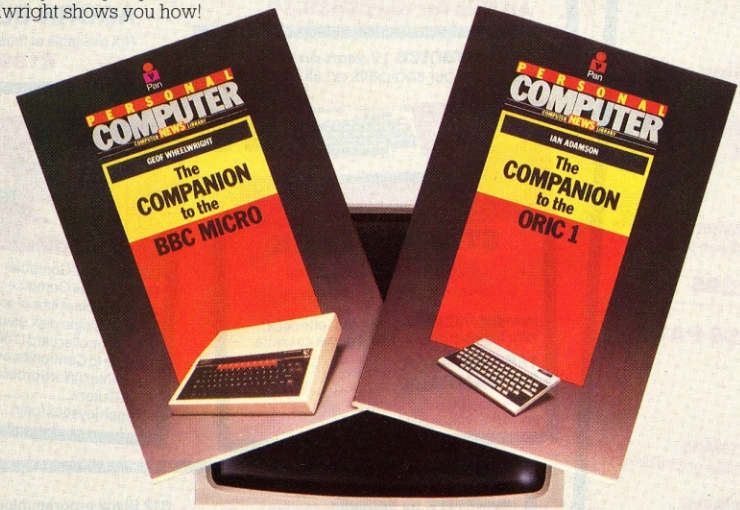

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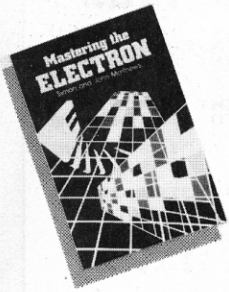

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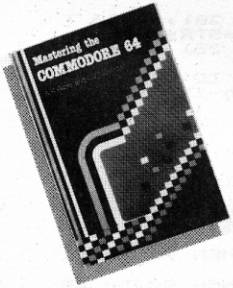

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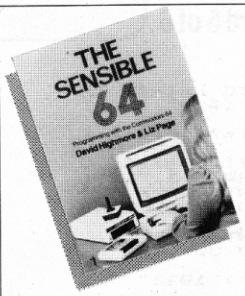

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```
4035 IF t=1 AND h$(17 TO 20)="02
04" THEN GO TO 4060
4040 IF t=2 AND h$(17 TO 20)="00
25" THEN GO TO 4060
4050 GO TO 4090
4060 IF VAL h$(33 TO 36)>=1000 T
HEN LET h$(12 TO 15)=STR$ 1000
4065 IF VAL h$(33 TO 36)<=0 THEN
 GO TO 4090
4070 LET n=VAL h$(33 TO 36): LET
 h$(33 TO 36)=STR$ (n-1000)
4090 IF t=1 THEN LET r$=h$
4095 IF t=2 THEN LET c$=h$
4099 REM [illegible]
4100 LET q=INT (RND*4)+1: LET a$
(10 TO 11)=STR$ q
4110 LET x=1: FOR f=1 TO LEN a$:
 PRINT INK 7;AT 21,0;a$(x TO f)
4120 IF f>=32 THEN LET x=x+1: PA
USE 5
4130 NEXT f
4140 IF INKEY$="y" THEN GO TO 41
60
4145 IF INKEY$="n" THEN GO TO 42
00
4150 GO TO 4140
4160 IF t=1 THEN LET h$=r$: LET
 y$=d$
4165 IF t=2 THEN LET h$=c$: LET
 y$=e$
4167 IF VAL h$(12 TO 15)<=0 THEN
 GO TO 4210
4170: FOR f=1 TO LEN y$ STEP 4:
IF h$(17 TO 20)=y$(f TO f+3) THE
N GO TO 4174:
4172 NEXT f: STOP
4174 IF LEN y$(f TO )/4-4<q THEN
 LET h$(17 TO 20)=y$(45 TO 48):
GO TO 4176
4175 LET h$(17 TO 20)=y$(q*4+f T
O q*4+f+3)
4176 PRINT AT VAL y$(f TO f+1),V
AL y$(f+2 TO f+3); PAPER 0;" ";
4177 IF t=1 THEN PRINT PAPER 0;
INK 2;AT VAL h$(17 TO 18),VAL h$
(19 TO 20);"AB"
4180 IF t=2 THEN PRINT PAPER 0;
INK 5;AT VAL h$(17 TO 18),VAL h$
(19 TO 20);"EF"
4182 IF h$(17 TO 20)<>"1324" THE
N GO TO 4190
4183 BEEP 1,30
4184 LET h$(24 TO 28)=STR$ 1000:
 LET h$(12 TO 15)=STR$ 0
4186 PRINT PAPER 0;AT 13,24;" "
: LET h$(17 TO 20)=y$(1 TO 4)
4190 IF t=1 THEN LET r$=h$
4192 IF t=2 THEN LET c$=h$
4195 GO TO 1150
4199 REM [illegible]
4200 IF t=1 THEN LET h$=r$
4205 IF t=2 THEN LET h$=c$
4210 IF VAL h$(24 TO 28)<=0 THEN
 GO TO 4270
4220: FOR f=1 TO LEN r$ STEP 4:
IF h$(29 TO 32)=r$(f TO f+3) THE
N GO TO 4230:
4225 NEXT f: STOP
```

4035-4040	Check that lorries are in factories	4090-4095	Replace updated results back into current player's string.	4170-4172	Get current position.
4060	If amount of stock held is 1000 then load lorry with 1000.	4100	Select random distance to move truck or boat.	4174-4183	Position lorry.
4065	If amount of stock is zero then continue.	4110-4150	Ask if truck is to be moved and respond.	4183	Beep when lorry is 'in port.'
4070	Subtract 1000 from current amount of stock.	4160-4165	Get current player's road data and status strings.	4184	Transfer load from lorry to ship.
		4167	Check that lorry has a load.	4190-4192	Replace status string.
				4200-4205	Get current status string.
				4210	Check that there is something in ship before it is moved.
				4220-4225	Get position of ship

PCN ProgramCards

Shipment — Card 5 of 6

8339SH5/6

