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THE COMPLETE COMPUTING WEEKLY

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NEC HEAVYWEIGHT

We size up this new made-for-business micro

GAMES GUIDE

First tests of cassettes for the Dragon, BBC, Spectrum and 64

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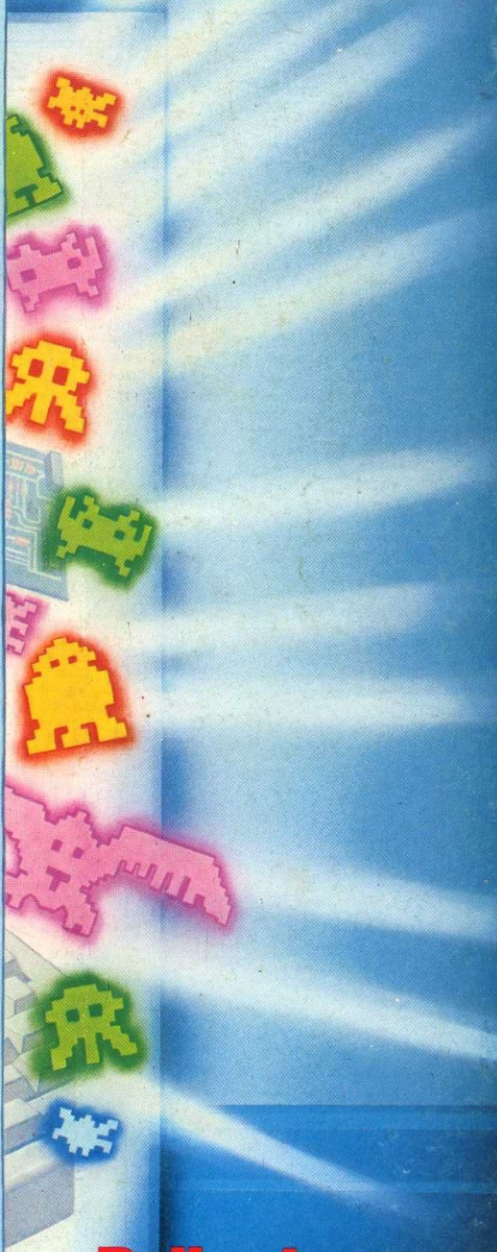
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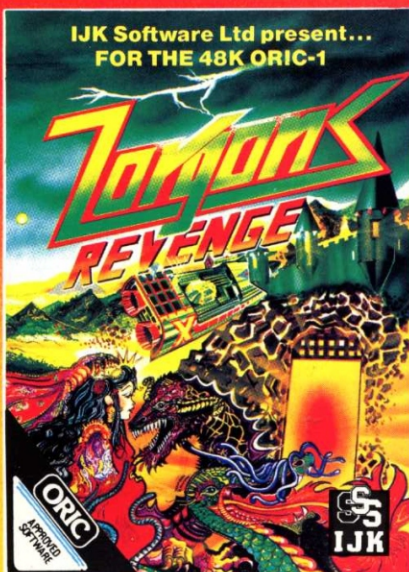
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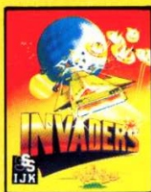
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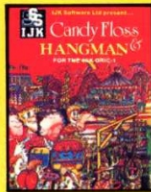
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Plus ça change . . .

From Geof Wheelwright in Paris

'Vive la différence' may have been the rallying cry of the French businessman for many a year, but when it comes to new home computers there just isn't much of a difference.

At last week's Sicob 83 (Salon International Informatique, Telematique Communication Organisation du Bureau Bureautique) show in Paris, it was obvious that manufacturers were interested in producing the same old kind of machines in both the home and business markets.

The massive CNIT exhibition centre was filled with new IBM-ables, CP/Mables and — most of all — MS-DOSables. There was also a sprinkling of new Spectrum-type computers at the low end of the home colour computer market.

Panasonic, for instance, showed two new micros — the JR-200UP and JR-800U. The Spectrum-style JR-200UP is slightly larger than the British machine it imitates and comes with 32K RAM, built-in RGB composite or UHF video output, cassette port, Centronics printer interface, five-octave music range with triad (three-note) chords allowed, eight colours and an RS232C port as an option.

There's the familiar squishy rubber keyboard with shifted keywords and block graphics characters, although it uses the unconventional MN1800A (apparently similar to the 6802) processor and includes a space bar, a traditional cross-shaped cursor control pad and an on-off switch.

The JR-800U — an LCD screen portable with Spectrum-style keys — is the upmarket version that claims rather grandly to 'create advanced personal automation in your life and business'. The LCD graphics seem to be of much higher quality than most LCD portables, with a 64 x 192 resolution. The 800U employs a 63A01V (CMOS-LSI) processor and comes with 16K, music generator (five octave), capacity for eight files in memory at once, and a built-in clock.

Panasonic would not say when



Sanyo's IBM challenger, the MBC-555. either machine would be available in the UK — although the JR800U portable was launched at the show for the French market. It will sell for FF4,500 (about £400) with an optional FF1,500 graphic printer.

No price or release date has been set for the JR-200UP, although Panasonic expects to price the machine competitively. Just how low that goes will have a lot to do with whether the machine makes it to the UK. To compete with machines like the Spectrum and Electron, Panasonic would have to sell the JR-200UP for well under £200 and perhaps as low as £150.

Sanyo's new home colour computer, the PHC-25, has also been kept out of the British market by what is seen as destructive price-warring. Its machine — a 22K Z80-based micro with a Tandy colour computer-type keyboard — sells in France for the equivalent of about £180. It offers four screen modes with a graphic resolution of up to 256x192, a Centronics printer interface, four function keys and an extension bus. It can support the now familiar Tandy-style four-pen colour printer/plotter (going under the name Sanyo SMP 30), a combined music synthesiser/joystick interface and a 40-track disk drive system.

Although it was released in Europe last spring, the small Sanyo machine won't make it to the UK until Sanyo can price it to compete.

It looks as though the French are also getting the first crack at the Commodore 64 portable. It will be released in France this month at £700 with a built-in high-resolution colour monitor and a disk drive. But



Sicob — France's premier computer show.

don't let the word 'portable' deceive you — 'carryable' might be a more accurate way to describe the machine as it doesn't have the capacity to run without mains power.

The portable machine has the same features as the standard Commodore 64, with the exception of the detachable keyboard and the built-in peripherals. French Commodore officials said they expect the machine to be available in the UK in time for Christmas.

One of the few machines it seems the UK has enjoyed for longer than France is the Oric-1. Oric launched into the French market only recently but has done very well there and is seen as major competition by established companies. This year Oric's French distributors expect to do FF90 million worth of trade in micros.

While Oric was busy trying to look like a winner (and apparently succeeding), traditional office equipment or electronics companies were falling over each other to produce three-box look-alike business machines.

Sanyo, for instance, launched a £1,400 IBM compatible that it described as its 'bombshell' to break heavily into Big Blue's seemingly unstoppable growth of IBM PC sales. The Sanyo 555 is built around the 8088 processor, comes with 128K standard dual double-sided disk drives, Centronics printer interface, 16-colour video output, the MS-DOS operating system (although CP/M86 is an

option) and Sanyo Basic.

The system claims full compatibility with the IBM and should be available in the UK shortly.

The French are getting into the 16-bit business as well with the launch of a new micro from a group ironically known as BRIT/MSI (Bureau Robotique Informatique Telematique/Mercure Systeme Informatique). The micro — Europe 2000 Serie 16 — comes with 256K RAM and runs CP/M86, Prolog and the Mercure operating system.

The price varies from about £2,900 to £4,000 depending on whether you get disk drives with the machine. For the moment, the machine comes with only a French keyboard — but if it's a success at home BRIT will probably bring the machine to Britain.

The French have also produced a tri-processor machine with videotex facilities and communications options. It bears more than a passing resemblance to the British Torch computer, except that it's modular. The monitor can slide along the 'box' containing the processors and the drives can either slide in beside it or sit detached from the machine.

The Goupil 3 runs 6809, Z80 and 8088 processors and can use the Flex9, CP/M, CP/M 86 and Unixflex (a Unix-derived system). Prices for the machine start at FF6,500 (slightly under £500) for the videotex/computer console and up to £4,500 for an 8088-based machine with dual drives.

The machine is expected to be in this country next month.

Panasonic's JR-800U: for 'life and business'.



Spectrum bytes back

By Chris Cunningham

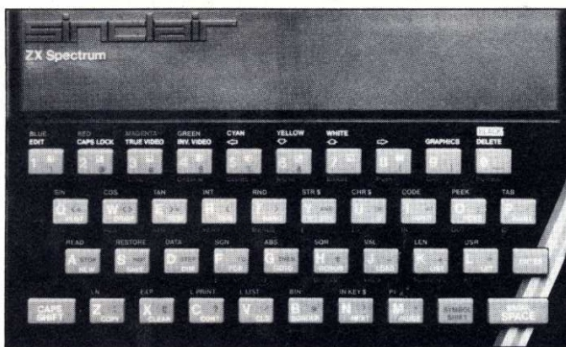
Sinclair Research has surprising news for anybody having trouble with software on an Issue 3 Spectrum — it's everybody's fault but Sinclair's.

The company has pointed the finger at 'unprofessional programming practices' in software houses to explain the failure of some software written for the Spectrum when it is run on the latest version of the machine.

According to a letter circulated among dealers by Sinclair's UK sales and marketing manager, programmers have been guilty of making 'certain assumptions about the Spectrum which are completely unsupported and undocumented by us'.

But Sinclair's explanation must provide cold comfort for Spectrum owners who have bought new Spectrums that are incompatible with items from their stock of programs — and for amateur games programmers.

PCN first revealed problems with



Spectrum — will it perform the same way two days running?

the Issue 3 Spectrum two weeks ago (issue 28). Sinclair introduced a new chip to the machine and this had the effect of changing the value of the byte describing the machine's earphone port (the entry point for cassette-loaded programs).

Software houses were not told of the change by Sinclair. When the matter came to light, Sinclair's software manager, Alison

Maguire, circulated software houses to warn of the dangers of 'assumptions' about machine code programming for the Spectrum. She points out that programmers should 'mask out' the values of the three highest bits in the byte that calls up the ear socket — that is, the values of the bits should be made irrelevant in any routine calling up the ear socket.

'Like any company, we make changes to improve the product, changes that don't conflict with the manual we produce,' Ms Maguire said. 'Some programs that made that assumption (about the values of the high bits) have probably always gone wrong.'

Meanwhile, Spectrum owners who write their own games programs in Basic and are not adept at masking out bits, could encounter problems with their Spectrums. The machine's keyboard can, for instance, be used as a source of control and fire buttons with the IN command.

The command IN 57342 should return the value of the ear port — 255 in early models of the Spectrum. If a games program defines as 255 the value returned when a certain key is pressed, that number can trigger a 'fire' routine in the program. However, if pressing the key returns the value 191, as it is likely to in the Spectrum 3, pressing the key will have no effect.

Big price reduction for the Lisa

Apple UK has followed the policy of its American parent by cutting the price of the Lisa. But unlike Apple's customers in the US, Britons will still have to buy a package of six programs.

The retail price of Lisa on both sides of the Atlantic is now 18 per cent below its level of two weeks ago. In the UK the new price is £6,500; this includes six business programs 'for the price of four'.

Within two weeks of Lisa's release in Britain, there are now about 200 machines installed —

'with large, national-account types of businesses', typically the cars and tobacco business — according to Apple.

Worldwide, Apple has sold around 2,000 Lisas, but many prospective customers are not the large, corporate concerns for which Apple design the computer. Smaller firms prefer to buy their own programs rather than rely on Apple's choice of business software, so American customers now have the option of buying the Lisa without applications software.

'That makes more sense in the US because of the much larger market for third-party software,' says Mike Spring, Apple UK's general manager. To date, there is little or no third-party software for Lisa in Britain.

Third parties come to the aid of IBM

IBM's move into the market for third-party software has proved longer established than recent announcements suggest.

According to IBM, the company has been foraging for suitable software to run on its Personal Computer since the machine arrived in the UK. Because the industry for third-party software is still relatively undeveloped, IBM appears to have given matters a gentle push by publicising its search.

To date, the computer giant's new UK subsidiary, International

Products Ltd, has garnered some of the biggest names in business software to run on the PC. The first was TK! Solver from Software Arts, authors of the legendary VisiCalc, closely followed by Micro Focus's Personal Cobol, an 'easy to program' version of Cobol, which was the first version of Cobol for microcomputers.

IBM is looking for what it defines as 'European appeal' in software that it will market through its own retail outlets and authorised PC dealers. The American company's marketing subsidiaries in Europe will have the right to fix their own deals for distributing IBM-approved software in the local language. In the US, where third-party software is a common option for business computer users, the scheme has been in operation for about a year.

Up-market TI micro for '84

Texas Instruments' latest venture in home computing is expected in the UK early next year.

Provisionally named the 99/8, the new computer will leave the long-established 99/4A standing for power and capacity. According to one source at Texas, the 99/8 will have 80K of memory, a built-in speech synthesis module and machine code access. It will also run program cartridges designed for the 99/4A. No final price for the computer is available yet.

Texas seems to have plumped for

an up-market micro after its decision earlier this year to abort further development of a relatively unsophisticated machine, the soundless 99/2.

Texas has had its fingers burnt in the home computer market by registering a huge loss on all sales for the second quarter of the financial year. A spokesman for Texas in the US told PCN that the consumer division's contribution to the loss was an overestimation of sales of the 99/4A during the summer months.

Osborne-again

Osborne may keep supplies of its portable computer going by setting up production in Britain.

The likely site for British-made Osbornes is the firm's small UK factory, where some assembly of the computer from parts already takes place. In the event that production ceases entirely in the US, Osborne UK will make alternative arrangements for the supply of components to its production centre.

But any final decision on the firm's future will have to wait another week. Osborne in the US has presented a 'go-ahead plan' to a San Francisco court. If the plan wins the court's approval, a revamped Osborne may resume production.

The plan would have stood no chance but for another decision in a Californian courtroom just two weeks ago. A group of venture

capital companies filed a fraud suit against Osborne, its auditor and banks in an attempt to stop the company drawing on \$7 million-worth of credit underwritten by the venture capitalists. The court threw out the suit when it learned that letters of credit for the \$7 million had been redeemed.

Osborne already has protection from its creditors under Chapter 11 of the American bankruptcy laws.

Mike Healy, Osborne's UK managing director, told PCN it looked 'very likely' that production would cease in the US. In any event, he said, 'it would be a very different company in the US'. With staff cut from 1,000 to around 80 in the last six months, that was inevitable.

But according to Mr Healy, 'The days of computer firms (or at least micro firms) employing 1,000 people may be over.'

VIEW FROM AMERICA



Strange days in Network Nation

From Chris Rowley

As readers of this column will have gathered, the pace in Microland USA is pretty intense this year. No dead cat will be left unturned, in fact the official Computer-Hater's Handbook is counted as a likely best-seller this fall. Despite the rumour, it's not true the author was Adam Osborne.

However, Osborne's demise, coupled with the spectacular reverses suffered by other big names this summer, has put a chill on the micro media image. But market analysis shows micros still selling strongly, although to a savvy public that is getting pretty picky.

Top 10 models account for 88 per cent of sales. Despite IBM's heavy presence, the market is still open and there are at least 150 small outfits battling away on the edges. Such a market will punish any managerial errors. Question: was A Osborne stamped off a cliff by all those IBM-compatible portables that were announced with such fanfare last Christmas? His premature announcement of the IBM-compatible Osborne 'Executive 2' is now said to have been the fatal mistake. Osborne thought the business elite he confided in would keep the secret, but these aren't those kind of times. There are no secrets (except in IBM).

The winners continue to win. Apple is said to be doing 70,000 Apple IIs a month now. IBM is moving 35,000 PCs and 10,000 XTs. Commodore 64 is going great guns. Timex Sinclair is said to have shot itself in both feet with a long lag in getting RAM modules to market for the TS 1000. Commodore offered a \$100 rebate on the 64, if you traded in any old computer. It reaped a rich harvest of \$50 TS 1000s.

Meanwhile, the odds on Coleco's magnificent, go-for-broke gamble on the Adam got a bit longer. The FCC has yet to OK the EPROM that will drive the Adam's printer, there are fears of radio interference. No FCC licence, no sale, so Adam is delayed until mid-October. Coleco's factory will be on double shifts for the rest of the year, but if Adam doesn't get into the Jungle of Eden called Christmas shopping, there'll be nothing but joy at Atari, which is winding up for a heavy fall campaign itself. But while tooth-and-claw remains the name of the game in the market place, out on the wide-ranging telenets, there is something more interesting in progress. 'Reach out and access someone' is the buzz phrase of the moment.

All over the land, computer users are plugging in modems and going out to chat on bulletin boards. At night the wires light up as 'Network Nation' comes out to play. The Compuserve net has about 70,000 subscribers now. The big competitor is The Source. Then there are smaller, more elite services like EIES, a study programme run by the New Jersey Institute of Technology in Newark, which has 1,200 members scattered about the nation.

Beyond that, there are hundreds of small user group bulletin boards. On CB Simulation, users chat via one-liners, everyone hiding behind a merry moniker of some kind. This is an élite, even elvish group and so things are rather polite for the most part. Invitations to war games are as frequent as invitations to Compuserve, which is basically a form of written, erotic recreation.

Meanwhile, Timothy Leary, sometime LSD advocate, has become a micro enthusiast behind his IBM PC. Tim's new tune is 'turn on, tune in, LINK UP'. He sees Network Nation as fertile ground for raising support for space colonies in the Legrange points of the Earth/Moon system.

If the thought of Timothy Leary running a turned-on, micro-linked space habitat boggles the mind, consider the potential of an experiment Commodore is funding in California. One Virginia Brauer, nursery supervisor of a safari park, is teaching a chimp called Isaac to spell with the aid of a Commodore 64 and some special programs.

Isaac was first taught some Ameslan signs and then when he showed interest in an Atari 800 at the safari park, Commodore grew interested and set up the experiment. If Isaac shows promise on his 64, maybe Ms Brauer will invest in the new, cut-rate Lisa and really turn him loose. Why, he might even want to plug into The Source, and join the rest of Network Nation on the anonymous wires at night.

HP in touch

Hewlett-Packard last week unveiled its new mousetrap.

In answer to machines like Apple's now-famous mouse-driven Lisa, Hewlett-Packard has incorporated an infra-red screen on its new £2,900 HP-150 micro that allows you to control programs, move text, graphics and data around the screen just by pointing at what you want.

The HP-150 software will use icons — small pictures that represent certain functions or programs — in such a way that you need only point to the program or function you want to run and it will be carried out by the machine.

The system works on the same principle as an infra-red remote control TV, where you simply 'aim' the remote control at the TV and an infra-red signal carries the commands to control volume, channel-switching and powering on and off.

On the HP-150, a number of infra-red beams move up and down across the screen, and depending on which one you interrupt, it will have a specific meaning to the program you're running.

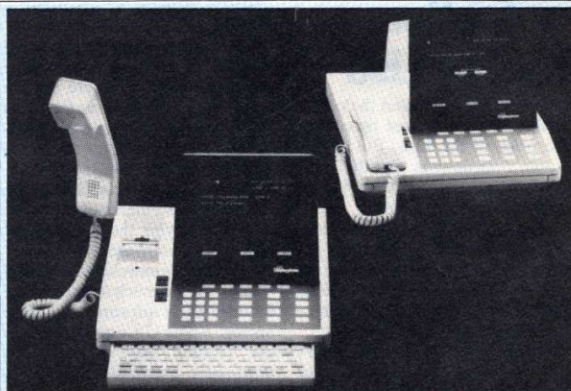
The machine uses the MSDOS 2.0 operating system and runs the Intel 8088 16-bit processor. It is also one of the first small business/home



Keeping your finger on the pulse with Hewlett-Packard's screen.

machines to use the Sony 3½in microfloppy standard. A set of Sony dual drives is included in the base price of the machine — which also features the bit-mapped Graphics Display Monitor, 256K expandable to 640K memory, built-in terminal features and built-in communications ports.

Hewlett-Packard has promised that it will have 3½in floppy disk versions of Wordstar, Visicalc, Spellstar, Mailmerge, Lotus 1-2-3, Microplan, dBase II and BPI General Ledger ready in time for the machine's January launch in this country.



TONE PHONE — The convergence of telecommunications and computer technology that everybody has been talking about for the last two years is here, and it sits on your desk in a single tasteful unit. The Displayphone from Intercompany Communications Technology (01-248 8895) gives you a keyboard, a screen, a telephone line for voice communications, another for data, protocols to interface to IBM or DEC systems, and storage for 81 phone numbers. But another well-known feature of the computer business, falling prices, may have to come into play before the phone/terminal wins mass popularity — it costs £1,868.

HMV set for software sales

The famous HMV symbol — a dog listening to a phonogram — may have to be updated. The music chain is moving into software.

As of September 26 HMV's stores on Oxford Street, London, and in Glasgow will start selling games software. They aim to have a range of 70 to 80 titles for nine systems: the Spectrum, ZX81, Vic 20, Oric, BBC, Atari 400 and 800, and Dragon.

The chain is not saying how long

it will be before you'll be able to shop for software at any HMV store — there are 37 of them around the country.

If the store doesn't have a particular game in stock it promises to order it for you — this could be good news, especially for ZX81 owners since W H Smith began to wind down its ZX81 coverage.

For further information contact HMV on 01-437 0444.