```
4230 IF q>(LEN r$(f TO )/4-4) TH
EN LET h$(29 TO 32)="1913": GO T
O 4240
4235 LET h$(29 TO 32)=r$(q*4+f T
O q*4+f+3)
4240 PRINT AT VAL r$(f TO f+1),V
AL r$(f+2 TO f+3); PAPER 1;" ";
4245 IF t=1 THEN PRINT PAPER 1;
INK 2;AT VAL h$(29 TO 30),VAL h$
(31 TO 32);"CD"
4250 IF t=2 THEN PRINT PAPER 1;
INK 5;AT VAL h$(29 TO 30),VAL h$
(31 TO 32);"CD"
4255 IF h$(29 TO 32)<>"1913" THE
N GO TO 4290
4257 BEEP 1,35
4260 LET q=VAL h$(24 TO 28)*(INT
 (RND*4)+1)+VAL h$(1 TO 8): LET
h$(1 TO 8)=STR$ q: LET h$(24 TO
28)="0000"
4265 LET h$(29 TO 32)="1424": PR
INT PAPER 1;AT 19,13;" "
4290 IF t=1 THEN LET r$=h$
4295 IF t=2 THEN LET c$=h$
4300 GO TO 1150
8998 STOP
8999 REM [illegible]
9000 RESTORE 9020: FOR f=USR "a"
 TO USR "f"+7
9010 READ a: POKE f,a: NEXT f
9020 DATA 0,63,63,63,63,63,24,0
9030 DATA 0,240,240,252,252,252,
96,0
9040 DATA 0,3,3,15,15,127,63,31
9050 DATA 0,192,192,240,240,254,
254,248
9060 DATA 0,15,15,63,63,63,12,0
9070 DATA 0,252,252,252,252,252,
48,0
9080 PRINT AT 3,9; INVERSE 1;"##
*SHIPMENT***"; INVERSE 0;AT 5,6;
"©J. Donnelly  1983"
9090 PAUSE 50
9100 PRINT AT 11,4;"Do you want
the rules";AT 13,4;"and instruct
ions (y/n)."
9110 IF INKEY$="n" THEN GO TO 92
00
9115 IF INKEY$="y" THEN GO TO 91
30
9120 GO TO 9110
9130 CLS : PRINT AT 1,1;"SHIPMEN
T is a ""board"" game of  busin
ess strategy."
9135 PRINT AT 4,1;"The aim is to
 make as much  money as you
can within a  certin number
 of days."
9140 PRINT AT 8,1;"You must buy
stock, deliver it  to Ex-Port by
 truck, and from  there by ship
 to your buyer at  Im-Port."
9145 PRINT AT 13,1;"Each player
gets the chance to  buy stock an
d move either ship  or truck onc
e each day."
```

4230-4255	Move ship.	4265	Position ship back at in port.
4257	Beep when in port.	4290-4295	Replace the status strings.
4260	Update the capital with the profit made and remove the cargo from the ship.	9000-9070	Define the ships and the lorries.
		9080-9120	Ask for instructions and act upon the results.

Shipment — Card 6 of 6

8339SH6/6