Expert way to train IBM

Artificial Intelligence on the IBM PC? 'Expert-Ease', one of the few expert systems available on a micro, was launched last week by Expert Software International.

Expert-Ease allows you to 'train' the system in a given area of knowledge. Demonstrations at the launch included medical diagnosis, farming and mechanical failure predictions.

Looking like a logical spreadsheet, the system requires an expert to set up tables of examples of up to 31 attributes which together yield a result. The system then uses these to induce a 'rule' which it can apply to data to yield a probable result.

Once an acceptable set of rules has been learned, Expert-Ease can be consulted by less expert users whose data forms the basis of a result according to the induced rules.

Interest in the product has been expressed by Ferranti, Marconi and professional individuals. Expert-Ease will retail at the rather high figure of £1,500, or £750 if you buy more than five. It was written in UCSD Pascal by Professor Donald Michie of Edinburgh University, who has long been the leading light of British artificial intelligence research.

Couple this with Keele Code's data compression utility, CLIP, and you might wonder whether cuts in education spending are having an unpredictable but welcome effect.

Contact Ian Ritchie or Roger Burrell on 031-556 3266 for further details.

Newbrain — liquidator is optimistic

The Newbrain could be about to get a new lease on life as Grundy Business Systems' liquidator studies the rescue bids.

Negotiations between the liquidator and possible buyers are known to be taking place over the rights to the Newbrain. But Timothy Harris, the liquidator, is not saying who he's talking to. Nevertheless it looks good for the system — a spokesman said last week that Mr Harris was hopeful that there would be a positive outcome to the talks.

A subsidiary of electronics giant GEC is thought to be one of the interested parties. Cash rich GEC recently came close to taking a majority stake in Torch (PCN, issue 21) but that deal fell through.

Another interested party could be a wholesale pharmaceutical supplier with a substantial investment (as a user) in Newbrain systems.

BBC up and away

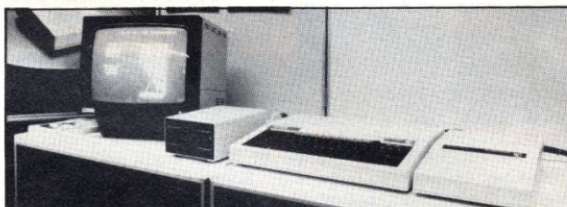
The BBC and Acorn have finally launched the telesoftware service and Teletext adaptor for the BBC micro (PCN, issue 29).

A section of Ceefax pages have been set aside for computer programs which can be received, loaded and run by BBC owners once they lay their hands on Acorn's adaptors. Much of the software will be aimed at the educational field but, says the BBC, there will also be a selection of games and home utility programs.

Unfortunately, Acorn doesn't expect the adaptors to be readily available from dealers until November (read early next year?). The adaptors aren't cheap either at £225 — this seems a lot to pay for a relatively limited service, but once you've made the initial outlay there are no further niggling charges to contend with — the software service is free.

What do you get for your money? The first thing to realise is that Ceefax is not another public access database like Micronet, it's a broadcasting service — in other words you get what you're given. What makes it different in concept from a TV channel is that you have the ability to select pages as they come flooding in over the airwaves.

Pages of data are broadcast very quickly on a spare TV channel (several a second) and picked up on the adaptor via a TV aerial. When



Software from the airwaves: the BBC service gets off the ground.

you tune in you get a title page, go to the menu and start selecting the pages or pieces of software you want to load into the computer. When software is being sent it is obviously necessary to use more than one page to contain a program of any complexity. Each page 'points' to accept the next.

All the pages are on a loop, so if you're accessing some information one page at a time, you may have to wait until the next page gets round to you again.

Although there are hundreds of pages available under the system, it can in no way compete for quantity with the capacity of Micronet or Prestel. This system is a broadcasting system in the true sense, and its value to you will depend very much on how the BBC goes about its 'programming'.

The programs will be replaced every 14 days or so on a rotating basis, so there will always be fresh material. The accent will be on

quality rather than quantity and the corporation believes the 'glamour' of the broadcasting business will attract enough talented people to provide the necessary stream of programs.

■ Patient applicants for Acorn's telesoftware adaptor should become satisfied customers by the end of this month, according to Vector Marketing, Acorn's shipping company. Some two years after the adaptor was first advertised, customers are now receiving the wherewithal to download software on to BBC microcomputers from Ceefax teletext transmissions.

In all, there are 'several thousand' orders to meet, says Vector. Of these, 'one or two' of the adaptors have left the manufacturer, AB Electronics, without the software that enables a user to download broadcast computer programs directly. But this is said not to be a significant problem in orders met so far.

SEVEN PARCHMENTS — These are the clues that will lead you to the lost treasure of the mysterious Xaro tribe should you choose to pass a rainy afternoon with Richard Shepherd Software's new game. Called *Invincible Island*, it uses split screen graphics and promises a separately drawn frame for each location. It will set you back £6.50 from the company on 06286 63531.



Government urged to act in Acorn row

An industry group is turning watchdog and sinking its teeth into Acorn.

The Computer Traders Association (CTA) wants the Government to declare Acorn's technical specifications for the BBC micro 'public domain' so that it will become a micro standard for the UK micro industry.

The CTA believes that the move would rationalise the currently fragmented industry because other companies could then base their products around BBC compatibility.

The CTA will be making a submission to the Secretary of State for Industry, says Nigel Backhurst, the CTA's general secretary.

Acorn remains unimpressed by the move. A spokesman pointed out that Acorn's licensing agreement with the BBC in no way affects its ownership of the computer's design. In return for calling the micro the BBC micro, the BBC receives a percentage for each machine sold and that is really the end of the matter.

Orient team hits Wembley

A Far East machine that has been selling in Asia, Australia and Canada is about to make it to the UK with 64K, floppies, and CP/M for £1,250.

The Tashkl 8064 is due to be launched next month. The standard unit has 64K, an eight slot expansion unit, a Z80 with a 6502 to drive graphics, up to 14K of ROM, an 80-column card, twin 163K floppies, keyboard, 12in screen, and a joystick adaptor.

The keyboard has 66 function keys with upper and lower case and numeric keypad.

It is being distributed in the UK by Tashkl Computer Systems of Wembley (01-904 4467). The company says that it is setting up distribution channels and that engineers are being trained in the Far East to take care of support once it begins to sell systems.

The spokesman said that the machine's spec should make it the kind of system to appeal to home and business users alike. With one eye on home users it is offering a starter kit which covers the basic system, graphics card, and expansion unit, and costs £477.



The Bank: 200Mb on deposit.

By Max Phillips

Corvus Systems has joined forces with its UK distributor, Keen Computers, to introduce a range of products that could take the Corvus Concept 68000-based micro from its year-old position of 'waiting in the wings' to the forefront of the business market.

Corvus is a pioneer of network technology, and now claims that its Omnet system is the de facto standard — with over half of the installed base of local area networks being either Omnet or its predecessor, Constellation. Omnet supports an ever growing list of micros — Apple II and III, IBM PC and Concept. Twenty other manufacturers have licenses, including DEC, Victor, Zenith and TI.

The most important addition to the net is 'The Bank', a new mass storage system. The Bank is a sort of giant Microdrive, providing 100 or 200Mb of storage on endless-loop removable tape cassettes. Its primary purpose is as a back-up system for Corvus hard disks.

Memory Banked

But the Bank is a random access device. So it can be used as a primary data store with access speeds similar to those of ordinary floppy disks and a capacity ten times that of most hard disks! On a 200Mb tape, the longest it can take to find a file is ten seconds, and transfer rates are as high as 60K per second.

So the Bank provides performances more in line with mainframe and mini tape drives rather than micros. And the price? £1,695 excluding VAT. The tapes themselves are not yet priced. Keen suggested somewhere between £25 and £50 for a 100Mb tape.

The system is based on a 100 track video tape technology. Currently, the Bank is supported on Omnet and by the Concept, but you can expect many more micros to be added to the list soon.

Also new for Omnet is a much overdue utility server — previous Omnets required a whole micro to be dedicated to printing. Each of these £750 servers will control two RS232 and one Centronics printers. An SNA gateway to connect Omnet into mainframe systems was also announced.

Corvus has backed off slightly from its proprietary operating system by developing a Unix box called

Uniplex. This will provide an extremely powerful processing facility on the network and allow access to the Unix software base.

Besides Unix, the second big breakthrough in Concept software is

a fully integrated mouse driven business system called Isis. This combines word processing, list management, business and creative graphics (in 3D) in one system. The Isis software will sell for £350.



COCA-KOALA — Can't put your finger on the right graphics software for an IBM PC or Apple II? If a mouse chews holes in your routines, you could try the Koala touch-sensitive graphics tablet from Pete & Pam Computers. Included with the tablet in a £114 package is the Micro Illustrator suite with a menu of drawing commands. There are versions of Koala for Atari and Commodore computers — but only by special order through the distributors on 0706 212321. You don't need eucalyptus leaves to operate the device.

ELECTRONICS

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The Vic 20 really can speak...but only if you use an ADMAN SPEECH SYNTHESISER. It's word power is endless as there is no set vocabulary. Yet operation is simple. The 64 elements of English speech are pre-programmed to let you put your own words together as soon as you switch on. Just imagine...program adventure games with characters that can actually talk!

Also for your Vic 20 there are 8K and 16K RAM PACKS and the ADMAN 3 PORT EXPANSION MOTHER BOARD. With proven designs of the highest quality they are the best value for money around.

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PCN/10/83

Programmed learning

By Bryan Skinner

Educational software received a welcome boost last week when Heinemann launched 24 programs for use in primary schools.

The programs cover the 8-12 age range, running from simple scale-reading exercises, where the pupil has to enter the correct reading shown on various types of measuring devices such as thermometer, balance etc., to map-reading skills using maps in Ordnance Survey style with text prompts such as 'In which square is the church by the river?'

The star of the series is a punctuation training package in which the child moves a figure — Punctuation Pete — round text, correcting errors of punctuation.

At the launch, children from Dudley primary schools were demonstrating the programs and the quality of the software was such that they were taking a genuine interest in this tedious but vital topic.

All the programs make full use of the graphics capabilities of the target machines, RML, BBC and Spectrum. The graphics are superb and the content of the programs seems to have been given as much, if not more, attention.

The programs will be available

from Heinemann Computers in Education and four of them will be offered for the Spectrum through retail outlets.

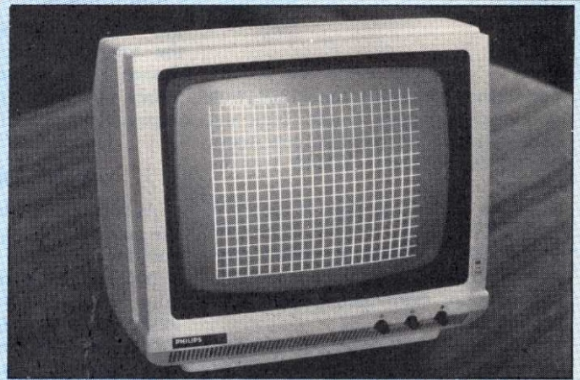
The suite is known as The Dudley Programs, after the town in which the programs were originally mooted, devised and tested. Written by Fiveways Software in close collaboration with teachers from the Dudley Primary Micro Group, the programs tackle six areas of learning: Weather, Exploration, 'Myself', Food, Homes and Travel. Each of these themes is further divided into four study areas, these being Science, Language, Maths and Environmental Science. The Spectrum programs comprise the Travel group and are written in assembler.

Each program comes with a keyboard overlay with well-designed symbols showing key functions and a workbook containing exercises based on the topic covered, as well as operating instructions which are clear and concise. The school's programs have a section in which a teacher can pre-set certain areas to be tested. This means that a given package can be tailored to some extent according to the level of achievement of individual pupils. Prices are £9.95

for Spectrum programs, £9.25 for the other machines. A Theme package of four programs will sell at £33 while the entire suite comes at a hefty £185.

At the launch in the Russell Hotel, Kenneth Baker, Minister for Information Technology, spoke of the 'world success' of the Mic-

roelectronics in Education Project (M.E.P.) and of the 'electronic generation' being taught today. While Heinemann's software represents a step forward in Computer-Aided Learning, unless more hardware is forthcoming, it's doubtful how much use can be made of such programs!



PHILIPS FILLIP — A 12in video monitor for personal computers, the TP 200, has been developed by Philips. Retailing at £75 the monitor offers an anti-glare screen giving clear definition with 80-25 character resolution. It has been designed for use with most micros, including the BBC and the Apple II. The unit has an extendable stand fitting which allows you to tilt the screen to the required angle. It is distributed by EMCO (01-737 3333) in London and Vako Displays (061-652 5111) in Oldham.

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On each of the four days of the PCW show we'll be giving a cassette recorder to whoever gets the highest score in a game written specially for the occasion. At the end of the show, the overall winner will net an Electron.

In the game you take the part of a bee. You have to move around the screen, eating flowers as you go.

The flowers grow and multiply as they

move up the screen and when one reaches the top, you've had it. Occasionally, though, they bloom giving you more points, but this feature is short-lived and impossible to predict.

Sudden death

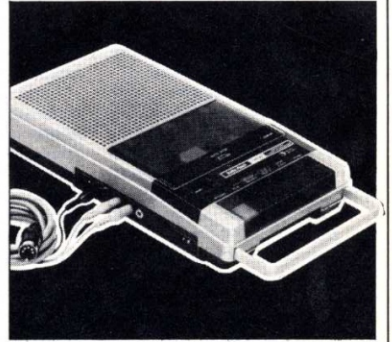
As you eat each flower, the seeds fall to the ground, starting new shoots to make your life miserable.

It's a sudden death contest that will test your nerve and your reflexes at the keyboard, because the coupon allows you only one play. That won't give you too long to get used to it, and some of the game's features will take you by surprise.

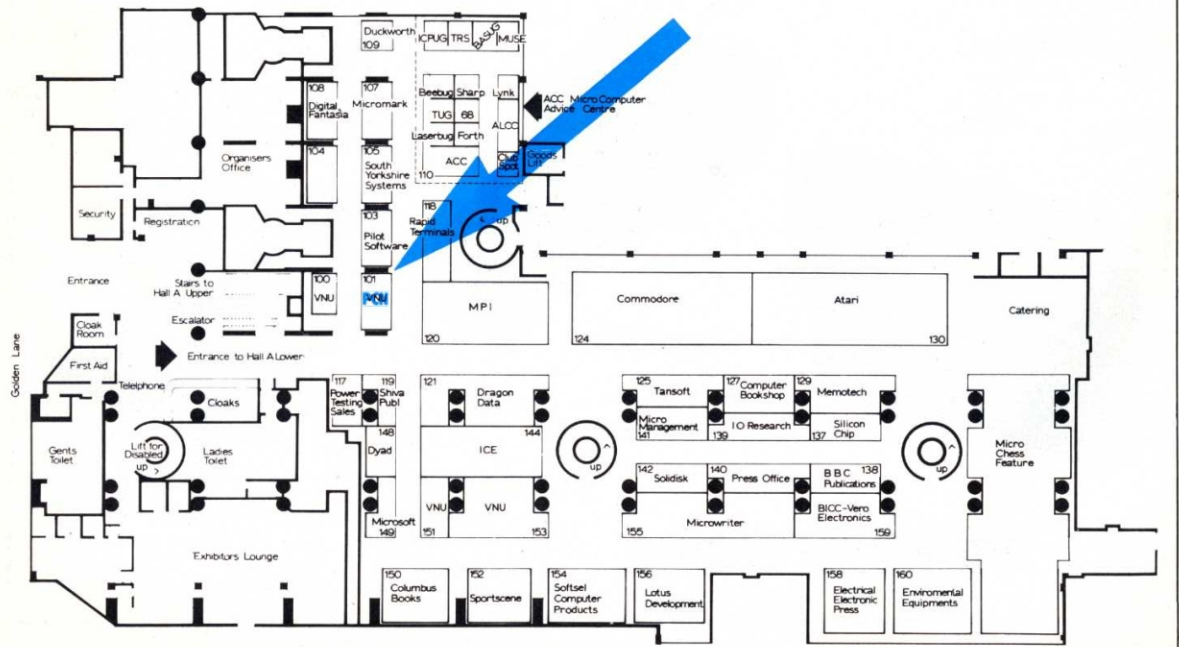
It will be running on a BBC, and the star

prize will be presented to the winner on the final day of the show.

Bring along the coupon, hand it over to the adjudicator on the *PCN* stand, and try your luck.



Even if you don't win you can always come and pass the time of day with *PCN* staff, who will be on hand to answer your queries at various times during the show. For the truly spendthrift there will be *PCN* T-shirts on sale, current issues of the magazine, and back issues for you to catch up on the important features you may have missed.



PCW Show '83

Personal Computer News will be making its first appearance at the PCW show among a number of more or less distinguished debutants. There will be systems taking their first public bow, games for most tastes, and peripherals from home and abroad.

Two of the most publicised new machines of the summer, ACT's Apricot and Elan's Enterprise 64, are due to be there, but it may also be your first chance to see recently launched systems like Acorn's Electron and the Sharp MZ700.

The Apricot has been launched with great pizzazz by ACT as a transportable business or home system running software also supplied by ACT. The Elan machine appeared more recently (*PCN, issue 29*) and has a handsome spec, but you won't be able to buy it until April.

One new business system on display will be Micronix' 68000-based micro running CP/MK68K, UCSD p-System, and Unix. It has 512K of main memory, and Micronix will also be unveiling a high-resolution (1024 by 768 pixels) graphics board that is also driven by the 68000 with a 7220 graphics processor.

NEC will show its Advanced Personal Computer and the

PC-8000, which could cause confusion since its Japanese neighbour Sharp hopes to bring the PC5000 as well as the MZ700. The PC5000 is a Gavi-lan-shaped portable which features bubble memory.

More for the hobbyist, Stirling Microsystems will be revealing the Dennis d-i-y machine, which has so far been shrouded in secrecy and could well be a fire-engine kit. Those in the know hint that it is based around a 6809.

It may be worth visiting Longs at stand 354. Not only does this company sell furniture — a valuable attraction at any trade show as long as they don't mind you sitting on it — but it will also be showing the NDK Printstar, a printer that is mak-

ing its first appearance in the UK.

Mattel's display is expected to be dominated by the Aquarius, but the US toymaker will also have attachments for the Intellivision system. These will be keyboards, one to turn the Intellivision into a usable computer system and one to turn it into a music centre of sorts.

On the software front there will be a wide range of new material plus some interesting existing suites. From the sublime — Eureka's Novag chess system — to the ridiculous — Microdeal's Cuthbert in the Jungle, with an exotically-attired female and a 16ft python, there should be something to appeal to every taste.

Bumper to bumper

Many public-spirited journalists have written worthy and well-intentioned articles about how to get the most out of fairs.

At the day's end you'll have a collection of plastic bags, a dozen balloons, sore feet and a headache. It may be that there is no way to avoid this fate; but there are precautions that you might take.

The first could be to visit the Amateur Computer Club's stand, numbers 110, 112, and 116. The ACC has been asked to co-ordinate the clubs and user groups at the PCW show; if you start there you can at least be sure of being among friends.

The second most important stand to visit is PCN's, number 101, and after that you're on your own. In alphabetical order, this is what you might find:

Abasco (F204) will be demonstrating software for the Spectrum, games for the Vic20, and small business suites for the Commodore 64. **Adman Electronics** (408) highlight will be an 'infinitely' programmable speech synthesiser. **Aniorg Software** (259) specialises in games. **Artic** (267) presents the adventures of Arthur.

Atari (130) has a clutch of new products including the 600XL, the 800XL, three new printers, a disk drive, a joystick and a recorder. **Audiogenic** (273) will exhibit games and business programs for Commodore systems.

Basicare Microsystem (271) will be encouraging you to add memory to your Spectrum, or to control your environment with the machine. **BBC Publications** (138) will have a range of software packs. **BiBi Magnetics** has a range of accessories and duplicating services.

Biodata will be demonstrating Microlink, an interface to link laboratory equipment to Commodore, Hewlett-Packard, and Sirius equipment (361).

Of the **Computers** stand (212) the 128K Lynx is expected to be the centre of attention. **CDS** (F201) has a range of machine code games for the Spectrum. **Centresoft** (229) distributes US software in this country. **Commodore** (124) will be showing the portable 64 again. **Compssoft** will be specialising in database programs.

Comshare (381), on the other hand, writes business applica-

tions; **Crystal Computing** (A2) says simply that it is very proud of its programs for the Spectrum.

Currah will be demonstrating speech synthesis on Sinclair kit. **Dacom** (408) will be launching a 300 bps £80 full duplex modem. **Data Management Systems** (426) is showing business software for the IBM PC and Sirius.

Digital Equipment (DEC) has the Professional and the Rainbow 100 to show off. **Digital Fantasia** writes mysterious games. **Dragon** will be keen to demonstrate its return to health and its disk drives.

For the connoisseur, **Electronequip** has Atom products. **Environmental Equipment** is a distributor for Watford Electronics, the BBC add-on producer.

Future Computers will focus on the FX30 with integral hard disk (424). Stand 366 was due to have been occupied by **Grundy Business Systems**. **IBM UK** will be somewhere about with its PC and XT. **ICL** (362) won't be far away with its own Personal Computer.

Ikon (283) will demonstrate its Hobbit storage system. **Im-**

agine (F202/3) will fill two stands with its games. **Kansas City Systems** (225) will have packages for the Colour Genie and the Tandy line.

KGB Micros (344) features Wang and IBM PCs. **Kuma** (218) will show its range of software for the Sharp systems.

Marketing Micro Software is concentrating on Practicalc and other Practi- packages (149). **Memotech** (129) is due to show the 64K version of its MTX500 micro. **Micronet 800** (439) will argue for modems against teletext adaptors.

The cut-price **Microwriter** will be at 155, **Oric** at 202, and the notable duo **Pete and Pam** at 345/7. **Pilot Software City** will demonstrate software for a variety of systems.

You can sample **Quicksilva's** particular brand of fantasy at 234 and **Salamandar's** at 254. More down to earth is **Silicon Chip** (144), with business packages in Microsoft Basic. **Sinclair** (217 and others) will show applications and peripherals.

Tandy (363) will launch the MC10, its junior colour computer, and the Model 100 lap computer. **Texas** will show the 99/4A and the CC40.

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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 September 15 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 two-week period ending two weeks before publication date, so they tell the story in the high street between September 1 and September 15.

GAMES

Top Thirty

	GAME TITLE	PUBLISHER	MACHINE	PRICE
▲ 1 (4)	Horace and the Spiders	Psion	Spectrum	£5.95
▲ 2 (10)	Penetrator	Melbourne	Spectrum	£6.95
▼ 3 (1)	Manic Miner	Bug Byte	Spectrum	£6.00
▼ 4 (2)	Jet-Pack	Ultimate	Spectrum	£5.50
▲ 5 (6)	3D Tanx	DK Tronics	Spectrum	£5.50
▼ 6 (3)	Flight	Psion	Spectrum	£5.95
▶ 7 (7)	Arcadia	Imagine	Vic 20	£5.50
▲ 8 (10)	The King	Microdeal	Dragon	£8.00
▲ 9 (11)	Gridrunner	Llamasoft	Vic 20	£8.50
▲ 10 (14)	Kong	Ocean	Spectrum	£5.90
▲ 11 (17)	Heathrow ATC	Hewson	Spectrum	£5.50
▲ 12 (19)	Football Manager	Addictive	Spectrum	£5.95
▶ 13 (13)	Mad Martha	Mikrogen	Spectrum	£6.00
▲ 14 (20)	Time Gate	Quicksilva	Spectrum	£6.95
▲ 15 (—)	Spawn of Evil	DK Tronics	Spectrum	£5.50
▲ 16 (—)	Wacky Waiters	Bug Byte	Spectrum	£6.00
▲ 17 (26)	Harrier Attack	Martech	Oric	£5.95
▼ 18 (5)	AH Diddums	Imagine	Spectrum	£5.50
▲ 19 (30)	Nightflight	Hewson	Spectrum	£5.50
▲ 20 (27)	Battle of Britain	Microsimulations	Spectrum	£5.50
▲ 21 (29)	Zoom	Imagine	Spectrum	£5.50
▲ 22 (28)	Matrix	Llamasoft	Vic 20	£8.50
▲ 23 (—)	Pool	CDS	Spectrum	£5.50
▲ 24 (—)	Dictator	DK Tronics	Spectrum	£5.50
▼ 25 (23)	Monsters in Hell	Softek	Spectrum	£6.95
▲ 26 (—)	Zip Zap	Imagine	Spectrum	£5.50
▼ 27 (12)	Jumpin Jack	Imagine	Spectrum	£5.90
▼ 28 (15)	Terror Daktil 4D	Melbourne	Spectrum	£5.95
▲ 29 (—)	3D Combat	Artic	Spectrum	£5.95
▲ 30 (—)	Frantic	Imagine	Vic 20	£5.50

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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 (1)	Spectrum	£99	(SI)
▲ 2 (4)	Vic 20	£140	(CO)
▼ 3 (2)	BBC B	£399	(AC)
▲ 4 (7)	CBM 64	£229	(CO)
▲ 5 (9)	Texas TI/99	£140	(TI)
▶ 6 (6)	Oric	£99	(OR)
▼ 7 (5)	ZX 81	£40	(SI)
▶ 8 (8)	Atari 800	£300	(AT)
▼ 9 (3)	Dragon 32	£174	(DR)
▶ 10 (10)	Colour Genie	£168	(LO)
▼ 11 (14)	Sharp MZ80A	£347	(SH)
▶ 12 (12)	Atari 400	£149	(AT)
▲ 13 (16)	Lynx 48	£225	(CA)
▼ 14 (11)	Tandy colour	£240	(TA)
▶ 15 (15)	Apple IIe	£972	(AP)
▲ 16 (17)	Epson HX20	£472	(EP)
▲ 17 (18)	Aquarius	£79.95	(MA)
▲ 18 (—)	CGL M5	£150	(SO)
▲ 19 (—)	Nascom 3	£549	(LL)
▼ 20 (19)	Sharp PC1500	£169	(SH)

Top Ten over £1,000

▲ 1 (2)	IBM PC	£2,392	(IBM)
▼ 2 (1)	Sirius 1	£2,525	(ACT)
▲ 3 (7)	Epson QX10	£1,995	(EP)
▶ 4 (4)	DEC Rainbow	£2,714	(DEC)
▼ 5 (3)	Apple III	£2,780	(AP)
▼ 6 (5)	Commodore 8096	£1,374	(CO)
▲ 7 (—)	British Micro Mimi 3	£1,490	(BM)
▲ 8 (9)	Portico Miracle	£1,795	(PO)
▲ 9 (—)	HP 86A	£1,541	(HP)
▼ 10 (6)	Televideo TS802	£1,960	(MI)

AC Acorn Computers. ACT — ACT. AP — Apple Computer. AT — Atari International. CA — Computers. CGL — Computer Games Ltd. CO — Commodore. DEC — Digital. DR — Dragon Data. EP — Epson. GR — Grundy Business. IBM — IBM. JU — Jupiter Cantab. LO — Lowe Electronics. LL — Lucas Logic. MA — Mattel. MI — Mideltron. OR — Oric. OS — Osborne Computers. PO — Portico Technology. RX — Rank Xerox. SH — Sharp. SI — Sinclair. SB — Sirtel. TA — Tandy. TI — Texas Instruments.

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'TRANS AM'

'PSSST'

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This dark obsession

My husband is an obsessed Spectrum owner. May I ask the manufacturers of computers if they would remove that hypnotic chip or what ever it is that I'm sure is put into these things.

Since my husband acquired a Spectrum (all of five months ago) I feel he is in a hypnotic state with nothing registering in that lovely head of his but INKEY \$ and those variables not found etc etc etc!

I get the occasional glimpses of recognition from him from time to time amidst those piles of mags, heaps of half-used cassettes and thickets of wires, and if I miss him, at least I can get to see his reflection in the television.

I say goodnight to his back at the table around 2-3am and wonder if he is still alive when I check in on him in bed at 12 noon.

'What time did you crawl into your coffin this morning Dracula?' I ask him. 'Oh, about 4-5-6-7' comes the baggy-eyed reply. 'I won't stay up on it tonight though love'. 'No dear, course you won't!???' I say knowingly. Good job I like playing the games when they are finished!

Deborah Sykes,
Margate, Kent

Why not get your own micro and join in the fun? Design your own games, it's more satisfying to do it yourself. And anyway, if you can't beat them — Ed.

Constructive advice

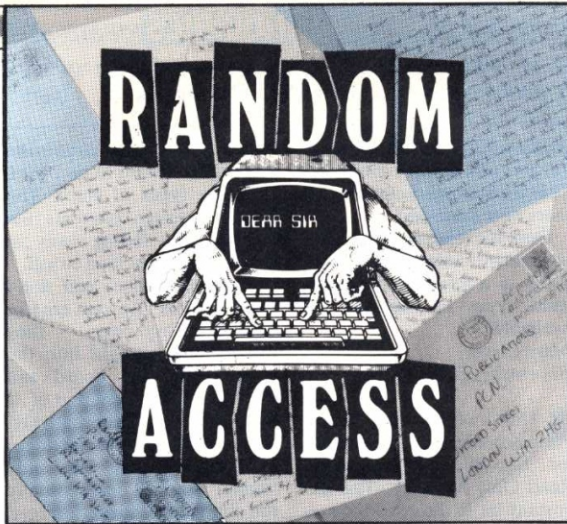
May I start off by thanking you for the very balanced review that you published on the Microtan computer. I would like to follow up on some of the points that emerged from that article, namely:

■ The Microtan 65 board has a Pin 1 identifier marked clearly with a white spot at every socket location.

■ Each socket supplied has a Pin 1 identifier mark in the form of a V shaped notch at one end of the socket only.

■ Every one of the chips supplied has a Pin 1 identifier in the form of either a dot or a notch at one end only.

■ Each diode supplied has either a band or arrow marking which identifies the polarity of



Don't carry a LOAD on your shoulders,
unburden yourself on PCN's letters page.

the device and the Microtan 65 board is clearly marked with the associated arrow markings.

■ It is not true to say that the Microtan board requires a monitor. The Microtan can be used with any normal domestic TV set.

To help the absolute beginner, the above information will now be included in the construction guide for the Microtan 65 computer.

David Northway,
Managing Director,
Microtan Computer Systems

Commodore's manual labour

On seeing Kevin Tye's letter in Random Access (PCN issue 23) about the games reviews and games for the 64, or to be more accurate the lack of them, I am moved to put pen to paper. If reviews for the 64 are scarce then game reviews for the Vic 20 are non-existent. It was nice though to see a program (at last) in PCN ProgramCards for the Vic. While I am agonising I might as well give my long felt feelings on the subject of manuals, user friendly and all that.

I have owned a Vic 20 (here's the plug) and I am very impressed with sound, graphics etc, but the manual, 'yuk!' Supposedly it gives detailed explanation of the ins and outs of Commodore Basic (yawn) PEEKS and POKES explained in glowing colour, variables and commands defined clearly and accurately. But, alas, this is not true. Instead I am faced with computer characters and cartoon bubbles. The best manual I have ever seen is the one for the ZX81.

Well maybe one day Commodore will come to its senses and match its brilliant computer with a good manual and dump that 'user friendly' rubbish.

Jeremy Daldry
Ipswich, Suffolk

Those Basic requirements

I must write to congratulate Gary J Starlings for his remark in Random Access, (PCN issue 23), namely, 'I would not deny that the manual and version of Basic (CBM 64) is not fool-proof, but would say that a little thought and logic on the part of the user would go a long way.'

High-level languages, such as Basic, were designed to make programming easier and machine independent. A cursory glance through an average Basic Commodore game reveals more POKES than a pig would meet in a lifetime. Thus, no matter how well documented a program is, when it gets to any great size, it will be very difficult to trace any errors.

Do not get me wrong, I am not sticking-up for the ZX81, or any other computer for that matter. It is just that when one spends over £200 for a computer these days, the least you should expect is for it to be equipped with a decent Basic.

John Kramer,
Palmer's Green, London

Stick to Commodore Basic and avoid POKES and you certainly get a reasonably portable program. Problem is, it'll also be pretty boring — Ed.

Promotion of piracy

Here is my contribution to the continuing story of software piracy.

To make a good game on cassette all you need is a programmer and a relatively cheap computer.

To make a good LP you need a composer/textwriter and the performing artists and good studio-facilities etc. So why do we have to pay more for a cassette game than for an LP?

Besides, if software companies made sure their games are really good and the packages they come in contain good information, are attractive and if possible uniform, then I think people would rather buy the original than copy it on a blank and unattractive cassette. That is, when the price is correct.

L. Schultinge,
Netherlands

As a last resort

I feel driven to respond to constant letters which appear in computer magazines from enthusiasts who apparently don't bother to read the rather good manual issued with every Spectrum.

■ The letter in your inquiries column a few weeks ago from a Spectrum owner requesting a list of Z80 mnemonics — didn't he get as far as Appendix A, pp 183-188, which lists all Z80 mnemonics complete with their corresponding codes in both decimal and hex?

■ A constant complaint which has appeared in several magazines concerning the lack of 'audio feedback' from the keyboard. Chapter 19 page 138 has the answer.

J Williams,
Malvern, Worcs

We do our best to ensure Microwaves does not repeat information available in manuals. My apologies for ones that slip through — Ed.

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Cross-talking machines

Q I own a BBC Model B and wondered if it was possible to make a list of statements for one computer which you can simulate on your own computer. This would make it possible to run programs for other computers on your own computer.

Walter van Heiden, Rotterdam, The Netherlands.

A You could make such a list — I haven't quite got the time and space to do it here! Lots of books and magazines have tried it and proved just how difficult it is.

The point is that it isn't just the words (or syntax) that varies from machine to machine. It's what they mean and how they are used (semantics) that make conversions difficult. Provided you know exactly what the original (or source) machine will do for any set of commands, you should be able to match it on your (the target) machine.

But the spanner in the works is that hardware abilities vary so much between machines that major rewrites may be necessary. How do you convert a program with an 80 column BBC display to a 22 column Vic? How do you take a Texas program using sprites and put it up on a Dragon?

So conversion isn't a matter of just translating vocab. Just like translating between real languages, you need a degree of skill in both the target and source machines. So, besides compiling your own list, try and get the machines you are converting from. Read their manuals, talk to their owners and write programs for them.

Once you get started, converting will come naturally. And practice makes perfect in any language.

Last night of the Eproms

Q I'd like to ask some questions about EPROMs and modems. Are Eproms pro-

grammable in Basic? What do burners and readers consist of? Thirdly, how much advantage is there over cassettes?

Onto the modems. Can modems convert a signal, say from a ZX81 to a Spectrum? Finally, what types of modems are available?

Marc Clever, Bournville, Birmingham

A I think a few definitions are in order here. Eprom stands for Erasable Programmable Read Only Memory. The important bit is the read only — Eproms are just one sort of ROM.

ROMs are memory chips that can't be changed — the manufacturer fixes their contents when they are made. They are used for information that is always needed whenever a computer is switched on. On many micros, ROM is used to store the machine's Basic. When you switch on, the micro can just start off in Basic. You don't have to sit around for half an hour loading Basic off a tape.

So, if ROM is permanent and can't be changed, what's Eprom? Well, an Eprom is a reusable ROM. Using a 'blower' or 'burner' you can set its contents though it does take time. It is then permanent (well at least ten years) unless you erase them with ultra-violet light or leave them in the sunshine for about six hours.

So Eproms aren't really used as a storage media like you use cassettes or disks. They are much more similar to cartridges. You might use them if your are customising a micro so that it always starts off in a particular program. You turn a ZX81 into an alarm or light show controller or whatever.

You'll also find that many manufacturers supply early versions of their software on Eprom. Only when they are satisfied that it is finished will they go to the expense of having ROMs done. So, an early BBC or Oric, for example, will have Eproms instead of ROMs.

You should be able to answer your own questions by now. Eproms are just memory chips — they store binary bytes. Usually, it's machine code or data but it wouldn't be impossible to put a Basic program on Eprom. 'Burners' actually 'program' the Eprom by setting the bits in it to either 0 or 1. This

is done by storing a charge in the bits that you want to be 1 (or 0 on some types of chip). The Eprom's design prevents the charge from fading away in anything approaching a rush.

And, of course, you don't need 'readers'. Eproms are like other memory chips — they usually plug straight into the computer's main board and become a permanent part of its memory.

Alternatively, Eproms will come in cartridges or what-have-you. The only 'reader' you will find is usually the ability of a 'burner' to read back and check the Eprom it has just blown.

Now for the modems! Again it's probably best to go back to square one. A modem (in the usual computing sense of the word) converts a digital signal from a computer into a audio tone that can be sent down a phone line. It can also decode audio tones back into digital signals. In technical terms, it can modulate a signal and demodulate it — get it?

Modems are usually used for going over phone lines, so they are a rather complicated way to communicate between a ZX81 and a Spectrum. The other point is that a modem (again, usually) is a serial device. It sends a stream of tones, each being a 0 or 1.

For example, the character A might be stored as 01000001. This would be transmitted as a serial stream 0,1,0,0,0,0,0,0,1 rather than all bits being sent at the same time — each with its own stream in parallel.

So a modem usually needs a serial interface; so your ZX81 and Spectrum would both need serial interfaces so you could plug them together anyway without a modem. Of course, if you are transmitting over phone lines using two modems, provided both computers are using the same speeds and coding systems (not true of your Sinclair example!) then any computer can talk to any other.

Finally, asking what types of modem there are is a bit like saying what types of cars/computers/programs are there? Some of the basic distinctions are worth mentioning. Modems can connect directly to the phone system (just like a phone does). This is a direct-connect modem though people frequently just call them just 'modems'.

The alternative is an acoustic coupler where the handset of a phone is placed in two cups on the coupler and the signal is transmitted by sound across the gap. Acoustic couplers are thus less reliable, or at least slower, than direct connect modems.

Some of the other types you'll meet are auto-dial (can ring up under computer control) or auto-answer (can be rung up). You'll also meet baud rates and 'duplexes'. Baud rates are the speeds of transmission. Duplexes are the directions.

Sounds fun? It's worth a library book or a trip to a club or exhibition to find out more . . .

Computing without risk

Q Could you tell me if using a colour TV with a computer, for example, a Vic 20, affects the TV in any way?

Ralph Raplay, Ipswich, Suffolk

A Computers and TV games are about as dangerous to TVs as test cards. You might damage the tube by leaving a steady, ridiculously bright or contrasty image on the screen for a long time. But, even if you are an all-night programmer or 24-hour rocket raider, normal use won't hurt it.

The rule is simply not to leave the thing on overnight or for long periods. By all means leave the computer running but switch the TV off or turn the contrast down if you leave the keyboard to do something else.

81 ideas for languages

Q Are there any other languages (besides Basic and machine code) that I can run on my ZX81?

D Snowden, London E18.

A The other main ZX81 language is Forth, probably the best known being the version by Artic Computing. You'll need a 16K RAM for this, of course.

And don't forget that you don't actually have to code directly in machine code to write machine code programs. Many companies offer assembly language systems — try Artic and Bug-Byte for starters.

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Oric gains colours

After you have experienced the colours on the Oric, you might like to add some more to your collection.

The program shown below produces every possible colour using the Oric colours. The colours are produced by POKEing two alternate colours onto the HIRES screen so that they merge together, and give the impression of another colour.

Using this method, colours such as pink and orange can be produced.

```
10 HIRES
20 FOR A=17 to 23
30 FOR B=17 to 23
40 FOR C=40960 TO 49000
STEP 80
50 POKE C,B
60 NEXT C
70 FOR D=41000 TO 48960
STEP 80
80 POKE D,A,
90 NEXT D
100 WAIT 200
110 NEXT B
120 NEXT A
```

Graham Bailey, Camberley, Surrey

All change on the Spectrum

One of the Spectrum's major disabilities is the fact that the colours cannot be changed without clearing the screen. This is especially annoying if you have a picture or screen of text which you would like to try out with different colours or attributes.

There are a number of machine code routines that overcome this problem, but these are clumsy if your want to overcome the problem quickly by typing something direct from

the keyboard. Here is a short Basic routine which will do the job perfectly. DIM A\$(704)

PRINT AT 0,0; OVER 1; INK colour required PAPER colour required; A\$

The print statement should all be on one line.

This sets up a string array of spaces the size of the screen and prints it with the OVER function on and with your new colours being used. It is also possible to set other attributes such as FLASH and BRIGHT.

Of course this technique is not limited to the whole of the screen, and by using the general form:

```
PRINT AT X,Y; OVER 1;
ATTR: ATTR; A$
```

You can change any section of the the screen quickly and easily

J R Mortleman South Woodford, London

Displayable Dragons

The following program may be of use to owners of the Dragon 32 computer. It produces and displays a simple routine which enables the colours of the machine to be displayed and allows the user, by means of the TV controls, to adjust them according to taste.

```
10 FOR X = 0 TO 63
20 FOR Y = 0 TO 31
30 C = INT (X/8+1)
40 SET (X,Y,C)
50 NEXT Y, X
60 GOTO 60
```

R W Stevenson, Warrington, Cheshire

Flashier Commodore

Owners of the Commodore 64 may find the following pokes useful for controlling the cursor.

POKE 204,0 before a GET will produce a flashing cursor, to switch off the cursor use POKE 204,1.

POKE 207,1 before an INPUT will switch off the cursor until a key is pressed.

David Gristwood, Tyne and Wear

Oric comes to a stop

When programming in HIRES mode on the Oric it is impossi-

ble to see the values of variables or sums because if you type PRINT X — where X is the variable or sum — the Oric just prints the result and automatically scrolls upwards as a result of printing it's Ready message.

However, if you enter PRINT X: WAIT 100 then, you are given a chance to read the answer.

S N Purvis, Malmesbury, Wiltshire

Try PRINT X; ... Ed

Plugging the Dragon's gap

It is a good idea to leave a gap between programs on a tape. On the Dragon (and presumably on the CoCo) it is possible to use the MOTORON and MOTOROFF commands.

This method often leaves rather a long gap due to the slow typing of the command MOTOROFF (and mistakes). To prevent this, it is possible to get the same effect by causing a syntax error by typing for example M<ENTER>.

A S Bradshaw, Bolton

The 64 disabled...

The following POKES are very useful when used on the Commodore 64. POKE 808,225 disables the RUN/STOP-RESTORE sequence. POKE 808,235 re-enables it. To stop any keys repeating POKE 650,64. To make all keys repeat POKE 650,128 and to just let the cursor keys, INSTL/DEL key and space repeat, POKE 650,0.

Paul Griffith, Cwmbran, Gwent

... and invisible

Invisibility will protect your brainwaves on the Commodore 64!

Any line of less than 35 characters can be made to disappear from a listing. To achieve this, type in: :REM""

at the end of the line you wish to conceal. Then delete the second quotation mark and press the Shift and INST/DEL keys forty times, followed by the DEL key forty times. This

will cause forty reverse field letter T's to appear.