```
9147 PRINT AT 18,3;"Press any ke
y to continue."
9149 PAUSE 0: CLS
9150 PRINT AT 1,1;"Each player w
ill start with      £10000 in cap
ital and £1000 of   stock. One tr
uck and one ship."
9155 PRINT AT 5,1;"You will be a
sked each day if    you want to b
uy stock. If you    do press y an
d at the prompt     input how much
 you are buying."
9160 PRINT AT 11,1;"After that y
ou will be given a  number of pl
aces to move and    asked if you
 want to move your  truck.";
9165 PRINT " If you answer yes y
our   truck will be moved otherw
ise,  if your ship is loaded it
will   be moved."
9167 PRINT AT 19,3;"Press any ke
y to continue."
9169 PAUSE 0: CLS
9170 PRINT AT 1,1;"There will al
so be NEWS for you at random poi
nts in the game.    This can be t
o your advantage    or not as the
 case may be."
9175 PRINT AT 7,1;"Each players m
oney will be        updated betwe
en turns. "
9180 PRINT AT 11,1;"In a moment
you will be asked   for how many
 ""days"" you want   to play. T
ry between 40 and 70."
9190 PAUSE 500
9200 INPUT "How many days ? ";g:
 CLS : GO TO 10
9499 REM [illegible]
9500 DATA "If your ship is at se
a half your stock is stolen.",24
,28,.5
9501 DATA "Your production is do
ubled due to oversight !!",33,36
,2
9502 DATA "Fire at the factory d
estroyed nearly all your stock."
,33,36,.25
9503 DATA "Strike at Ex-Port cos
ts you 50% of your capital in wa
rehouse costs.",1,8,.5
9504 DATA "Your buyer sayes he'l
l pay double for your next ship
ent if your ship has left Ex-Por
t.",24,28,2
9505 DATA "Your driver has half
his load stolen.",12,15,.5
9506 DATA "Your factory goes on
strike for one day costing you 2
5% of your stock.",33,36,.75
9507 DATA "The stock exchange th
inks your worth money. Your stoc
k is now worth four times as muc
h.",33,36,4
9900 SAVE "Shipment" LINE 1
```

9130-9190	Playing instructions.	9500-9507	Data for news items.
		9900	Line used to save the program to auto run it.

Monitor 64 — Card 5 of 8

8339MO5/8

```
2060 IFSS=1THEN3010
2070 CO$=RIGHT$(CO$,LEN(CO$)-F):IFLEN(CO$)<>10THEN500
2080 IFLEFT$(CO$,1)<>"."THEN500
2085 IFMID$(CO$,6,1)<>"."THEN500
2090 H$=MID$(CO$,2,4):GOSUB600:IFH=-1THEN500
2095 SA=H
2100 H$=RIGHT$(CO$,4):GOSUB600:IFH=-1THEN600
2110 EA=H
2120 IFEA<=SATHEN500
2130 PRINT:PRINT:OPEN2,1,1,NA$:PRINT#2,SA:PRINT#2,EA
2140 FORS=SATOEA:PRINT#2,PEEK(S):NEXT:CLOSE2:GOTO200
3000 REM*********************************
3001 REM       MEMORY LOAD ROUTINE
3002 REM*********************************
3003 IFCO$="L"THENNA$="":GOTO3010
3005 SS=1:GOTO2005
3010 PRINT:OPEN2,1,0,NA$
3020 INPUT#2,SA,EA
3030 FORG=SATOEA:INPUT#2,A:POKEG,A:NEXT:CLOSE2:GOTO200
```

2070	Remove the file name from the front of CO$.	2120	Check to see if the start address is less than than the end address.
2080-2085	Check to see if the first and sixth characters are full stops.	2130-2140	Save the data in memory to tape.
2090-2110	Jump to 600 to convert hexadecimal addresses back into decimal.	3000-3030	Load data from tape into memory at the same place it was saved from.

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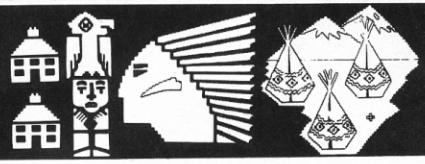

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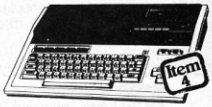

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PCN 3

Monitor 64 — Card 6 of 8

8339MO6/8

```
4000 REM*********************************
4001 REM      MEMORY MODIFY ROUTINE
4002 REM*********************************
4005 IFLEN(CO$)<>29THEN500
4010 AD$=MID$(CO$,2,4)
4020 H$=AD$:GOSUB600:IFH=-1THEN500
4030 AD=H:FORG=6TO27STEP3:IFMID$(CO$,G,1)<>" "THENER=1:G=27
4040 NEXT
4050 IFER=1THENER=0:GOTO500
4060 CO$=RIGHT$(CO$,23)
4070 FORG=1TO23STEP3:H$=MID$(CO$,G,2):GOSUB600:IFH=-1THEN500
4080 POKEAD,H:AD=AD+1:NEXT
4090 GOTO200
4500 REM*********************************
4501 REM  MACHINE CODE 'FILL' ROUTINE
4502 REM*********************************
4510 D=2:SS=0:IFLEN(CO$)<>14THEN500
4520 IFMID$(CO$,2,1)<>" "ORMID$(CO$,7,1)<>"."ORMID$(CO$,12,1)<>"."THEN500
4525 H$=MID$(CO$,3,4):GOSUB600:IFH=-1THEN500
4530 A1=H:H$=MID$(CO$,8,4):GOSUB600:IFH=-1THEN500
4540 A2=H:H$=RIGHT$(CO$,D):GOSUB600:IFH=-1THEN500
4542 IFSS=1THEN4610
4545 IFA2<A1THEN500
```

4000-4005	Check if the length of CO$=29. If no then goto 500.	4020	Convert AD$ to decimal.	4500-4540	Decodes the command.
4010	Takes four characters, starting from the second, from CO$ and store in AD$.	4030-4040	Checks to see if spaces are in the correct places.	4545	Checks to see if the second address is less than the first address.
		4050	If not then go to 500.		
		4060-4090	Pokes the data into memory.		

PCNProgramCards

Monitor 64 — Card 7 of 8

8339MO7/8

```
4550 IFA1=A2THENPOKEA1,H:GOTO200
4560 POKE252,INT(A1/256):POKE251,A1-256*PEEK(252)
4570 POKE254,INT(A2/256):POKE253,A2-256*PEEK(254)
4580 POKE2,H:SYS40710:GOTO200
4600 REM*********************************
4601 REM  MACHINE CODE 'MOVE' ROUTINE
4602 REM*********************************
4605 D=4:SS=1:IFLEN(CO$)<>16THEN500
4606 GOTO4520
4610 IFA2<=A1OR(H<=A2ANDH>=A1)THEN500
4620 POKE252,INT(A1/256):POKE251,A1-256*PEEK(252)
4630 A2=A2+1:POKE821,INT(A2/256):POKE820,A2-256*PEEK(821)
4640 POKE254,INT(H/256):POKE253,H-256*PEEK(254)
4650 SYS40740:GOTO200
5000 REM*********************************
5001 REM  RETURN VALUES IN REGISTERS
5002 REM*********************************
5010 PRINT"■■■REGISTERS:-■"
5020 PRINT"■A = ";:H=PEEK(780):GOSUB700:PRINTH$,
5030 PRINT"X = ";:H=PEEK(781):GOSUB700:PRINTH$,
5040 PRINT"Y = ";:H=PEEK(782):GOSUB700:PRINTH$
5050 GOTO200
```

4550-4580	Pokes the required data into memory for use by machine code subroutine and the calls the machine code subroutine.	4610	Checks to see that AD3 is not between AD1 and AD2, or if AD2 is less than AD1.	5020-5040	Convert decimal numbers in memory locations 780-782 into hexadecimal numbers by jumping to 700.
4600-4605	Checks the length of CO$.	4620-4650	Pokes the required data into memory for use by machine code subroutine and then calls the machine code subroutine.		
4606	Jumps to 4502 to decode the command.				

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PCN ProgramCards

Monitor 64 — Card 8 of 8

8339MO8/8