Press the RETURN key to enter the line. When the program is listed, this line will be mysteriously absent.

The line is actually listed, but the screen editor is tricked into deleting it before it can be seen.

S A Sassoon, Long Stratton, Norfolk

BBC plots and points

The BBC's graphic commands use X and Y coordinates to plot points and draw lines. The following program converts these to the actual screen memory locations, for any graphics mode.

```
10 INPUT "Which mode " MD
20 IF MD>5 OR MD=3
PRINT " Must be graphics mode": GOTO 10
30 IF MD>2 THEN
HI=&5800:R=320:C=32:
ELSE HI=&3000:R=640:
C=16
40 INPUT " Enter X Coord "
X
50 INPUT " Enter Y Coord "
Y
60 A=INT((1023-Y)/4)
70 ROW=INT(A/8)*R
80 LIN=A MOD 8
90 CL=INT(X/C)*8
100
MEMLOC=HI+ROW
+LIN+CL
110 PRINT " Memloc =
&";MEMLOC
120 END
```

D.A. Wells, Crawley, W. Sussex.

64 fit to PRINT

One of the many missing commands on the CBM 64 is the 'PRINT AT x,y', used to print something at column x, row y. However, all is not lost, it can be simulated by this short three line program.

```
10 Y$="(21 cursor down
chars)":X$="(40 cursor
right chars)"
20 A$="CBM
64":X=10:Y=10:GOSUB
9000
9000 PRINT "(cursor
home)";
LEFT$(Y$,Y);LEFT$(
X$,X);A$:RETURN
```

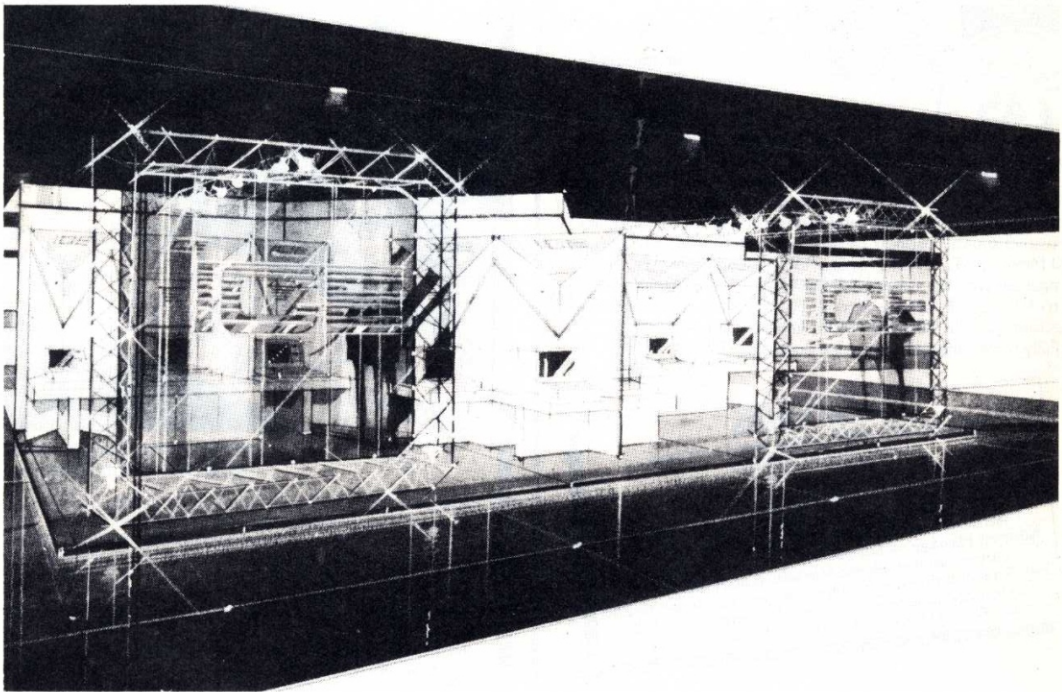
The X in line 20 is the column and the Y is the row.

Trevor Morgan, East Ham, London

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Dynamic displays

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Fear not . . . PCN to the rescue . . .

This article and the associated machine code program 3 are written for the machine code programmer using the Sinclair Spectrum. The program is a short data transfer routine which simplifies the output (of predominantly text) from within a machine code program. I say predominantly text because that is what it does best; that is what the routine is designed to handle.

Anyone with at least a slight knowledge of working machine code must be familiar with how a computer represents information on the screen. Working with the ZX81 in machine code you become used to outputting messages on the screen (from machine code) simply by loading each byte with the ASCII code of the next character in your text — hey presto, your message appears on the screen.

Such a screen layout is very convenient and economical on memory (792 bytes of the ZX81), but is also relatively limited. There is no way that pixel-definable high resolution graphics can be produced. Therefore the Spectrum clearly had to have some other arrangement as it does accommodate high resolution graphics.

The inconvenience of each character having to be made up of eight bytes could have been bearable if the locations were sequential, but they aren't. The Spectrum's screen memory was designed with, I'm sorry to say, the television picture scan in mind, not the programmer. The result is that outputting text onto the screen is as hard on the Spectrum as it is easy on the ZX81.

The numerous calculations necessary are a pain, as they have to be recalculated every time your PRINT AT

position changes. I know you shouldn't kick a man when he is down, but unfortunately the calculations are even more complicated than they first seem. The screen is split up into three sections, each of eight lines. You just watch how drastically the locations change when the PRINT AT position crosses one of the 'boundaries'.

In the end I decided that there must be an easier way of doing things, hence this article. The principle behind the routine is this: a pseudo screen memory is set up above RAMtop. This pseudo screen memory contains 768 bytes (one byte per character) and is arranged in a manner identical to the attribute file — ie starting top left, along each row in turn down the screen until bottom right. The machine code program is also above RAMtop. Every time you call the machine code with the command:

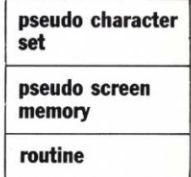
RANDOMIZE USR start address

The contents of the entire pseudo screen memory are placed into the display file and therefore appear on the screen. The contents of each byte in the pseudo screen are taken to be an ASCII code. For example, if you POKEd 65 into the first location of the pseudo screen memory and then called the routine, an upper case 'A' would appear at PRINT AT position 0, 0.

What the routine has actually done is that it has worked out the location in the

Figure 1 — memory organisation

Physical Ramtop



RAMTOP —

ROM of the eight bytes that make up the upper case 'A', and has then moved them into the eight bytes of PRINT AT position 0, 0. (Incidentally it does this for every position on the screen every time you call the routine). If you PEEK the complete character set (in ROM) you will find that it isn't in fact complete. Only the characters up to ASCII code 127, the copyright symbol, are stored in ROM.

Any character above 127 is either a graphics block or a keyword, both of which are worked out by the ROM routines. This means that characters 128 to 255 are redundant when using this routine, because you can't fit a whole keyword into one PRINT AT position.

Instead of wasting all those spaces, all the characters from 128 to 255 inclusive are re-defined as user defined graphics. There are 128 of them, and their 1024 bytes (128x8) are also stored above RAMtop. The routine includes a check

Figure 2 — memory addresses

	16K	48K
Routine call address	30908	63676
Pseudo screen start address	30973	63741
Pseudo character set start address	31742	64510
RAMTOP	30907	63675

Program 1, 48K Spectrum

```

90 REM :::48K Spectrum
100 CLEAR 63675
110 PRINT AT 18,4;"Dumping Machine Code:"
120 LET a=63676
130 READ z: IF z<>999 THEN POKE a,z:LET a=a+1:GOTO 130
140 GOTO 200
150 DATA
1,0,0,33,253,248,17,0,64,205,213,248,17,0,72,205,213,248,17,0,80,205,213,248,201,229,213,197,110,38,0,62,127,189,48,5,160 DATA
1,254,247,24,3,1,0,60,41,41,41,9,6,8,126,18,20,35,16,150,193,209,19,225,35,16,21
B,201,999
200 FOR f=63741 TO 64509: POKE f,32: NEXT f
210 FOR f=64510 TO 65534: POKE f,255:NEXT f
220 PRINT AT 20,0;"Type in char. code....32 spaces....."
230 INPUT i: IF i<32 OR i>255 THEN BEEP .1,-40: GOTO 230
240 PRINT AT 20,0;"Type in char. position....19 spaces...(63741-64509)"
250 INPUT o: IF o<63741 OR o>64509 THEN BEEP .1,-40:GOTO 250
260 POKE o,i: LET i=USR 63676
270 GOTO 220
    
```

19 which looks in the ROM for character codes 127 or below, and in the RAM for character codes 128 or above.

Because they are in RAM you can change them — hence 128 user defined graphics. The three areas above RAMtop (the routine, the pseudo screen memory, and the pseudo higher character set) only just fit in, so they over-write the Basic operating system's user defined graphics.

However, they are replaced by 128 others, and besides, this is a machine code routine, designed to be used within machine code programs, so the Basic UDGs are not missed. The Basic set-up program used in this article loads all the 1024 UDG bytes with 255 to start with, (see line 210 of the listing) so you can see that they are being printed.

When you use the routine in your own programs, it can be called from Basic or from machine code programs — it doesn't matter which, because the last 201 will RETURN to machine code or Basic, whichever was used to call the subroutine.

When using the routine in your own programs, don't forget to fill the pseudo screen memory with 32s right at the beginning. This is because when you CLEAR the RAMtop, the space is cleared with zeros, and when you call the routine the zeros produce an inverse clearscreen. When loaded with 32s, the pseudo screen memory is CLS-ed.

The easiest way to save the routine is to just save the whole Basic program after you have typed in the appropriate version for your memory size, and then whenever you want to use the routine, LOAD up the Basic program, dump the machine code bytes and then NEW the computer. The routine and the pseudo screen memory (complete with loaded 32s) will be totally safe above RAMtop (unless you pull the plug out or type RANDOMIZEUSR 0).

Lazy programmers may want to work out a formula which converts a pair of PRINT AT coordinates into the correct location in the pseudo screen memory. They may also care to do the same for the pseudo character set (the UDGs). Work out where to put your eight UDG bytes like this: first design your UDG on squared paper as you would normally, then work out the decimal value of each horizontal row. Then decide which char-

Figure 3 — Mnemonics for pseudo screen memory routine

	LD BC, 0	
	LD HL, pseudo screen memory start address	
	LD DE, 16384	Spectrum screen memory
	CALL routin	
	LD DE, 18432	2nd screen section
	CALL routin	
	LD DE, 20480	3rd screen section
	CALL routin	
	RET	RETURN to BASIC
routine	PUSH HL	
	PUSH DE	
	PUSH BC	
	LD L, (HL)	ASCII byte into 'L'
	LD H, 0	clear high order byte
	LD A, 127	code of last ROM character
	CP L	are character bytes in ROM?
	JR NC rom	jump if yes
	LD BC, pseudo chrs set — 1024	address of bytes in RAM
	JR ram	
ROM	LD BC, 15360	address of bytes in ROM
RAM	ADD HL, HL	multiply code of character by 8
	ADD HL, HL	
	ADD HL, HL	
	ADD HL, BC	add start address of chrs set
	LD B, 8	initialise loop counter
loop	LD A, (HL)	move character byte into screen memory location
	LD (dE), A	
	INC D	next byte in char position
	INC HL	next byte from char set
	DJNZ loop	loop 8 times
	POP BC	
	POP DE	retrieve values
	INC DE	next character position
	POP HL	
	INC HL	next character location in pseudo screen memory
	DJNZ routin	loop back 256 times
	RET	RETURN from subroutine

acter (128 to 255) your UDG will be, subtract 128 from the code, multiply by eight, and add the start address of the pseudo character set (see Table 1). The result is the location where the first byte of the UDG should be POKEd/LOADed. The next seven bytes are for the rest of the UDG.

The following points should be noted about using the routine:

- Simply loading the pseudo screen memory with character codes will not automatically PRINT them out on the screen. As far as the computer is concerned, your pseudo screen memory is just a group of reserved memory locations. Only when you call the routine will the pseudo screen's contents be displayed.

- Be warned about calling the routine

too often. Remember that machine code routines do actually take time to execute, even though they appear to be instant. If speed is of primary importance in your application then you will have to reach a compromise between speed and screen updating.

- Don't be tempted to load the display file directly with bytes between calls to the routine. If the bytes are not in the pseudo screen memory, they will be over-written with zeros when the routine is called.

Although the routine has a Basic set-up program (program 1 for 48K, program 2 for 16K), it is only for demonstration purposes to introduce you to the concept of the routine. From Basic you might just as well PRINT normally, with instant results on the screen.

Program 2, 16K Spectrum

```

90 REM :::16K Spectrum
100 CLEAR 30907
110 PRINT AT 18,4:"Dumping Machine
Code:"
120 LET a=30908
130 READ z: IF z<>999 THEN POKE a,z:LET
a=a+1:GOTO 130
140 GOTO 200
150 DATA
1,0,0,33,253,120,17,0,64,205,213,120,17,
0,72,205,213,120,17,0,80,205,213,120,201
,229,213,197,110,38,0,62,127,189,48,5
160 DATA
1,254,119,24,3,1,0,60,41,41,41,9,6,8,126
,18,20,35,16,250,193,209,19,225,35,16,21
8,201,999
200 FOR f=30973 TO 31741: POKE f,32:
NEXT f
210 FOR f=31742 TO 32766: POKE
f,255:NEXT f
220 PRINT AT 20,0:"Type in char.
code....32 spaces....."
230 INPUT i: IF i<32 OR i>255 THEN BEEP
.1,-40: GOTO 230
240 PRINT AT 20,0:"Type in char.
position....19 spaces....(30973-31741)"
250 INPUT a: IF a<30973 OR a>31741 THEN
BEEP .1,-40:GOTO 250
260 POKE a,i: LET i=USR 30908
270 GOTO 220
    
```

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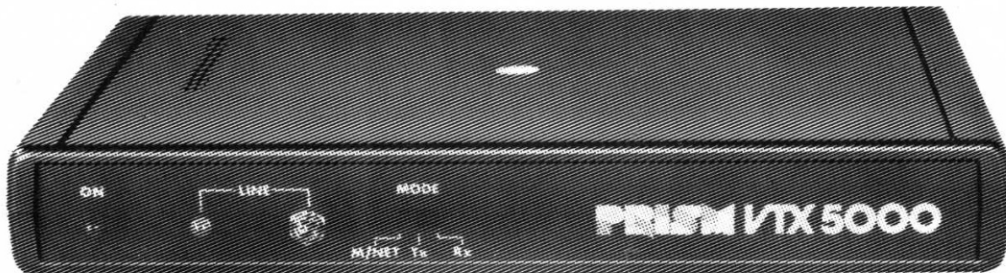
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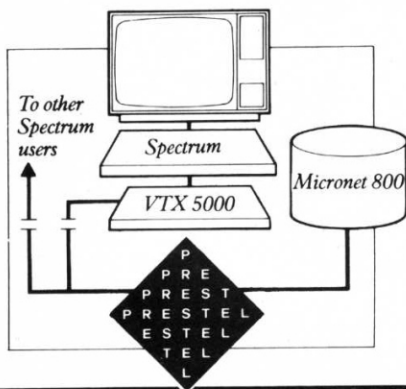
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Ashton Tate tries its hand at financial planning for the IBM — Pete Fawcett tells you more.

Forward finance

Ashton Tate is more or less a household name in software, on the strength of its file-handling package dBase II. But now the company is trying its hand at other kinds of application software packages, and this new IBM financial planning package is one result of this policy.

The Financial Planner is only one of dozens of packages of its type, used for applications ranging from simple budgeting and cash-flow analyses right up to building complex business planning and accounting models. Financial planning packages vary a great deal in their scope and complexity though, the simplest being the popular spreadsheet packages such as VisiCalc and Planncalc.

The Financial Planner, on the other hand, is in the more advanced league, alongside the likes of Micromodeller and Micro-FCS. It's specifically aimed at the experienced user, particularly those people who may have found the simpler spreadsheets not powerful enough for their needs.

I tested out the Financial Planner on a large IBM PC under PC-DOS. The version I tried was number 2.36, which does not include any graphics features — due soon, probably this month, according to Ashton Tate. There's also a CP/M version of the package available, which is limited to only 30,000 cells of information.

The 16-bit version is also limited to that size at the moment, but the newer version due to be launched shortly should be able to cope with 62,500 cells.

Presentation

The Financial Planner (FPL) comes with a large black ring-binder manual, packed with 240-plus pages of text, and several appendices. The software comes on disk, and there's a separate demonstration disk.

The manual is shot through with technical jargon, and it's aimed squarely at the advanced user.

I found looking up points for reference a real problem. The manual is not really designed to let you locate particular chunks of information in a hurry. There is a useful separate reference card, but if you want more detailed descriptions of the operations you can carry out, you are in for a long search through the manual.

Features

FPL features — as you might expect — the tools you will need to allow you to create and modify financial models. Models are set up in spreadsheet format, with a maximum limit of 30,000 cells. Row and column names are up to eight characters long, and rows and columns may also have titles of up to 100 characters, which can be displayed on the reports you produce.



A set of editing commands lets you pick the format in which data in your model is to be displayed — number of decimal places, dollar signs, underlining, overlining, plus or minus signs, credit or debit signs, percent signs, and so forth.

You have a reasonably comprehensive set of rules at your disposal with which to manipulate your data and compute the model. Rules may operate on cells or variables, rows or columns, read from or write to files or accept input from the keyboard, and there is a LOOP command to repeat execution of a set of rules until the difference becomes insignificant.

You can use the full set of logical operators to build rules — greater than, less than, less than or equal to, and so on. You can also use AND, OR, IF, ORIF, THEN and ELSE. Then there is a comprehensive set of arithmetic functions ranging from MAXIMUM, MEAN, running total, rounded values and fractional part through to arctangent, log, cosine and square root.

There's a set of report commands which you can either execute immediately or save as a file to be run later. You have control over the precision to which your data is displayed, you can add footnotes to a report, take commands out of another file, and pick the rows and columns to be displayed and the space between them. Various other commands are available.

Getting started

After finally succeeding in loading the package, I was launched straight into the following menu:

1. EDITOR
2. DSS
3. SELECT
4. RESTART

5. MODEL

6. EXIT

The editor is that section of the package where you create or modify models. The DSS is the decision support system used to process the model. The other options are used for a variety of secondary functions. I did not use this menu, however — it was quicker to use the commands directly. The rest of the system is command-driven rather than menu-driven, anyway.

I tried booting the demo, only to be greeted by a sequence of screens that flashed through an example at such speed that it was impossible to read more than a couple of words on any screen. Once it had finished, I discovered that it was possible to change the configuration of the demonstration and set it to either a slow scroll or to manual mode. Following the tutorial sessions does bring you to a level of familiarity quite quickly.

In use

Many of the commands are less than obvious, and they are none too straightforward to handle. The functions of STET, MATHCELL, DEFINE and #120 are not immediately obvious.

The way in which the package works is also constraining compared with spreadsheet packages. To do a simple financial plan, for example, you must first define all your data, then define the rules by which you wish to manipulate that data. Only then do you run your program, and at this stage you may discover that it will not work due, most probably, to a syntax error you have made in using the commands, or a missing comma in the data section.

What this means is that you then have to go back and try again, until you have corrected all the problems that may turn up. This is a slow and rather annoying process.

There is a Help function, but in practice it is of little more use than what is in the manual anyway. So you are left to switch backwards and forwards into the editor function, and back out into the package proper, whenever you commit illegalities such as using names with brackets or spaces in them in your formulae.

This eternal switching back and forth to the editor means you will need to have a high degree of perseverance if you are to get your program developed. Despite these drawbacks, though, the facilities are very powerful, especially compared with VisiCalc. You go about using Financial Planner as follows:

Developing a model To develop a model to represent your personal budget, say, you must first define the rows and columns you require, including the row and column descriptions you wish to use. Having

specified your model's layout, you are ready to enter data into it.

Data entry is rather messy, since all you have to do is get a comma out of place and your data goes in incorrectly. It is not possible to move around the model as you can with the spreadsheets, which I found restricting. There are some nice features, however, such as 'Repeat this figure throughout the matrix, but growing by 9% each year'.

I found that the models ran into trouble with large numbers. The package tried to truncate the figures and convert them into exponential values, but this did not appear to be working properly, and all that was left were garbage figures.

Processing the model In order to manipulate the data in your model you have to enter logic rules. The number of rules you can apply is large but you have to specify them without being able to refer to the model, which is not easy.

Within your rules, you can LOOP, you can READ or WRITE other files and you can specify keyboard INPUT. You can also make use of report commands to edit any reports you may wish to print, but I found these commands less than friendly to use.

Once all this has been done, you are ready to DEFINE and COMPUTE the new model. This is the point at which errors inevitably get reported, and here the package is not very flexible.

Performance

I found that for small models, the speed of this package was quite disappointing whenever I went into or out of the editor, or whenever I computed the model. This effect was worse with larger models; with one of 200 rows and 20 columns it took more than two minutes just to reserve the space—and further progress was very slow indeed.

There is a theoretical limit of 500 rows and columns, and a constraint of 21K on file size.

It appears, though, to be practical to use only much smaller models, owing to the severe performance drop-off as the model size increases.

Reliability

Generally the package did what it claimed it would do, but several bugs crept in. Mysterious @ signs appeared from time to time on the screen for no apparent reason. The AD instruction did not work, and I managed to crash the system with a COMPUTE command.

The package responded with Error 99 and threw me out of FPL—losing my file in the process.