```
5100 REM*********************************
5101 REM  ALTER VALUES IN REGISTERS
5102 REM*********************************
5105 IFLEN(CO$)<>5THEN500
5110 Z=0:N$=MID$(CO$,2,1)
5120 IFN$="A"THENZ=780
5130 IFN$="X"THENZ=781
5140 IFN$="Y"THENZ=782
5150 IFZ=0THEN500
5160 H$=RIGHT$(CO$,2):GOSUB600:IFH=-1THEN500
5170 POKEZ,H:PRINT:GOTO200
6000 REM*********************************
6001 REM  DISPLAY SYNTAX FOR COMMANDS
6002 REM*********************************
6004 PRINT:PRINT:PRINT"■ D AAAA.BBBB                    - DISLAY MEM"
6005 PRINT" M AAAA.BBBB.CCCC          - MOVE MEM"
6010 PRINT" F AAAA.BBBB.CC            - FILL MEM"
6015 PRINT" G AAAA                    - RUN MEM"
6020 PRINT" S"CHR$(34)"FILE NAME"CHR$(34)".AAAA.BBBB    - SAVE MEM"
6025 PRINT" L"CHR$(34)"FILE NAME"CHR$(34)"   ■OR JUST■  L - LOAD MEM"
6030 PRINT" ;A=AA ■OR■ ;X=AA ■OR■ ;Y=AA  - ALTER REGS"
6035 PRINT" X"TAB(26)"- EXIT":PRINT" R"TAB(26)"- DISPLAY REGS"
6040 PRINT"NOTE- ALL SPACES AND FULL STOPS MUST BE INCLUDED AS ABOVE."
6050 PRINT"ALL NUMBERS MUST BE IN HEX AND OF THE   LENGTH SHOWN."
6060 PRINT:GOTO200
```

5100-5170	Decodes command and alters the required register with the new data.
6000-6060	Displays the syntax for all the commands.

PCN ProgramCards

Basic Search — Card 1 of 1

8339BS1/1

BBC A/B BBC Basic

Application: Utility Author: Steven McLean