I also found that the Workfiles option on the menu didn't work, but simply threw me out of FPL when I tried to use it. And when I attempted to read a file that was not there, the system promptly hung.

Verdict

Like dBase II, this is no system for novices or for end-users; some fairly heavy-duty programming is needed to produce a working model. It is a powerful package and can be used for some very advanced applications, but it will most often be used to develop complex models such as sophisticated budget plans or complicated accounting analyses.

Even so, I have doubts about the reliability of this package as it stands. Compared with a similar and rather more powerful package, FCS-EPS, the Financial Planner seems to be less robust; and it does not handle large models particularly well.

I found the Financial Planner quite unfriendly to use. I shall continue to make do with VisiCalc whenever I can.

RATING

Features

Documentation

Performance

User interface

Reliability

Overall value



Name The Financial Planner **Application** Financial planning package **System** IBM PC **Price** £437.50 **Publisher** Ashton-Tate, Coffridge Close, Stony Stratford, MK11 1BY. **Format** Disk **Other versions** CP/M-80 **Outlets** Various Ashton-Tate dealers.

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WHO IS

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WHO IS

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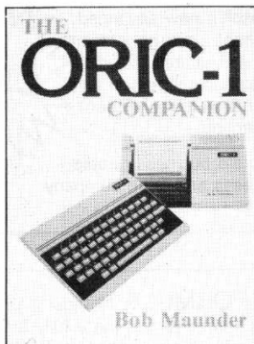
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Norman, Marcus and Jessica test family educational packages for the BBC micro.

Blackboard Beeb

There may be a Beeb in every school, but home is where the Spectrum is. So it could be a shrewd move for schoolbook publisher Longman to write its first three offerings for that machine.

If you bought a computer for the kids but the five year old hasn't yet shown the expected flair for programming, these could be just what you needed. Each program is designed for four to eight year olds at home, aiming at a combination of fun and the teaching of a basic skill.

The programs come in bright double-size boxes (so as not to be confused with big brother's arcade games?) together with a 'notes for parents' leaflet. The test team were my children Marcus (5) and Rebecca (8). The tapes are double-sided and all loaded first go.

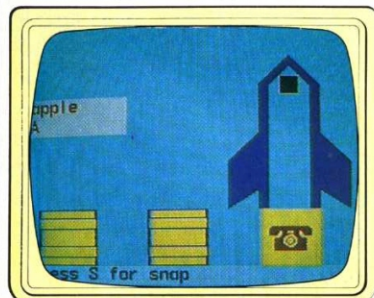
While the tape is running the three-masted Longman ship sails serenely across the screen (whoever designed that logo was far-sighted) and then you are welcomed to the program by 'Microchimp', who subsequently appears in one of the games.

Instructions are all on screen in big easy-to-read lower case letters. We couldn't crash the program by wrong key presses, and the only function available apart from the required key is Break, which takes the place of NEW and clears the memory. This meant that we couldn't get inside the program to insert modifications while running. A tone sounds whenever a key is pressed, which is good for hesitant small fingers, and each new event has its accompanying tone or tune.

Marcus was managing on his own within a few minutes of starting each new game. But parental involvement is still useful and suggestions for helping the child and supplementary activities are given. For parents wanting to know how much educational content they are getting for their money, the descriptions on the boxes are regrettably sketchy.

a, b, c . . .

This teaches the alphabet and word recognition in two linked programs. First the whole alphabet is written out and then an apple is drawn in three colours in a box. Its title, 'A apple' then appears in another



a, b, c . . . lift off!

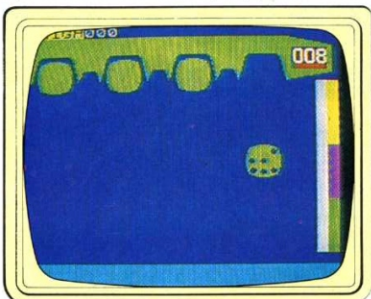
box. Pressing the next letter of the alphabet brings up the next image. Only the right key press works: it might have been useful to have an option of prompting with the next letter.

Press Enter at any time and action cuts to the game. Packing crates are being conveyed to a rocket on its launch pad. An alphabet image is revealed in the crate. If it matches the word that then appears in a box, 's' for snap then loads the object, while a wrong snap unloads one crate. When a full load of six has been stowed, the hatch closes, the rocket lifts off in a spectacular shower of sparks and we hear the Close Encounters theme.

All the objects were easy to recognise and the children had fun trying to be first to spot which object was appearing. The match word is revealed for less than three seconds before the chance to snap is lost, but this didn't cause any difficulties.

Countabout

Here's an animated 'Little Professor' . . . Addition and subtraction using numbers up to ten. Microchimp appears at the



Countabout

bottom of a banana plant and you choose addition, subtraction or a combination of both. A box is drawn, a door on one side flips open and in file a number of objects, say four red TV sets.

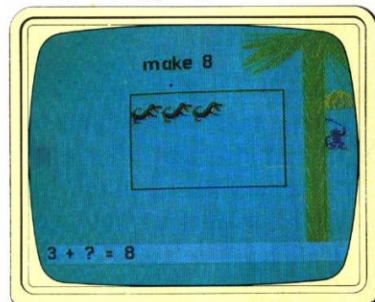
How many are needed to make a given number? Get it right and the extra ones file in or out and Microchimp hops one stage nearer his hand of bananas. Ten right answers and he grabs the bunch, slides down and devours it.

There are nine objects in any of four colours, again easily recognisable, although we just had to christen one a crocodile. Unlike the other games, there's no time limit on pressing the answer and attention can be fixed on the box or the written out sum underneath. Two wrong answers gives you a demonstration of what should have happened with no penalties. The objects form lines of five, which encourages estimation, and their movements are pure ballet.

Hot Dot Spotter

That's right, dot not dog. This is a real

action game with rapid number estimation providing the challenge. First you type your name, which comes back at you in those gratifyingly large letters. Soon the



Hot Dot Spotter

children were inviting whole strings of fictitious characters along to play, some with distinctly naughty names.

A 'dropper' releases a ball inscribed with a random number of dots in a 3x3 matrix. Punch the right number and you score points according to which of the three zones of fall you got the answer in.

Guess wrong or fail to guess in time and the ball hits the bottom, a croupier's rake scoops it off screen and one of your three lives is lost. Get the highest score so far and one of a variety of very laudatory messages flashes up.

Numbers and rate of fall start low and then steadily increase, while a bleeping tone inexorably rises in pitch. The ball isn't exactly slow at the beginning and it's hard to follow the parental guideline of counting with the child and still get your keypress in in time.

Although the concepts on screen are quite abstract, the kids soon showed an instinctive appreciation of what was going on.

Verdict

The colour, sound and graphics capabilities of the Spectrum are all exploited to the full. By using blocks of colour and selective scrolling, the screen never becomes cluttered. The screen images can be used in a variety of ways. The programs succeed in keeping up the interest level by providing very satisfying rewards. There are no options provided that might have extended the age range, such as changing the operating speed, but in return you get a reliable package that the kids can operate for themselves over and over again.

RATING

Lasting appeal	3
Playability	5
Use of machine	4
Overall value	3

System Spectrum 16K or 48K Publisher Longman software, Longman House, Burnt Mill, Harlow, Essex CM20 2JE Price £7.95 Format Cassette Language Machine Code Outlets Most high street dealers.

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This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

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the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result,

the Electron delivers twice as many characters across the screen as its closest competitor.

Built to last and to grow.

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style: robustly constructed with a good, solid 'feel'. It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the

manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

A gentle teacher.

The Electron plugs straight into virtually any TV set and cassette player so you will be



ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.

A free taste of its versatility.

You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal

Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely

EXPERTS LIKE 'WHAT MICRO?'
AND I RATE THE ELECTRON
HIGHER THAN ANY OF THE
COMPETITION.



important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Electron is available from selected WHSmith and local Acorn stockists. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.



Technical Specifications

Hardware.

2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

Software.

BBC BASIC.
Extensions include interger, floating point and string variables, multi dimensional arrays: IF... THEN... ELSE, REPEAT... UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn  Electron.

The Prism VTX5000 promises the Spectrum all the fun of the phone. John Lettice gets its number.

The Prism diaries

Spectrum owners can now access Micronet, with the aid of the Prism VTX5000 modem. The Prism is a neat black box which fits tidily under the Spectrum and — with the aid of your customer identity number and password — opens up micro news, downloadable programs and Prestel to you.

The unit itself is the same size as the Spectrum, and is simply designed, with a mode switch on an on-line switch and a power light on the front. The back of the unit houses an edge connector which links to the Spectrum edge connector, and other peripherals can be connected via an extension in the ribbon cable.

The manual makes reference to Interface 1, and the Prism's construction is such that it should be possible to use the two together, but we were unable to test for compatibility. We *did* test a total of three Prisms — but that's another story — and there was no wobble problem with any of them. Indeed, one of them clung onto the Spectrum with leech-like determination.

The combination can only be good news for Prism, Micronet and the Spectrum; Micronet increases its potential market massively by adding the fast-growing numbers of Spectrum users to its base,

while the Spectrum gets new opportunities to display its potential. If all this pans out right, the advantages for Prism are fairly clear.

Setting it up

Getting the Prism and Spectrum up and running is easy. You use the ribbon cable supplied to connect the two together, set the mode switch to M/NET, connect the Prism to the telephone socket (if you don't have one of these beasts, phone British Telecom and go back to go), then power up and follow the instructions on the screen.

This is the gist of the instructions in the manual that comes with the Prism, and you can see that they're not exactly idiot-proof.

First, there is no proper diagram to show you how to set the system up. There's only one way you can set up the ribbon connector's extension edge connector back of the box shows, apparently, the connector's extension edge-connector wedged firmly into the Spectrum's edge connector.

It doesn't fit, clearly, but this drawing could well cause much scratching of heads among new Spectrum owners.

There is also the question of the little

silver switch labelled 'On-Line'. This is initially referred to in the manual only in the sense of 'switch on the adaptor'. Later on there are further instructions which partially explain, and partially contradict, the earlier instructions. For example, should you replace your receiver five or 20 seconds after going on-line?

And why are the instructions in two sections at either end of the manual? The number of people who'll read on as far as the second lot before trying to log-on are as the grains of sand on the floor of the Ritz . . .

These may seem carping criticisms, and with many other micros they would be largely irrelevant, but the Spectrum is being bought by a lot of people who're new to the game, and who would appreciate clear, easy to follow instructions.

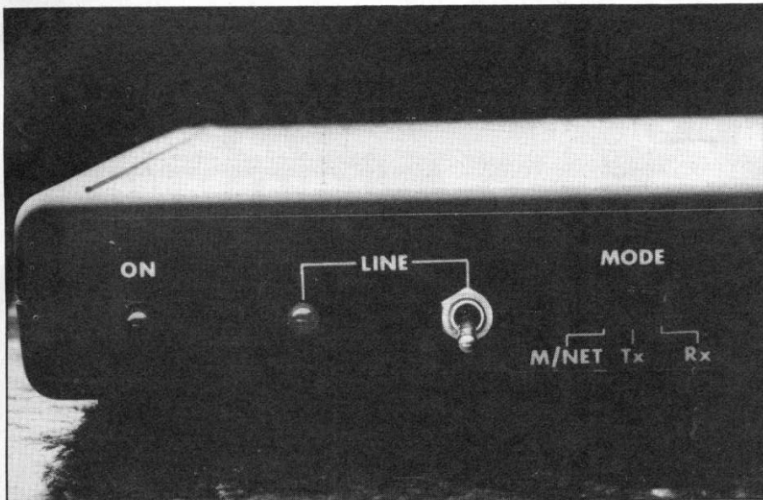
In use

That said, a little thought before your first effort should see you alright, and once you've actually made the connection, the incredible Micronet maze adventure begins. You wend your way through with a combination of number (for menu options or specific pages) and # and *. The Enter key produces #, while * is achieved by the

Naru



The Prism modem fits neatly underneath the Spectrum, making few demands on desk-space or your sense of style.



Symbol Shift. We Spectrum owners are being standardised . . .

It's relatively easy to find your way around Micronet and Prestel once you've worked out the basic directory and menu pages, but it's a lot more fun to meander around them — you never know what you might find in the course of a good browse. If you want to know more about where to find specific topics, *PCN* issue 8, page 23 gives a brief directory to the 20,000 pages of Micronet. Once you've read that lot you can always try Prestel. Prestel gives you access to a whole range of general and specialist interest news and information. You can get the day's headline news, home and international, you can delve deeper into stories, and you can also tap specialist information sources on, for example, commodities and financial topics.

You can also get tourist information, check hotel prices home and abroad . . . essentially, if you're not a high powered executive it's a very cheap way of pretending, until the phone bill comes in.

Software

If the charm of stuffing your head full of the sort of information you'd never expected you needed in the first place fades, there's still the free downloadable software to try. Sparing no expense, your *PCN* reviewer sampled a number of the games available. To put it bluntly, the free games are fairly rudimentary.

The standards are there, including Pacman, invaders and the like, but they have a great deal more in common with magazine listings than with commercial games.

There is the argument that these are still early days in the Spectrum's relationship with Micronet, and that the range of free software available will increase as the number of users increases, but it seems that there hasn't been a great deal of movement, either in terms of quality or games available, over the months Micronet has been available for, say, the BBC micro.

Of course, you can't expect too much for free, but the Spectrum/Prism team-up has meant that the investment necessary to

join Micronet is far lower than it was, and a consequence of this might be that people will be joining in the expectation that it's a bottomless supply of free software. At the moment it certainly isn't and there's no guarantee it will become so.

However, Micronet *can* be viewed as a supply of *cheap* software, which is a different matter altogether. So far the supply of commercial software available is limited. People who've owned Spectrums for getting on for a year now will get a sense of *déjà vu* when they see Mastermind again — a neat little presentation, but not something that's going to get you killed in the stampede to download.

Micronet splits its commercial downloadable software into eight categories, only a few of which are currently downloadable. There were at the time of review only two 16K games for the Spectrum, and although there were rather more of the 48K variety, the range didn't quite fall into the cornucopia category.

The menu alleges that there is educational software now available, but I failed to gain access to any of it. Conversely, at the time of review business software was listed as unavailable, but I did manage to get through to a subsidiary menu which led to — nothing, as yet. This space to let, I assume.

As for the 'general' software, we had perhaps best draw a veil over the somewhat specialist nature of at least one of the two on offer.

That said, Spectrum Micronetters should not despair. If you take a look at the software that is now available for the BBC micro, you'll see there's much more of interest, and as the Spectrum is at least the equal of the BBC as regards the amount of software available, things should change very fast.

As for price, it's difficult to tell what things are likely to cost when there's such a small range available, but the software does promise to be fairly good value.

Downloading the software is again menu-driven, and fairly straightforward. I did have a few problems getting some games loaded — particularly Midway,

which appropriately enough seemed to get stuck somewhere in between — but this is probably attributable to the telephone system being not all it could be, rather than to any fault of Prism or Micronet.

One point worth bearing in mind is that you are automatically taken off-line when you download software. You have to log-on again, so trying various dodges to get yourself back on the Micronet merry-go-round is a particularly pointless exercise. I initially thought that you were always taken offline, whether or not you had successfully downloaded, but this seemed to vary. On one occasion, after an unsuccessful try, I was left online and menu-less, and although I'd seen money clocking up while downloading was being attempted, I lost track of the bill while getting out and going back to go. I foresee a certain paranoia among Micronetting tightwads.

Verdict

Considering the difficulties you would have had getting your Sinclair hooked up to the phone lines, never mind linking into Micronet, just a year or so ago, the VTX5000 comes into the dream come true category. It plugs directly into the phone lines, so there's no problem with extraneous noise — which you'd tend to encounter with an acoustic modem — and there's no fiddling around trying to match your handset with the modem.

The Prism also has all the software ready-installed, so just powering up takes you into the main menu; in this sense it's very user friendly, and is easy to handle once you've got the hang of the system's basic working methods. A more detailed manual would have made it even more accessible, but even the shortcomings here are relatively easy to surmount.

So if you want to get into Micronet and Prestel, the Prism offers a cheap, neatly-styled and efficient way of doing it. But more important than that is the fact that communications technology seems to be following micros as regards price. We've now got to the stage where both micros and the ability to communicate with the world outside can be afforded by a wide range of people.

It's now only a matter of time before a wide range of databases can and will be accessed by home users, and the Prism is an indication that the time involved could be very short indeed.

If Prism does the same for other micros, the acoustic modem would certainly seem to be on the way out, and as far as the Spectrum is concerned the VTX5000 represents a giant step. It isn't simply a tool for letting the machine be used with Micronet — it's a route out into the big wide world, and it will at least start the Spectrum off in the direction that micros will be taking through the home information revolution.

Item Prism VTX5000 **Machine** Spectrum 16/48K **Manufacturer** Prism **Price** £99.95 inc VAT, p&p **Contact** Micronet 800, Scriptor Court, Farringdon Road, London EC1 3AD, 01-278 3143

Brian Cadge gives you the lowdown on the new Extended Basic that goes with Dragon's disk drives.

Extend your Basic without the tears

The Dragon's 16K Microsoft Basic is probably one of the most complete built-in Basics available for any sub £200 micro. It offers 78 commands and 34 functions and executes at a very respectable speed. And the new Dragon disk drive system and controller add a number of useful words to the Basic that make it all the more powerful.

Last week we looked at the drives and the Extended Basic provided with the disk controller, and now we'll show you how to put some of those Extended Basic commands on your Dragon without buying the system.

The programs presented here give you a further six commands and ten functions. There is an assembly language listing for you to type in, and a Basic listing for those without those without assemblers.

We'll go into how the program works later on, but first an explanation of how to use the new functions. All are accessed via a new reserved variable, '%'. This has replaced the MEM function, but don't worry, as this has in turn been replaced by a new function.

The correct syntax to use is: XX = %statement, where 'statement' is either a function or command. XX is any variable and will contain the result for a function, or zero for a command.

Alternatively, you can use ?%statement

to print the result straight to the screen.

For example, the function FRES will give the amount of free string space remaining. This would be typed as XX=%FRES or ?%FRES. On power up there are 200 bytes reserved for strings. This is changed by the Clear command, and by keeping an eye on this value you can avoid OS errors (out of string space). A line such as: 100 IF %FRES<50 THEN ?"String space short!" would be an example.

HIMEM will return the highest memory location that Basic can use, which is one less than the second number in a Clear command. Again, you access this, as all new statements, via the '%' function as in ?%HIMEM.

Memory monitored

PROGL gives the length in bytes of the Basic program currently in the memory. STATUS returns the status of the cassette interface, a zero indicating that it is Closed, one meaning open for input, and two meaning open for output. Using this in programs can help prevent AO errors (file already open).

Although the JOYSTICK command is very good, there is no function for reading the joystick's fire button — you have to mess around with PEEKs and logical ANDing. TRIGR will return a 0 if the right

joystick button is pressed and a 1 if it is not. Similarly, TRIGL works with the left joystick's button.

the KEYIN function is similar to INKEYS, hence its name. The difference is that it pauses program execution until a key is pressed and then returns its ASCII code, eg:

```
100 PRINT "Press 1, 2 or 3"
110 A=%KEYIN
120 IF CHR$(A)="1" THEN . . . etc
```

Some computers have a DEEK function; this is similar to PEEK except that it gives a 16-bit result. If you type ?%DEEK (25) you will see the start address of the Basic program text. The equivalent in normal Basic would be ?PEEK(25)*256+PEEK(26). The DEEK function is not only easier, but executes faster.

FREE has replaced the normal MEM function, which is no longer available and does exactly the same thing. Type %FREE wherever you see MEM.

Error trapping would be an extremely useful function to have. When an error occurs the program usually stops with an error message, throwing the user back to command level.

With the extended Basic, if you add the following line at the beginning of your program:

```
10 XX = %TRAP 1000
```

CODE ERROR MESSAGE

- 0 = ?NF ERROR
- 2 = ?SN ERROR
- 4 = ?RG ERROR
- 6 = ?OD ERROR
- 8 = ?FC ERROR
- 10 = ?OV ERROR
- 12 = ?OM ERROR
- 14 = ?UL ERROR
- 16 = ?BS ERROR
- 18 = ?DD ERROR
- 20 = ?/0 ERROR
- 22 = ?ID ERROR
- 24 = ?TM ERROR
- 26 = ?TS ERROR
- 28 = ?LS ERROR
- 30 = ?ST ERROR
- 32 = ?CN ERROR
- 34 = ?UF ERROR
- 36 = ?FD ERROR
- 38 = ?AD ERROR
- 40 = ?DN ERROR
- 42 = ?IO ERROR
- 44 = ?FM ERROR
- 46 = ?NO ERROR
- 48 = ?IE ERROR
- 50 = ?DS ERROR
- 52 = ?NE ERROR

```
10 CLEAR200,31899
20 FORI=31900 TO 32450:READ A#:POKE I,VAL("&H"+A#):NEXT I
30 FORI=31900 TO 32450:CS=CS+PEEK(I):NEXT
40 IF CS<>65473 THEN STOP ELSE EXEC 31900
50 DATA 8E,7E,C3,BF,01,26,10,8E,81,CA,A6,A0,A7,80,10,8C,82,2C,23,F6
60 DATA 86,A5,A7,90,10,8E,82,30,A6,A0,A7,80,10,8C,82,93,23,F6,8E,7F
70 DATA 47,BF,01,20,10,8E,7C,E5,10,AF,80,36,8E,7E,27,BF,01,92,8E,7E
80 DATA 4D,BF,01,95,86,7E,B7,01,91,B7,01,94,39,8E,7E,5B,5F,10,9E,A6
90 DATA A6,A4,A1,84,26,20,A6,80,81,80,24,06,A1,A0,26,16,20,F4,84,7F
100 DATA A1,A0,26,0C,10,9F,A6,58,8E,7E,A3,3A,AE,84,6E,84,30,1F,A6,80
110 DATA 81,80,25,FA,5C,C1,10,25,CC,7E,8B,8D,DC,23,93,21,DD,52,7E,9C
120 DATA 3E,9E,27,9F,52,7E,9C,3E,DC,1B,93,19,83,00,02,DD,52,7E,9C,3E
130 DATA 05,79,7E,8C,36,9D,A5,F6,FF,00,81,4C,27,0A,81,52,10,26,0E,3D
140 DATA C4,01,20,03,C4,02,54,9D,9F,7E,8C,36,BD,8B,E5,27,FB,1F,89,7E
150 DATA 8C,36,BD,8E,83,1F,10,D7,9B,C0,10,D7,9A,16,00,E3,BD,8E,83,9F
160 DATA 8D,9E,8D,26,FC,16,00,D7,8D,8E,83,AE,84,9F,52,7E,9C,3E,9D,A5
170 DATA 81,88,27,00,81,C2,10,26,00,F7,86,FF,B7,01,48,20,03,7F,01,48
180 DATA BD,00,9F,16,00,B1,86,3F,B7,FF,23,BD,8E,83,9F,8D,10,8E,88,89
190 DATA A6,A0,B7,FF,20,10,8C,8B,80,23,02,20,EF,9E,8D,26,EF,86,37,B7
200 DATA FF,23,16,00,8A,9E,A6,BF,7F,BF,BD,8E,83,BF,7F,8D,16,00,7C,F6
210 DATA 7F,C3,7E,8C,36,8E,7F,C1,9F,52,7E,9C,3E,9E,19,8F,7F,C4,9E,1B
220 DATA 30,1E,9F,19,AD,9F,A0,04,8E,01,DA,9F,7E,AD,9F,A0,06,9E,19,9F
230 DATA 7E,AD,9F,A0,06,96,7C,4C,27,02,20,F3,9E,7E,30,1F,9F,1B,8D,8D
240 DATA DC,BD,84,1F,BD,83,ED,8E,7F,C4,9F,19,7E,83,71,F7,7F,C3,9E,68
250 DATA 8C,FF,FF,26,01,39,BF,7F,C1,8E,7F,BD,8C,FF,FF,27,F4,32,62,BD
260 DATA BA,C3,7F,00,6F,8E,7F,BF,9F,A6,7E,85,A8,34,10,8E,FF,FF,BF,7F
270 DATA BD,35,90,5F,7E,8C,36,46,52,45,A4,48,49,40,45,CD,50,52,4F,47
280 DATA CC,53,54,41,54,55,D3,54,52,49,C7,4E,45,59,49,CE,57,49,44,54
290 DATA C8,50,41,55,53,C5,44,45,45,CB,41,46,45,45,C4,4E,4F,49,53,C5
300 DATA 46,52,45,C5,54,52,41,D0,45,52,D2,45,52,CC,4D,45,52,47,C5,7D
310 DATA 20,7D,29,7D,30,7D,3C,7D,41,7D,5C,7D,66,7D,74,7D,80,7D,8A,7D
320 DATA A6,8C,31,7D,CD,7D,DB,7D,E1,7D,E9
```


Bryan Skinner checks out NEC's long overdue comeback in the big business micro field.

The NEC's step

The spate of new micros being launched in the UK shows no sign of abating. The introduction of 16-bit hardware, operating systems and applications software has further served to stimulate manufacturers keen to keep abreast of, or create, competition.

Each new 16-bit micro has at least one unique feature and NEC's Advanced Personal Computer (APC) is no exception. It may even have more than its fair share of innovations.

The APC is not brand-new. It was released in Japan some two years ago, in the US in May 1982 and in Australia last November. Its disk capacity, processor speed and graphics were, in Australia, compared favourably to the IBM PC and the Sirius.

The first impression is one of sheet size. The APC is a large and heavy beast, weighing in at 80lbs with keyboard. This makes it difficult to move around but raises the question of the extent to which one might want to move a micro around once its use has been clearly defined.

The cream plastic case is some 18 inches square, though there is a peculiar visual illusion whereby the machine appears to be deeper than wider. Despite its apparent size, it does not take up much more desk-space than comparable machines such as the dual processor NCR Decision Mate V.

The second impression is that this machine has 8in drives. We have become so accustomed to the standard 5¼in drives (be they full-height, two-thirds or half-height) that this comes as something of a surprise at first. Why has NEC taken the apparently retrograde step of using yesterday's technology in a brand-new 16-bit machine which it hopes will capture a large proportion of the IBM PC market?

A few moments' thought reveals the logic. First, the capacity of the drives: the APC's double-sided double-density (DSDD) format provides about 1Mb of storage per disk. At £1,985 for the twin-drive monochrome version, the APC must be the most cost-effective micro in terms of disk capacity on the market today, surpassing even the DSDD Sirius at £2,695.

Second, the machine can read standard IBM 3740 single-sided single-density (SSSD) disks. This format has been around for long enough to have become almost an industry standard and so many companies have facilities for copying programs on this disk format.

Most software distributors are supplied with master disks on this format so they can easily make copies of programs to suit the APC without having to worry about matching an awkward disk format such as that of the Sirius and Mimi. Software

should be available for the APC from more sources than is the case for most other micros.

Of course, the IBM format gives only some 240K of disk capacity, but the nice thing about the APC is that it automatically recognises what sort of format disk is being used, so you can easily transfer files from one type to another. You can, as I must confess I did, create problems if you start using an SSSD disk then swap it for a DSDD (or vice versa) without doing a reset or control-C.

Documentation

I have never seen such a cornucopia of manuals. There's an Operator's Guide, a System Reference Guide and a Maintenance Guide — from which I swear you could construct your own APC — and even a CP/M-86 User's Guide and separate CP/M-86 Reference Guide.

The manuals are covered with a light brown substance which I can only describe as 'suedette'. This has the unforeseen advantage of giving the texts a high coefficient of friction so that they stay in place when propped up as desk or table-tops.

The manuals are well-presented and range from novice's introduction to a micro (clearly explained definitions of phrases such as 'booting up') to an engineer's workshop manual (detailed circuit diagrams and technical specifications of the PCBs) with everything you could wish to know about the machine in between (including a guide to 8086 assembly language programming).

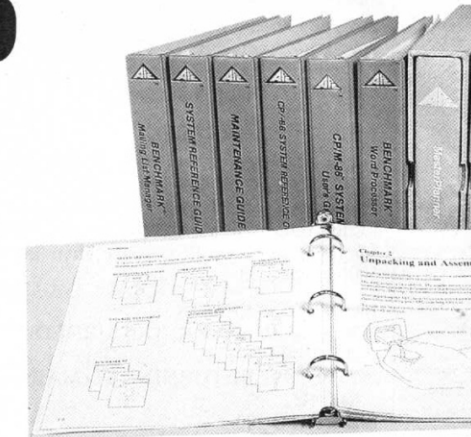
There is almost too much information and I found it difficult to find my way around such a welter. Even so, a welcome change from the paucity of useful detail that so many manufacturers see fit to provide.

Keyboard

The keyboard, like the rest of the machine, is large. An enormous coiled lead connects it to the rear of the machine and allows it to be placed up to 5ft away from the screen. All cables provided were of a generous length. It was something of a novelty to be able to set the printer up far enough away from my desk to avoid interference with telephone conversations.

The keyboard is standard qwerty but looks a bit old-fashioned compared with the superb ergonomic design and modern styling of the IBM PC or TI Professional keyboards. The keys have a pleasant feel, with a short travel and positive response, though feeling a bit functional. I asked some typists for their opinions and most were favourable.

There are 109 keys, including numeric keypad and 22 programmable function



NEC manuals and licenced software is presented in neat IBM style binders. Information is clear and complete.

keys which unusually can usually be shifted, theoretically giving 44 user or program-defined functions. In practice, however, only 32 such functions can be character strings — eg commands such as PIP B: = A:.*.[VO].

The keyboard also has a clearly labelled Backspace, Control, Tab, Escape, Delete, Insert, Clear/Home, Break/Stop, arrows, print keys and so on. The keyboard contains its own chip which is supposed to provide a 64-character buffer — rather excessive and generally not available as a 'type ahead buffer' during program operation.

At the top of the keyboard is a panel which holds a plastic grid, underneath which you can insert a strip of function key labels. Plenty of room is provided here and it is needed, given that each such key can have two functions. Unfortunately, the plastic cover does not fit well and is prone to dislodging. I tested two machines and one was better than the other in this respect — with one of them it was virtually impossible to keep the label strip in place which made using the word-processor a real bind, so dependent is it on function-key usage.

Display

The 12in screen may be monochrome (£1,985) or colour (about £2,500) and only one control — brightness — is offered. A contrast control would be a useful facility as I found character clarity not all it might have been. Nonetheless, if you want to tinker with the CRT controls such as focus or linearity the manuals provide a wealth of information.

The CRT coating is slow to respond to character deletion, giving rise to a disturbing ghosting at times, such as when doing a large DIRectory. The screen is claimed to have a special matt surface, but I found it very reflective and almost impossible to use if the machine was facing a window. It is nowhere near as good as the high-tech

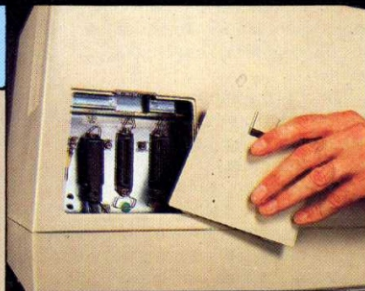


Above: The APC is solid but somewhat bulky. Right: Interfaces are neatly hidden in a compartment at the back of the machine.

screen of the Sirius but is a lot easier to clean.

The colour monitor provides eight colours and they are good. It was a novel experience to use the Metasoft Benchmark word processing package, which makes use of some of the many attribute facilities for character display.

Perhaps the most unusual display facility offered by the APC is its resolution — 1024×1024. This is not all available on-screen however, being referred to as the 'virtual graphic area'. The 'real graphic area' size is 640×475, which provides a window onto the larger resolution 'screen'.



NEC marketing manager Alan West is quoted as saying that '1983 will be called the year of business graphics'. NEC is clearly preparing to lead the field here with the APC. It will be interesting to see how

soon the Digital Research GSX system will be fully available on the APC. No graphics packages were provided for the review but some disks held GSX files, the function of which would appear to be CRT drivers, allowing emulation of such graphics terminals as the ADM-5A. Other GSX files looked as if they were designed for printer/plotter configuration.

Interest in high-resolution graphical representation of data among business users is high and companies such as Chang Laboratories are already offering programs like Graphplan, a colour graphics-oriented spreadsheet.

Also available soon will be a graphics adaptor board which will simplify graphics applications such as pie or bar charts with



Above: The APC's large and copious keyboard. The 22 function keys are labelled across the top. Below: The 8 inch disk drives — slow, noisy but capacious.

area shading and even simulated movement, if we are to believe the advertising copy.

Standard characters are composed within an 8x19 matrix and include a stick figure, miniature clock-face and even the Greek alphabet. Up to 256 customised symbols can be designed using the CHR file and these can, of course, be saved to disk. However, accessing such characters is not explained clearly. Indeed, I found this a general failing with the documentation — marvellous facilities were available, but finding out exactly how to use them proved problematic.

Alternative character sets (foreign fonts) are also provided (I particularly liked the Swedish characters), as well as a set of predefined graphics characters which can be invoked by use of either of the two graphics keys or the ALT key.

The CRT has a number of interesting facilities such as scrolling, partitioning and scrolling within defined areas, over and under-line, as well as the normal functions of flashing, highlighting, reverse video and so on. The speed at which characters are sent to the screen can be altered by pressing Control and a numeric key. This latter reminded me of early experiences using Applesoft and provided hours — well minutes — of fun. Even so, this aspect can be used to good effect in training programs.

Storage

The drives are Sanyo-made and are well-designed. The doors are opened by squeezing the flange on the drive door against the protruding lip on the machine case then releasing pressure. Inserting a disk requires you to press it home firmly against a spring locking device before squeezing the door shut. Opening the drives springs the disks out neatly.

My only criticisms of the drives are that they are noisy compared to 5¼in (and some 8in) drives used today and you have to insert disks back-to-front, ie with the label facing away from the door. Still, these are minor points and I found that I quickly got used to them.

Below each door are plastic panels labelling the drives A and B and two red lights which shine through the panels. Two may seem excessive but they provide a useful diagnostic function, the lower light being on all the time the machine is switched on, as an indication of 'disk ready'. The upper lights are lit when the disk is being accessed as is usual.

A single drive version is available at £1,875 and a 10Mb hard disk version should soon be available in the UK at about £3,690. Such low prices show NEC's determination to break into the UK market.

The drives are a bit slow. Although disk formatting time is on a par with other machines, the PIP (file transfer) facility of CP/M-86 is slower than other machines I have used. This is probably due to the high track-access time.

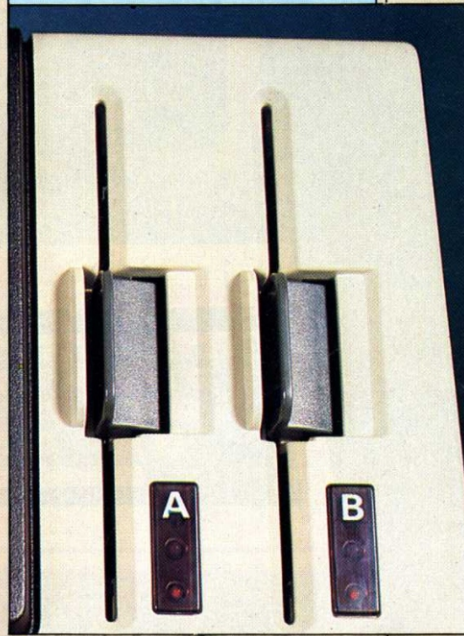
Software

NEC claims that one reason for the delay in introducing the APC to the UK was the preparation of software. NEC's chairman recently declared: 'We are now prepared to sell total business solutions'.

NEC has a licence for Metasoft's Benchmark — the word processor with which this article was written — and there is also a mailing list program by the same name. Comshare provides Masterplanner, a comprehensive business-oriented spreadsheet, and Systematics International offers a Sales Ledger under the NEC banner.

These two companies are British, a fact which underscores the chairman's recent remark that 'We have found many good UK programmers'.

Certainly the standard of most of the software I have encountered is fairly high, with clear screen formatting and instructive manuals. This is not true of the word processor, which caused me a lot of aggravation by losing documents for reasons I was unable to discover from the sparse detail of its manual. It is nowhere near as transparent or friendly as Wordstar, is slow and lacks many of that package's useful features such as changing



default drives, directory viewing, Save and Continue. I would certainly not use it from choice.

An acquaintance in the software supply industry was at first unable to install Wordstar or other standard CP/M-86 programs on the APC. However, when supplied with a revised version of CP/M-86 (version 1.107), Wordstar and other products installed easily, with the APC defined as an ADM-3A terminal. Even this paragon may have teething problems.

Expansion

The standard interfaces provided include parallel printer and an RS232C port, synchronous or asynchronous (with transmission rates up to 19,200 bytes per second). Optional extras include a second RS232C port.

ADVANCED Personal Computer??

The



from

NEC



The



from

£1985

Modest advertising is a hallmark of NEC, the leading Japanese microcomputer manufacturer, and one of the world's largest electronics companies. We can now reveal some of the secret features that make the APC something special . . .

Standard features:

- **SPEED:** Full 5 MHz 8086 16 bit processor (true 16 bit data).
- **CAPACITY:** TWO MEGABYTE professional standard 8 inch disks.
- **MEMORY:** 128k user RAM + screen RAM + system ROM + battery-backed CMOS non-volatile RAM & clock/calendar.
- **OPERATING SYSTEM:** Standard CPM-86, (MSDOS & UCSD soon).
- **HIGH RESOLUTION** 8 × 19 dot character screen definition, (25 lines of 80 characters + 26th system status line).
- **AWARD WINNING** NEC 7220 graphic chip in character mode. 256 standard character set includes maths/greek symbols. ADDITIONAL 256 USER-PROGRAMMABLE shape character set(s). £ SIGN.
- **KEYBOARD:** Fast 61 key + 25 key numeric/cursor pad + 22 dual mode function keys with labelling facility (16 of which will each hold two 15 character user-defined strings).
- **SERIAL RS-232:** to 19,200 baud synch/asynch. Parallel Centronics output.
- **PROGRAMMABLE POWER-OFF:** 2 year lithium battery. Music.
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- **COMPACTNESS:** 19 inches wide, 24 inches deep, 14 inches high.
- **PRICE:** unbelievable for the quality of this product from the minicomputer division of NEC.

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While every effort has been made to ensure the accuracy of the information provided, Xitan are unable to accept any responsibility for errors.

		CP/M-80	CP/M-86	PC-DOS
Word Processing				
WORDSTAR	MicroPro	□□	●●	*****
MAILMERGE	MicroPro	□□	●●	*****
SPELLSTAR	MicroPro	□□	●●	*****
EASYWRITER II	IUS	□□	●●	*****
EASYSPELLER II	IUS	□□	●●	*****
Data Bases And File Management Systems				
CARDBOX	Caxton	□□	□□	****
DATASAR	MicroPro	□□	□□	****
dBASE II	Ashton-Tate	□□	●	****
EASYFILER	IUS	□□	□□	****
INFOSTAR	MicroPro	□□□□	●	****
PERSONAL PEARL	Pearl Software	□□□□	●	****
REPORTSTAR	MicroPro	□□□□	●	****
RESCUE	MBS	□□□□	●	****
TIM III	Innovative S/w	□□□□	●	*
Business Systems, Financial Planning, Accounting				
CALCSTAR	MicroPro	□	□	**
EASY PLANNER	IUS	□	□	**
MICRONET	Abtex	□□□□	□□	**
MULTIPLAN	MicroSoft	□□□□	□□	**
SAPPHIRE MARS	Sapphire Systems	□□□□	□□	**
SUPERCALC	Sorcim	□□□□	□□	**
MILESTONE	Organic Software	□□□□	□□	**
GBS (General Business System)	ByteSoft	□□□□	□□	**
ISL (Integrated Stock & Ledger)	ByteSoft	□□□□	□□	**
Statistics				
MICROSTAT	Ecosoft	□	□	*

Programming Tools (Inc. Cross Assemblers)

		CP/M-80	CP/M-86	PC-DOS
ACCESS MANAGER	Digital Research	□□	●●	
ANIMATOR	MicroFocus	□□	●●	
AUTOCODE (for dBASE II)	Stemmos	□□	●●	
EDIT	MicroSoft	□□	●●	
BT-80	Digital Research	□□	●●	*
DISPLAY MANAGER	Digital Research	□□	●●	*
FORMS 2	MicroFocus	□□	●●	*
MACRO	MicroSoft	□□	●●	*
PROGRAMMERS UTILITIES	Digital Research	□□	●●	*
QUICKCODE (for dBASE II)	Fox & Geller	□□	●●	*
SID	Digital Research	□□	●●	*
SPP	Digital Research	□□	●●	*
WORDMASTER	MicroPro	□□	●●	*
XASM18 (1802)	Avocet	□□	●●	*
XASMF8 (F8/3870)	Avocet	□□	●●	*
XASM65 (6502)	Avocet	□□	●●	*
XASM68 (6800/01)	Avocet	□□	●●	*
XASM84 (8048/8041)	Avocet	□□	●●	*
XLT86	Digital Research	□□	●●	*
ZSID	Digital Research	□□	●●	*

Operating Systems

		CP/M-80	CP/M-86	PC-DOS
CP/M	Digital Research	□□	●	
CP/M PLUS	Digital Research	□□	●	
CP/NET & CP/NOS	Digital Research	□□	●	
MP/M II	Digital Research	□□	●	
CP/M-86 (IBM PC)	Digital Research	□□	●	
CONCURRENT CP/M-86 (IBM PC)	Digital Research	□□	●	

THE SOFTWARE

		CP/M-80	CP/M-86	PC-DOS
Training Packages				
HANDS-ON BASIC	MicroCal	□□	●●	
HANDS-ON CP/M	MicroCal	□□	●●	
HANDS-ON COBOL	MicroCal	□□	●●	
WP WORKSHOP	MAC	□□	●●	
FLIGHT SIMULATOR	MicroSoft	□□	●●	*
Languages				
BASIC COMPILER	MicroSoft	□□	●●	
BASIC INTERPRETER	MicroSoft	□□	●●	
BAZIC	MicroMikes	□□	●●	
C COMPILER	Digital Research	□□	●●	
CBASIC	Digital Research	□□	●●	*
CBASIC COMPILER	Digital Research	□□	●●	*
CIS COBOL	MicroFocus	□□	●●	*
COBOL	MicroSoft	□□	●●	*
FORTRAN	MicroSoft	□□	●●	*
LEVEL II COBOL	MicroFocus	□□	●●	*
MULISP/MUSTAR	MicroSoft	□□	●●	*
MUMATH/MUSIMP	MicroSoft	□□	●●	*
PASCAL/MT+	Digital Research	□□	●●	*
PASCAL/MT+ & SPP	Digital Research	□□	●●	*
PERSONAL BASIC	Digital Research	□□	●●	*
PL/I	Digital Research	□□	●●	*
XBASIC	Xitan	□□	●●	*

		CP/M-80	CP/M-86	PC-DOS
Utilities				
COPYALL	MicroMikes	□□	●	
DESPOOL	Digital Research	□□	●	
DUTIL (for dBASE II)	Fox & Geller	□□	●	
FILESHARE	MicroFocus	□□	●	
FILESTAR	MicroSec	□□	●	
MUCOPY	Wheatcroft Hards	□□	●	
SORT	MicroSoft	□□	●	
SUPERSORT	MicroPro	□□	●	
SUPERVYZ	Epic	□□	●	
SDISK (Silicon Disk)	Xitan	□□	●	

Communications

		CP/M-80	CP/M-86	PC-DOS
BSTAM	Byrom Software	□□	●	*
BSTMS	Byrom Software	□□	●	*

Graphics

		CP/M-80	CP/M-86	PC-DOS
DGRAPH (for dBASE II)	Fox & Geller	□	●	*
FASTGRAPHS	Innovative S/w	□	●	*
GSX	Digital Research	□□	●	*
GSS- Kernel	Digital Research	□□	●	*
GSS- Plot	Digital Research	□□	●	*

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STAR TREK (Vic 20)

A 16K adventure type of program with instructions. Take charge of the Enterprise and go out into space in Search of the Klingons.