```
10MODE 7:VDU14:@%=5:PROCin
20A%=&83:P%=(USR(&FFF4)AND&FFFF00)/&100:N%=P%:C%=0
30REPEAT
40IF ?N%=&D:IFN%?1=&FF:C%=1:GOTO 80
50IF ?N%=&D:L%=(N%?1)*256+(N%?2):N%=N%+4:B%=0
60IF?N%=Q%:PROCout
70N%=N%+1
80UNTIL C%=1
90PRINT''CHR$131;"Search Complete."''CHR$130;"Another search?";
100REPEAT A$=GET$:UNTIL INSTR("YyNn",A$)
110IF A$="Y" OR A$="y" RUN ELSE VDU 10,13,15:PAGE=P%:END
120DEFPROCin
130CLS:PRINT TAB(0,3)CHR$131"This routine will search for all"
140PRINT CHR$131;"referances to a goven string of"
150PRINT CHR$131;"characters."''CHR$131;"keywords are ignored."
160PRINTTAB(0,10)CHR$130;:INPUT"Enter string: " Q$
170S%=LEN(Q$):Q%=ASC(Q$)
180ENDPROC
190DEFPROCout
200IF LEFT$($N%,S%)=Q$:IF B%=0:PRINT'L%;:B%=1
210IF LEFT$($N%,S%)=Q$:IF B%>0:PRINT TAB(7,VPOS)"(";B%;")":B%=B%+1:N%=N%+S%-1
220ENDPROC
```

10	Set graphics and page modes, numeric field width. Input string.	50	L%=line number, set N% to first byte of line.	90-110	If another search required then RUN else line feed, page mode off, return to default page.
20	Find default page (P%), initialise byte indirector (N%=P%) and end flag (C%).	60	If this byte = first byte of string then PROCout	120-180	Input required string.
30	Main loop	70	Next byte.	190-220	If matching string is found, print line number. Further matches update the number of occurrences.
40	Check for end of program marker.	80	Until end of program found (line 60).		

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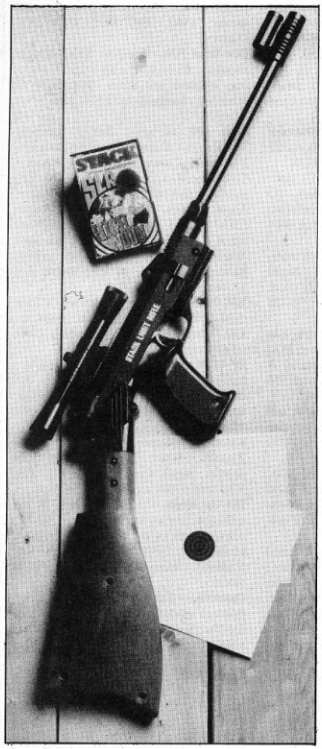

In 1881, when men were men and cowboys chewed the bullet, a silver mining town in Arizona, heart of the Wild West, was ripped by gun-blazing fueds. The Clanston gang oiled their holsters and rode into bloody battle with the Earps (of Wyatt fame). As Doc Holliday the dentist coughed and spluttered and added his ebbing strength to his friends the Earps (thereafter known as the goodies) the townsfolk cleared the streets and the coffin maker ordered more wood.

How the sad and sorry story ended is legendary. The Clanstons lost, the town rejoiced and the brothers were buried. But do you know where they were laid to rest, where they ended their last journey after the OK Corral shoot-out?

The program below will give you the answer, but first you have to put the jumbled and unnumbered lines in the right order and then, when you have the print out you must pick out the name of that famous spot by discarding all irrelevant letters we've thrown in as a smoke screen. Then find out the name of the famous mining town, write both answers on the entry form and send it to *PCN* Wild West Shoot-out, 62 Oxford Street, London W1A 2HG by the closing date of December 21.

Rules

No entries will be accepted after December 21 and the competition is not open to any person employed by VNU Business Publications or their relatives, or to any person employed by Stack Computer Services.

The Clanstons are buried at .....

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```
L=VAL(MID$(B$,(T*4)+1,3))
B$=B$+C$+D$
N=39
PRINT CHR$(L-N)
NEXT T
B$="14621103166412261591123 9"
N=VAL(MID$(A$,8,2))
A$=STR$(SQR(N))
C$="1793130715731278"
D$="1119316561201"
FOR T=0 TO 13
```

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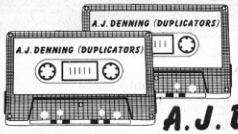

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Hairy offer

Not to be outdone by Softek's £1,000 prize (Issue 35), Twig Systems is offering £10,000 to the winner of its 'Monster Challenge'.

All you have to do is risk permanent brain damage solving six games to get to the final challenge in London, which may be televised. Dave Lee Travis, the Hairy Monster, involved in the development of the challenge, comments: 'These games will have people beating their heads on the floor with frustration.'

Rumours that the finals will be held in padded cells are completely unfounded.

Look ahead

The Acorn Electron may have made a slow start but you have to take your hat off to the speed and efficiency of user friendly company Orbit.

With Electrons apparently as rare as a win over the All Blacks, Orbit has already established the Independent National user Group for the Electron. It plans a monthly magazine and a free cassette with eight programs.

It may strike you as premature or even an act of faith to join a user group before you have the machine. But as it's Acorn, you know it makes sense.

NEXT WEEK

Peripherals *PCN's Micropaedia pull-out gives you a Buyer's Guide to add-ons.*

Hardware *The Spectrum's US cousin, the Timex/Sinclair 2068, gets a UK road test.*

Software *Pro-Tests of a music package for the BBC, a database manager for the Commodore 64, and educational software for the Spectrum.*

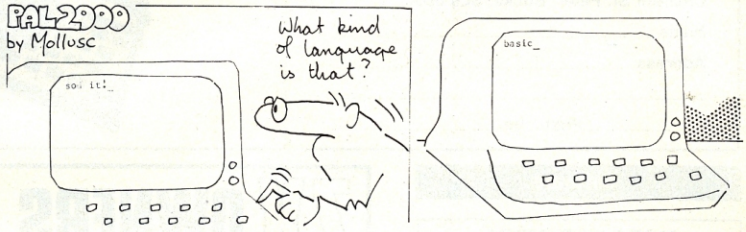
Newbrain *Part three of a series that shows you how to write-it-yourself for the micro that found a Dutch uncle.*

Gameplay *Reviews of games for the Dragon 32, Vic 20, Spectrum and Atari.*

SYNTAX ERRORS

A hash of it

If you've tried opening hashes in the first part of our Newbrain WP article, issue 38, you'll have discovered that the line of program under the heading Screens on page 31 should read: OPEN 1,01, L50.



PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
Ninth ZX Microfair	December 3-4	Alexandra Pavilion, Alexandra Palace, London N22	ZX Microfair, 01-801 9172
BBC Micro User Show	December 9-11	Westminster Exhibition Centre	Database Publications, 061-456-8383
Your Computer Christmas Fair	December 15-18	Wembley Conference Centre	Reed Exhibitions, 01-643 8040
Which Computer? Show	January 17-20	NEC, Birmingham	Clapp & Poliak Europe Ltd., 01-747 3131
Northern Home Entertainment Show	January 19-22	Excelsior Hotel, Manchester Airport	Stamley Wire Advertising Ltd., 01-253 6637
Acorn Education Exhibition	January 25-27	Central Hall, Westminster	Computer Marketplace (Exhibitions) Ltd, 01-930 1612
Communications & Computer Systems Fair — CABLES	February 2-4	Pontin's, Prestatyn, Wales	Pontin's Ltd., 07456 2267
LET '84	February 13-15	Heathrow Penta Hotel	Anthony Farrar, 0923 774262
International Home Computers, Video Games & Software Exhibition	February 13-15	Heathrow Penta	Wheatland Journals Ltd., 0923 774262
Information Technology & Office Automation Exhibition and Conference	February 21-24	Barbican Centre, London EC1	B.E.D. Exhibitions Ltd., 01-647 1001
OEM Only Conference	March 7	Hilton Hotel, London W1	Tom Lewis, 01-994 6477
Computer Trade Show	March 13-15	Wembley Conference Centre, Middlesex	Reed Exhibitions, 01-643 8040
Essex Apple Village	March 25-28	Festival Hall, Basildon, Essex	Database Publications, 061-456 8383

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Computer Indonesia	Nov 22-25	Jakarta	Overseas Exhibition Services Ltd., 01-486 1951
Computer Dealers Exhibition	November 28-Dec 2	Las Vegas, USA	Interface Group Conference & Exposition Management, 160 Speen St., Framingham, MA 01701, USA
Personal Business Computer Show	February 29-March 3	Hong Kong	Overseas Exhibition Services Ltd., 01-486 1951

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If you want to know more about the Hobbit before you make up your mind send to the address below for more details, or order the manual and see just how sophisticated the Hobbit really is.

If you have a different make of computer, but are interested in the Hobbit system, send us a stamped addressed envelope and details of your computer so that we can send you advance information of new products when they become available.

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Available from most good computer shops or direct from:- IKON COMPUTER PRODUCTS, KILN LAKE, LAUGHARNE, DYFED. Tel. 099 421 515. BBC Hobbit £135.00 + £3.00 p&p. BBC Second drive £120.00 + £3.00 p&p. Zero Memory Option £25.00 (£18.00 if ordered with the Hobbit). Power Supply £12.00. Manual (ordered separately) £1.50 (No VAT; refundable on purchase of Hobbit). Nascom Hobbit (unboxed) £120.00. Nascom second drive £94.00. Basic Upgrade Kit £10.00. Box of 6 cassettes £17.50. Cleaning cassette £3.50. Please add VAT at the current rate to the above prices. ACCESS AND VISA ACCEPTED.

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▲	2 (6)	Manic Miner	Bug Byte	Spect
▼	3 (1)	Jet Pac	Ultimate	Spectr
▶	4 (4)	Zoom	Imagine	Spectr
▲	5 (8)	Hobbit	Melbourne	Spectr
▼	6 (5)	Penetrator	Melbourne	Spectr
	7 (10)	Harrier Attack	Martech/Durell	Spectr

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