With full use made of the sound and colour on the Vic and updated information displayed on the screen all the time it becomes a game of intrigue and strategy to outwit your enemy.

Using your warp engines to move around the galaxy and its 64 quadrants to find the Klingons and starbases. Repair and re-fuel your ship. Load up with torpedoes and continue your search.

The 10 levels of play will enable the game to be played in varying degrees of difficulty giving you fewer starbases and more Klingons to destroy. The more damage you receive from the Klingons in combat the more difficult it becomes to defend yourself.

A game of skill and cunning at £9.50 including p/p.

STAR RUN (Vic 20) 16K

You are the pilot of the freighter XR8 loaded with vital equipment for the satellite planet Amethos 10 which is trying to fend off an invasion of aliens from penetrating the inner galactic empire. The satellite planet has developed a malfunction in its gyroptic stabilizers which is causing the planet to spin erratically.

The aliens will try to stop you reaching Amethos 10 but should you run the gauntlet safely then you must land in a docking bay without crashing. The controls are switched over to the cursor controls or joystick.

The XR8 has two laser cannons to help defend itself and in combat the XR8 may be damaged. There are bases along the way to re-fuel and repair.

Not an easy game to play.

There are 9 levels of play and if you found Star Trek easy then this one is for you. £9.50 including p/p.

ALARIANS REVENGE

A fast moving game of wizards and goblins based on a fable. Find the amulet and its stones and save the kingdom from monsters and the evil sorcerer. A very complex game of skill and the facility to save the game to tape has been included to enable the player to re-load at any time and continue where they left off.

A 16K game using U.D.G. full colour and sound. £9.50 including p/p.

SPRITEMASTER (CBM 64)

This program for the 64 will allow the creation of graphics on the screen. This is done one at a time so that they can be changed if desired. The colours can be arranged at the same time. The sprites can be moved around the screen using cursor controls. This helps to give some idea of what the finished creation will look like in certain positions on the screen. It also gives an idea of what the created character will look like in motion.

The sprites can be saved as data to some designated high line numbers and merged with your own program. The program can then be re-numbered to save memory. £6.50 including p/p.

SYNTHESISER (CBM 64)

A program to turn your 64 into a full synthesiser. The range includes three octaves on the first voice. Sustain, attack and decay are used to make the sound very real.

The waveforms can be changed in mid tune by the use of the function key.

It is not even necessary to be able to read music but it helps. £4.50 including p/p.

GET YOUR CARDS RIGHT (16-48K Spectrum)

A card game based on the television series where the cards appear face down. The player must decide if the following cards are higher or lower. There is an amount of money to gamble. Wins are paid on getting all the cards right but bonuses are paid for pairs etc.

User defined characters have been used to add realism and the game is ideal for younger players (average age is 10 years). £4.00 including p/p.

PEG IN THE MIDDLE (14-16K Spectrum)

A game of solitaire with the option of horizontal/vertical moves or incorporating diagonal moves for the less experienced player. After 3 attempts to move a blind the player is asked if they want to see a solution.

All legal moves have been covered and it is not possible to cheat.

A game for all ages and not as easy to complete as you would think. £4.00 including p/p.

Peg in the Middle/Get Your Cards Right double package at £6.00 for the two.

The versatile Setcom file provided allows the user to define such factors as transmission rate, parity, length, and number of stop bits for the serial port.

The APC has a standard S100 bus and the five-card cage at the rear of the chassis (under the easily removable one-piece case moulding) can be used to hold such useful PCBs as a 32-bit maths processor, communications devices, development boards and extra RAM — up to 640K. The existing boards had clips at the tops making removal and insertion very easy — a nice touch.

At the rear of the machine is a small panel which is a bit awkward to remove. Underneath this are three D sockets for the keyboard, printer and comms devices. Cables and plugs are threaded into this compartment through a hole in the base of the machine.

In use

The APC comes with CP/M-86 as standard and NEC UK say MS-DOS should be available soon. This is curious as some of the manuals make reference to MS-DOS as a *de facto* item and it is implemented on the APC in other countries. CP/M-86 has been dealt with extensively in this and other magazines so I will not go into detail here except to say that I hope the fact that the CPU is not a real 8086 but one of NEC's own look-alike chips will not cause problems. Certainly NEC has a good track record with chips and the rest of its products seem reliable and well-designed. There are so many features that make up the unusual character of this machine that I feel there are other interesting and unusual aspects to discover.

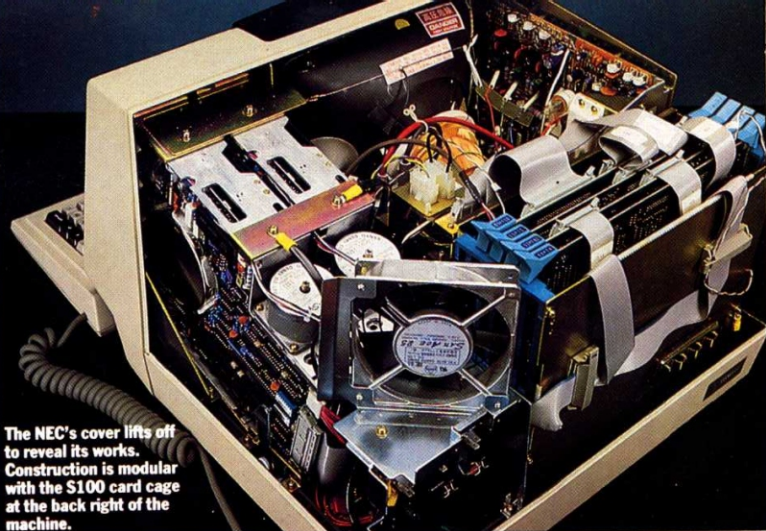
The APC has a built-in clock (powered by a lithium battery) which is used to display the current date and time on the first screen line. This is reserved during normal operation as a status line (giving an effective 26 lines on-screen) and also provides information as to whether such functions as CAPS LOCK are engaged.

The clock is a welcome addition and a relief from the tedium of machines such as the Sirius which require you to enter the date and/or time on boot-up.

The battery also powers 4K of CMOS RAM and should need replacing every two years or so. In theory it should be possible to write often-used information such as function key assignments to this store.

There is a file called POW that can be initiated remotely or locally which turns off the power to the system. This could surely prove useful, if only to give the peace of mind of knowing that the system would shut down at the end of a long run, perhaps in the middle of the night.

Another soft feature is the HELP file, which provides on-screen information about some of the CP/M-86 and APC commands, with examples if required. The contents of the information files may be altered easily. When CP/M-86 boots up it obeys any commands found in a file called AUTSTR, which allows such utilities as alternative character definitions to be loaded.



The NEC's cover lifts off to reveal its works. Construction is modular with the S100 card cage at the back right of the machine.

Couple this with the other functions mentioned here and you could easily turn the APC into a dedicated turnkey applications machine for almost any level of user in any market.

The APC can make noises — optimistically referred to as music in the manual — having a pitch range of 2-plus octaves; duration of 1/32 to whole and dynamics called piano, medium and forte accent. The demo program called BACH is little more than a pathetic reminder that single-channel noises should be reserved for user prompts when keyboard errors are committed. Those who've heard the demo music on the Torch will understand the mistake made here.

As with the majority of new machines, both 8- and 16-bit, the APC runs through a set of diagnostic routines on boot-up but these are mercifully short — especially when compared with the IBM PC, which allows you time to make a cup of coffee between morning boot-up and usability. I believe a more extensive set of system diagnostic routines called Test 82 is available, but these were not supplied for review.

Finally, the APC has a feature that I believe should be implemented in any operating system or program worth its salt. That is, if you attempt to divert data to an unconnected printer you will be prompted to retry or abort the print. How much more sensible this is than being faced with a 'frozen' system.

Support

NEC appears to be committing itself

wholeheartedly to the future of the APC in the UK, witness the fact that it is negotiating with such unlikely partners as the John Lewis Partnership, Steiger and Tesco, has established some 70 APC dealers already and plans to appoint 100 by Christmas. A maintenance contract should also be available through GEC.

Verdict

The NEC APC is an extremely impressive machine overall. In some ways it looks and feels a bit old-fashioned with its rather solid keyboard, large, heavy body and 8in drives, but with such features as its large storage capacity, graphics capabilities and built-in facilities it is very modern. If I was in the market for a 16-bit micro for business applications it would be at the top of my shopping list.

Given the level of support, its many useful facilities and low price, the APC could easily become the market leader in 16-bit micros and to my mind represents the best value for money on the market today.

PRICES (ex VAT)

APC, 128K, monochrome, single disk	£1,875
APC, 128K, monochrome, twin disk	£1,985
APC, 128K, colour, twin disk	£3,118
Monochrome graphics subsystem	£396
Colour graphics subsystem	£687
128K expansion board	£437
128K RAM for above	£125

SPECIFICATION

Price	£3,118 (see box for breakdown)
Processor	8086, 5MHz
RAM	128K-640K
Text screen	80x25, 8 colours, programmable character set
Graphics screen	(optional) 640x475, 8 colours, NEC 7220 graphics processor
Keyboard	109 keys, detached, numeric pad, cursor cluster, 22 function keys
Storage	2x 1Mb 8in floppies
Interfaces	RS232, parallel printer, 5 expansion slots
Operating system	CP/M-86
Distributor	NEC, 164/166 Drummond St, London NW1, 01-388 6100

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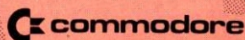
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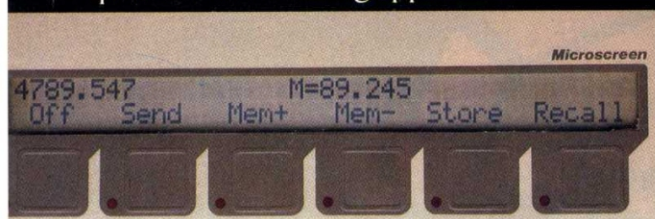
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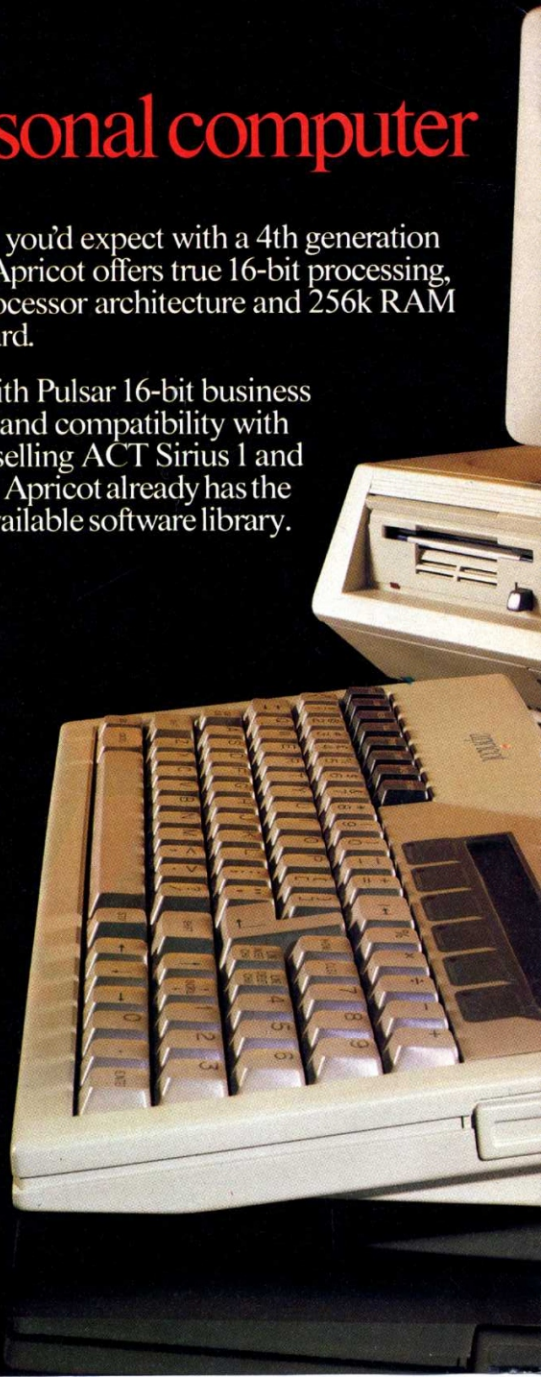
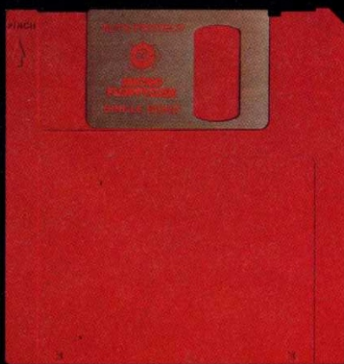
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MUMMIES & MONSTERS

COMMODORE 64

Horrible halls

Name Halls of Death **System** Commodore 64 **Price** £8 **Publisher** Supersoft, Winchester House, Canning Road, Wealdstone, Harrow HA3 7SJ **Format** Cassette **Language** Machine code **Other Versions** None **Outlet** Mail order and most dealers.

'Tell me, Sir Archibald, you've treated many strange maladies in your time, but do you have any idea how to cure a case of Mummy Rot?' The answer to this question would be of more than fleeting interest if you had played Halls of Death.

Objectives

Six floors of rooms and caverns await your exploration. The sole objective is to collect as much treasure as you can and get out again, richer and wiser than when you first entered. You will need strength and sorcery in your perambulations. The halls contain many monsters, not the nicest of which is a mummy, inflictor of the aforementioned rot.

Finding various artefacts increases your powers, and while there are greater prizes down in the nether regions, it is there that the nastier monsters congregate in the hope of shredding a passing bold adventurer or two.

There are only a few commands to memorise, all being single key depressions. You need to be nimble on the

keyboard since the game is played in real time — any attacking monster is not going to drum its fingers while you make up your mind whether to slice or spell-bind it. Orders include attack, swing a sword, cast a spell, and move around the halls.

In play

A split screen display provides the data on your progress. The greater part is taken up with a plan of the current level, which is updated as you progress. At the top of the screen is a message area telling you what is in the room.

When you encounter one of the inhabitants, the window expands to show you and the enemy approaching each other for combat. Both figures look distinctly undernourished — disconcertingly, the troll so resembled Beaker (of Muppets fame) that I could scarce bring myself to attack. A message area at the bottom of the screen handles battle orders and commentary.

If either is killed, the appropriate figure does a slow backward slide and falls to the horizontal position. Casting a spell causes the scene to flash. Retreating has you slowly backing away — if you're lucky.

Verdict

The split screen use of animated figures and the variety of encounters make it a very enjoyable game — but I've gone off mummies.

Bob Chappell

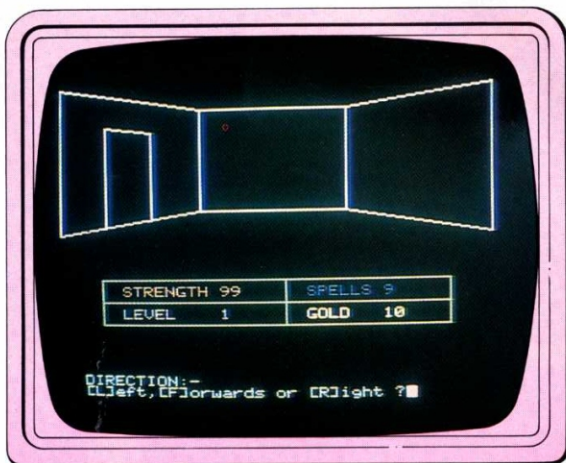
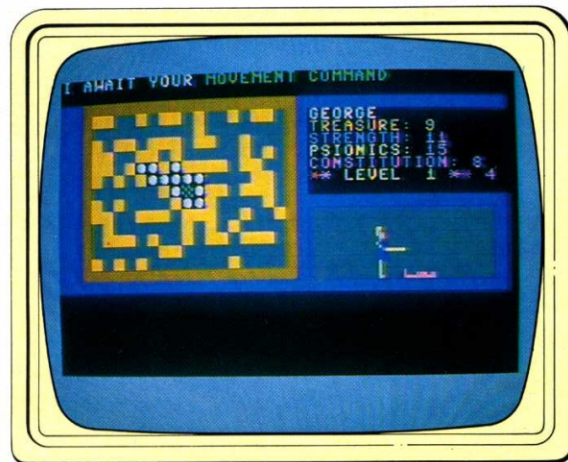
RATING

Lasting appeal

Playability

Use of machine

Value for money



COMMODORE 64

A spell inside

Name Sword of Fargol **System** Commodore 64 **Price** £20.75 **Publisher** Epyx Inc, Sunnyvale, California **Format** Disk **Language** Basic and machine code **Other Versions** Vic 20 (cassette) **Outlets** Mapsoft Ltd, Unit A, Oak Road South, Hadleigh, Benfleet, Essex SS7 2BB, 0702 554002.

A multi-level dungeon, populated with ghouls, ghosts and long-legged things awaits you. Treading a precarious path through the maze of darkened tunnels and caves, prepare to meet a variety of monsters and hazards in your search for the famed sword. This quest combines graphics and fantasy, and provides ample helpings of magic, mystery and mayhem.

Objectives

Overcoming all perils, your quest is to seek out the Sword of Fargol, which lies somewhere between the 15th and 20th level of the dungeon. You begin your journey equipped only with a smattering of spells, skill and strength. You can add to these attributes by defeating nasties, finding goodies, and making donations to your neighbourhood temple.

Once you have found the sword, you have 33 minutes to get the heck out of there as every baddie and its brother will be gunning for you.

In play

A title page with suitable mediaeval lettering is displayed, to the strains of lute-like music. Your attributes and

possessions are shown just before you start at the first level.

You may well bump headlong into a monster out for a stroll. Monsters are shown as tiny sprites, each having a different appearance. Unless you have a 50in TV, you are unlikely to make out all of the detail. Human nasties resemble you, except their sword is in the other hand. Battle is met by you jumping on the enemy or the enemy on you.

Text messages and scores are displayed in mediaeval characters. Occasionally some messages disappear before you have time to digest them.

Traps cause rocks to fall on your head, pits to open beneath your feet, bombs to go off by your ankles and teleports to zoom you off to other levels.

Stairs are there for descent or retreat. When moving to another level (or playing a new game), the locations of everything are randomly juggled around. Since most of the program is in Basic, this leads to a wait before the program lets you continue your journey. Every few moves some sinister chords throb out, rather like an old mystery movie. This adds to the atmosphere, but as everything stops while the chords play, it soon gets a bit irritating.

Enchanting weapons and beacons may be discovered, as can magical maps which light up a whole level.

Verdict

An absorbing fantasy game, just the thing for a wet winter's night. Nice graphics and easy to play.

Bob Chappell

RATING

Lasting appeal

Playability

Use of machine

Overall value



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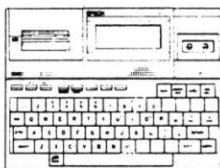
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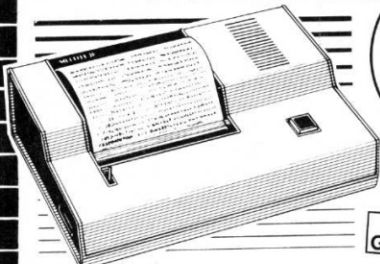
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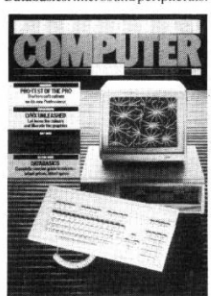
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BACK ISSUES

Issue 11, March 11-18.
Pro-Tests: Apple's Lisa, Text TX8000; Spectrum speech synthesiser, Apple printer, Commodore network; 3D on Spectrum, graphs package for Apple and IBM, BBC graphics system.
Features: computer chess, Occam parallel processing language, Vector/Sirius function keys.
ProgramCards: Towers of Braham (Pascal), Biorhythm (Apple II), Roman Year (Apple II), Shape Utility (Apple II).
Gameplay: Darts, Soccer (Atari); Castle of Riddles (BBC Model B); Pimania (Spectrum); Flight Simulator (IBM PC).
Databascs: micros and peripherals.



Issue 2, March 18-25.
Pro-Tests: Toshiba T100, Casio PB100, ZX81/Basicarc, Vic speech synthesiser, Spectrum headset, IBM graphics, BBC word processing.
Features: Colecovision, micro backgammon, nursery computing.
Gameplay: Ultima II (Apple), Trader (ZX81), Starquest (Vic 20), Hungry Horace (Spectrum).
ProgramCards: String editor (Spectrum), Analogue Clock (BBC Model B), Chart generator (Spectrum), String extract/replace.
Databascs: full software listings.

Issue 3, March 25-April 1.
Pro-Tests: TI Professional, Apple speech synthesiser, Facit 410 printer, IBM keyboards, Pepspeed compiler, Sirius toolkit, Dragoncalc.
Features: Atom upgrade, Lynx programming, Apple music.
Gameplay: Mangrove (Vic 20), Mutant Herd (Vic 20), Compendium (Dragon), Patience (Spectrum), Noughts and Crosses (Dragon), Great Britain Ltd (Spectrum), Ulysses (IBM PC).
ProgramCards: Magnify (Spectrum), Spider (Vic 20), Firing Range (BBC).
Databascs: micros.
Micropedia: Anatomy of the BBC, part 3.

Issue 4, April 1-8.
Pro-Tests: Pied Piper Communicator, Olympia ESW3000 printer, Namsal Superwriter, Commodore Calcesult, Spectrum Pascal, Cashbook (BBC).
Gameplay: Dark Crystal (Apple II), St George (Dragon), Wizard War (Dragon).
ProgramCards: Fruit Machine (C64), Tunsmith (Oric), Array Editor.
Databascs: peripherals.
Clubnet: Clubs and user groups.
Micropedia: Go Forth, part 1.

Issue 5, April 8-15.
Pro-Tests: Commodore 700, Ikon Hobbit, 1-2-3 (IBM), ZX81 machine code.
Features: speech packs, monitors.
Gameplay: Grand Prix (Dragon), Derby Day (Spectrum), Deadline (Apple).
ProgramCards: Wacky Racers (Oric), Fruit Machine (C64), Parse Interger.
Databascs: Software.
Clubnet: full list of user groups.
Micropedia: Go Forth, part 2.

Issue 6, April 15-22.
Pro-Tests: Tycom Microframe, IBM PC, Scorpio Disks, Dragon sound module, ZX81 graphics, Bottom Line Strategist (CP/M), PaperClip word processor.
Features: IBM PC DOS, BBC word processing, PC 1251.
Gameplay: Mined Out (Spectrum), Transylvanian Tower (Spectrum), Lunar Leeper (Apple II), Evolution (Apple II).
ProgramCards: Wacky Racers (Oric), Mortgage Comparison

(Sharp MZ80K), Computer Set Up (BBC), Day of Week.
Databascs: micros.
Micropedia: Graphics, part 1.

Issue 7, April 22-29.
Pro-Tests: BBC Model Aquarius, Epson FX80, Olivetti JP101, Lisp on Spectrum, Vic 20 assembler, Supergraf on Victor/Sirius.
Features: Dealer support, Atari graphics.
Gameplay: Krakit (ZX81), Cruising On Broadway (Spectrum), Kaktus (Vic 20), Fantastic Voyage (ZX81).
ProgramCards: CBM controls, Computer Set Up (BBC), Wacky Racers (Oric), Julian Dates.
Databascs: Peripherals.
Micropedia: Graphics part 2.

Issue 8, April 29-May 6.
Pro-Tests: Atari Home Files Manager, Kobra's Vic Stat for the Vic 20, Hestacrest's Accounts for the Spectrum; Epson RX80 printer, NCR's Decision Mate V, Future Computer's FX20.
Features: Micronet, Compact programming on the TI99/4A.
Gameplay: Harvester (Vic 20), Strategic Command (Dragon 32), A first Book of Micro Rhymes (BBC), Telling the Time/Money (Spectrum).
ProgramCards: Program Indexer (BBC B), CBM Database cards 1-4, Sort Extract.
Databascs: software.

Issue 9, May 6-13.
Pro-Tests: Structured Basic on the Apple, Pixel Power on the Vic 20; Star DP510 printer, Dams and Interop interfaces for Commodore 64; Micro-Professor.
Features: BBC function keys, Atari word-processing part 1.
Gameplay: Dungeons of Intrigue (Oric), The Castle (Oric), Starship Command (BBC B), Dragon Trek, Nowotnik Puzzle (Spectrum).
ProgramCards: Lower case (Dragon 32), CBM database cards 5-6, Monster (Spectrum), Wildcard Search (MBasic).
Databascs: hardware.
Micropedia: Graphics, part 4.

Issue 10, May 13-20.
Pro-Tests: Infomast on Commodore 64, Dragon Mace, MC202 and CM1800 music synthesisers (Apple), Prism directly coupled modem; Epson OX10.
Features: ZX81 graphics part 1; Atari word-processing part 2.
Gameplay: Rescue (Spectrum), Dictator (Spectrum), Roman Empire (Spectrum), Choplifter (Vic 20), Skyhawk (Vic 20).
ProgramCards: Union Jack (Lynx), Escape (Spectrum), CBM Database cards 7-9, Evaluate (MBasic), Formula (BBC B).
Databascs: peripherals.
Micropedia: Graphics, part 5.

Issue 11, May 20-26.
Pro-Tests: BBC Vufile, PFS:File for IBM, Apple Pascal; printer comparison, Pickard Joystick Controller for ZX81 and Spectrum; C9E Computer Board.
Features: ZX81 graphics part 2, Basic on the Sharp MZ80K.
Gameplay: Motor Mania (Commodore 64), Oric Flight, BBC Music Synthesiser, Music Maker (Spectrum), Embassy Assault (Spectrum), Tobor (Spectrum).
ProgramCards: Homeward Bound (ZX81), Connect Four (Dragon 32), CBM Database, cards 10 — end.
Micropedia: Keyboards.

Issue 12, May 27-June 2.
Pro-Tests: Spectrum word processor, PFS:Report on IBM, File Handling for Colour Genie; CTI CP80 type 1 printer, TG Trackball; Sord MS.
Features: Epson Basic, Oric sound part 1, Tandy Colour graphics.
Gameplay: Mad Martha (Spectrum), Frenzy (Spectrum), Head-banger (Spectrum), Oric roundup.
ProgramCards: Election Ballot (Commodore 64), Memory Utility (BBC B), Munch (Spectrum).
Databascs: Hardware.
Clubnet: clubs (Cambridge Micro-computer Club special).
Micropedia: Disk Drives, part 1.

Issue 13, June 3-9.
Pro-Tests: Telewriter for Dragon 32, Abersoft Forth for Spectrum, GFS graphics processing system for Apple II-ii, joystick rulers; Ajile.
Features: Dragon meets Tandy, Oric music part 2, transferring Basic for Colour Genie and Genie 1.
Gameplay: Everest Ascent (Spectrum), Colour Genie roundup, Micro Maze (Jupiter Ace), Qix (Atari).
ProgramCards: Cupid (Oric), Alien (Dragon 32), Time Bomb (Atari).
Databascs: peripherals.

Issue 14, June 10-15.
Pro-Tests: Apple Accelerator II board, Modula-2 (Apple II), OricBase, Joystick Control Unit J6, Kempston Centres Interface, BBC Speck Synthesiser.
Features: Newbrain Basic part 1, Sirius designing.
Gameplay: Ah Diddums (Spectrum), Monopole (Commodore 64), Automonopoli (Spectrum), Dragon dramatics.
ProgramCards: Time Bomb (Atari, cont), Sheep Drive (BBC B).
Databascs: Software.
Micropedia: Spectrum, Part 1

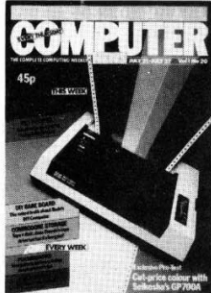
Issue 15, June 16-22.
Pro-Test: Coms 355, Address Manager (Spectrum), Sysres (Commodore 64), MST Database (Epson IX-20), Voice Input Module (Apple II).
Features: Newbrain Basic part 2, Genie scene.
Gameplay: Cleared for Landing, Playing the Ace (Apple II), Vultures, Star Jammer (Dragon 32).
ProgramCards: Mover (BBC B), Sprite Clock (Commodore 64), Pirate Island (Atari, 3 of 9), Micro-mind (Colour Genie), Brickbat (Dragon 32).
Databascs: Hardware.
Micropedia: Spectrum, part 2.

Issue 16, June 23-29.
Pro-Tests: Atari v Acorn, word processing for the Commodore 64, Simplifile (CP/M), MPF-II printer, Z80 Pack for BBC.
Features: ZX81 Maths, US mail order, Atari graphics.
Gameplay: Computer Scrabble (Spectrum), Education (BBC), Horace and Spiders (Spectrum), Catcha Snatcha (Vic 20).
ProgramCards: Video Titrer (TI99/4A 3 of 6), Bowling (Spectrum), Pirate Island (Atari cont).
Micropedia: Spectrum, part 3.

Issue 17, June 30-July 6.
Pro-Tests: Duet 16, The Organizer (CP/M), Trace and ZX Text (Spectrum), Juki 6100 daisywheel, Videx Ultra Term (Apple II).
Features: Leasing part 1, Atari screen action.
Gameplay: Oric chess, Grand Master (Commodore 64), Escape from Orion (BBC), Jet Pac (Spectrum), The Ring of Darkness (Dragon 32), Spectrum spectacle.
ProgramCards: Video Titrer (TI99/4A cont), Pirate Island (Atari cont) Word processor (BBC).

Micropedia: Sound, part 1.
Issue 18, July 7-13.
Pro-Tests: Tandy 100, RS232c interface (ZX81), ROM pager (Commodore), Interface printer buffer, IBM Personal Basic, Spectrum assembler, Newbrain WP.
Features: Leasing Part 2, Lynx music.
Gameplay: Spectrum Backgammon, BBC Snooker, Commodore 64 round-up, Serpentine (Vic 20), Pst (Spectrum), Spectrum Safari.
ProgramCards: Word Processor (BBC), Fruit Machine (Spectrum).
Micropedia: Sound Part 2.

Issue 19, July 14-July 20.
Pro-Tests: 16-bit chips, Stock control (Epson HX20), Mailplus (Torch), Smith-Corona daisy-wheel, ZX81 word processing.
Features: Insurance, buying second-hand.
Gameplay: Escape MCP (C64), Escape from Perilous (Atari), Apple round-up, Temple of Apsahi (C64), Airline (Spectrum), Heathrow (Spectrum).
ProgramCards: Colour Code (Atari), Wreck (Dragon).
Micropedia: Sound, part 3.



Issue 20, July 21-July 27.
Pro-Tests: Rade bareboard, Vic digital tape drive, Seikosh colour printer, Toolkit (Spectrum), Bonus (Pet payroll), Newbrain monitor.
Features: Computer art, Dragon scrolling.
Gameplay: Rabbit Trail (TI99/4A), Aztec Challenge (Atari), Vic 20, TI99/4A; BBC round-up, Joust (Spectrum), Molar Maul (Spectrum), Print Shop (Spectrum), Time-Lords (BBC).
ProgramCards: Tumbler (Oric), Wreck (Dragon), Atari Errors, Speed Race (Vic 20).
Micropedia: Sound, part 4.

Issue 21, July 28-August 3.
Pro-Tests: BBC graphics, Newbrain assembler, BBC turtle, Oric printer, Triumph printer.
Gameplay: Franklin's Tomb (Dragon), Hummer House of Horror (Spectrum), Jumpman (64), Jumping Jack (Spectrum), Fourth Encounter (Vic), Cyclons (64).
ProgramCards: Collection (Vic), Bomber (64), Definer (BBC).
Micropedia: Sound, part 5.

Issue 22, August 4-August 10.
Pro-Tests: Spectrum Forth, BBC graphics, Music synthesiser, IBM plotter, Brother daisywheel, Maltron keyboard, Mupid.
Features: Genie assembler, Dragon machine code.
Gameplay: River Rescue, Oric Attack (Atari), Zork (64), Knot in 3D, 3D Combat Zone (Spectrum), Moria (Oric), Velnor's Lair (Spectrum).
Micropedia: CPM part 1.

Issue 23, August 11-August 17.
Pro-Tests: Sord Basic-G, Tasword, BBC microapps, Microdrive, Tandy Model 4.
Features: Dragon machine code, Atari controllers.
Gameplay: Bridge Master, Styx, Manic Miner (Spectrum), Atari roundup, Candy Floss/Hangman (Oric), Wizard (Dragon).
Micropedia: CPM, part 2.

Issue 24, August 18-August 24.
Pro-Tests: T-Maker III, Spectrum Fifth, daisywheels surveyed, Spectrum digital tracer, Laser.
Features: Videotex, Dragon machine code.
Gameplay: Oric roundup, Cookie, Egg Farm, Xadom (Spectrum), Sea Lord (BBC), Lusitanic (Dragon), The Island (64).
Micropedia: Commodore 64, part 1.

Issue 25, August 25-August 31.
Pro-Tests: Electron, Simons Basic, Oric monitors, Microdrive.
Features: Newbrain map, Acorn Atom, Dragon machine code.
Gameplay: Suspended (64), Terror (Dahhis), Atanz (Dragon), Dragon roundup, Jogger (Oric), Frogger (IBM).
Micropedia: Commodore 64.

Issue 26, September 1-September 7.
Pro-Tests: Microtan 65, BCPL, BBC tracer, 80 column Pet, Oric interface.
Gameplay: Magic Mountain, Smugglers Cove (Spectrum), Spectrum roundup, Matrix (64), Ninja Warrior (Dragon), Dallas, (Oric), Call to Arms (IBM).
Micropedia: Commodore 64.

Issue 27, September 8-September 14.
Pro-Tests: Sharp MZ700, BBC Lisp, Apple editor, IBM mice, ZX81 surgery.
Gameplay: Zip Zap, Zoom (Spectrum), Spectrum roundup, Hover Bover, Benji-Space Rescue (64).
Micropedia: Dragon, part 1.

Issue 28, September 15-September 21.
Pro-Tests: Zenith Z100, Snail Logo, Atari Supergraphics, Newbrain CPM, IBM mice.
Gameplay: The Witness, Super Scramble, Stix (64), Harrier Attack (Oric), Morocco Grand Prix (Dragon), Pharaoh's Tomb (Spectrum).
Micropedia: Dragon, part 2.

Issue 29, September 22-September 28.
Pro-Tests: Portico Miracle, Dragon editor, BBC toolkit, Dragon drives, Apple light pen.
Features: HX20 disassembles, TI transformations.
Gameplay: Griddler, Gloopert, California Gold Rush (64), Oric roundup, Bomb Alley (BBC), Splat, General Election (Spectrum).
Micropedia: Dragon, part 3.

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AIRPLAY

BBC B

A sky old time

Name 747 Flight Simulator System
BBC B Publisher Doctor Soft **Price** £6.95 **Format** Tape **Outlets** Mail order.

The BBC has been crying out for a good flight simulator for a long time. Doctor Soft's 747 Flight Simulator is one of the best. And unlike Molimerx's Jumbo, which is text only, 747 gives you a screen representing the layout of the cockpit that recreates the real thing.

Objectives

The aim is to take off in a 747 and land it at either Heathrow or Gatwick. To aid your navigation you have on-board radar that can lock onto beacons along the route.

If flying from one airport to another is too much of a challenge, you can make a couple of quick circuits of the airport and land where you started from. There appears to be no limitation to the duration of your flights, as there is no fuel limit.

You will soon learn the importance of mastering the controls and getting the take-off and landing speeds right to ensure a successful flight.

In play

You start off with the plane on auto-pilot. A touch on the + key turns up the power and you roll down the runway

gathering speed. As you do so the airport buildings flash by the windows. At around 120 knots and power at 1.50 you rotate and lift off.

To set a course for Heathrow you lock your navigation aids onto Ockham beacon. Flying over it you start your landing approach. Throttling back on the power and putting the flaps out slows down the plane (not forgetting to lower the landing gear).

Drop the power level to around 1.03, and with flaps full out the plane drops. You should aim to slow the plane to around 140 knots to land it successfully.

I say 'should' because my first landings were far from successful. The radar showed I was on course and the runway loomed up. Suddenly, the plane drifts to the right, I overshoot the runway and crash to the sound of a large explosion.

Verdict

As a computer model of the real thing, this is the best flight simulator around that runs on the Beeb. Add in good graphics and reasonable sound effects and the game is a must for all budding pilots. You will soon be 'up, up and away', handling the world's largest aeroplane in a way that will give even professional pilots air sickness.

Kevin Williams

RATING

Lasting appeal



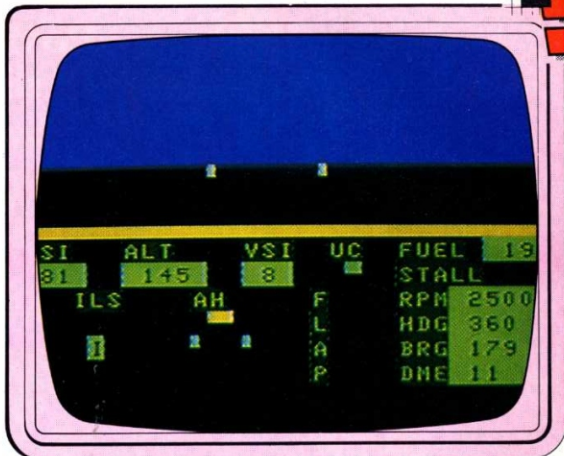
Playability



Use of machine



Overall value



DRAGON 32

Clouds of witless

Name Dragonfly System Dragon 32
Price £6.95 **Publisher** Hewson Consultants, 60a St Mary's Street, Wallingford, Oxfordshire OX10 0EI (0491-36307) **Format** Cassette **Language** Basic **Other Versions** None **Outlets** Mail order.

Yet again it's time to try one's hand at what is mistakenly called a Flight Simulator. In my case the description should invariably be a Crash Simulator.

Objectives

This Basic program gives you two options, both of them beginning with you stationary on the runway of Norwich airport.

The cassette is well-presented, with three pages of instructions plus a simple diagram to illustrate what angles of heading and bearing are.

In play

Doubts begin even before you taxi down the runway. Having said yes or no to the joystick (which takes the place of the arrow keys for nose up, nose down or banking left or right), you then see that the wind is blowing from 290°. This is 10° more than the cassette insert says, but no matter.

You must then input the wind strength from 0-5... or rather the wind strength, which is what the screen actually says. The instructions then tell you to press the F key for flaps down, while the insert says the E key.

Now I don't know if I dislike flight simulators because I'm no good at them or if it's the other way round, but I do know that if I'm going to crash a plane then it ought to be for a legitimate reason.

Having attained maximum RPM and seen my altitude (or attitude) increase to seven feet I raised my undercarriage. Crash. 'Undercarriage raised on ground.' Oh well, seven feet is obviously too low, try again. Next attempt was at fourteen feet. Crash. 'Undercarriage raised on ground.' Taking no chances I then waited till I was over 80ft in the air. Crash.

Later attempts did manage to raise the undercarriage, though I don't know in what way they were different from previous efforts, but I do know that my 'attitude' meter was distinctly wonky. Even when leaving the ground at maximum revs of 3,000 as recommended, and the Up arrow key being pressed to increase the rate of climb, the altitude would inexplicably and suddenly drop from 100ft to 50ft.

Verdict

My verdict is affected by simultaneously looking at Microdeal's Space Shuttle, published at the same time as this. Comparisons are inevitable, though in fact there is no comparison. This bears as much resemblance to Microdeal's excellent program as Norwich airport bears to Cape Kennedy. No offence, Norwich.

Mike Gerrard

RATING

Lasting appeal



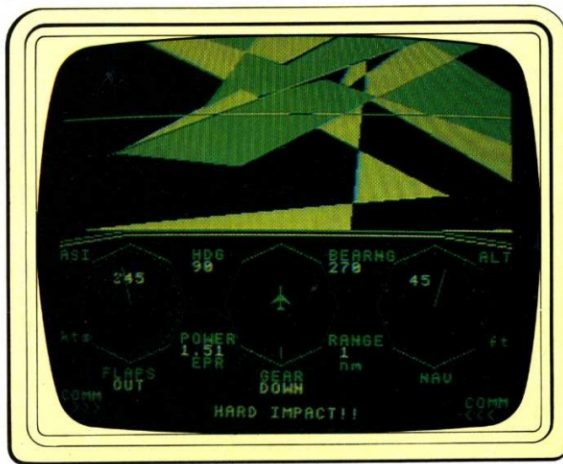
Playability



Use of machine



Overall value



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and the special 3D glasses provided with each game.

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CUES AND CLUES

BBC B

Chemical solution

Name Forensic System BBC B **Price** £5 **Publisher** Worm Software, 76 Hurstwood Road, New Oscott, Birmingham **Format** Cassette **Outlets** Mail order.

Learning should be fun. Not surprisingly, software companies are writing educational programs that are played like other computer games. Often it is impossible to decide where the boundary line is between games and educational software. This program comes close to falling into that grey area, so if you thought chemistry was deadly boring, read on.

Objective

Forensic is an educational game that requires you to solve a murder using chemical analysis. You are given details of alibis and results of chemical tests carried out on the suspects' clothing.

The tests carried out are: flame tests; reaction with hydrochloric acid; reaction with barium chloride; reaction with silver nitrate; action of heat; chromatography.

You play the part of the forensic officer. You can get help from the program, and this basically tells you how to play the game. In the help section are all the tests and what they signify. When you have finished the tests you have to make out a report.

In play

The whole game is menu driven with the various prompts made quite clear. The way I went through the game was to start with the case.

I then went through the suspects' alibis. These include chemical clues of what to look for. After the suspects come the tests; these can be taken in any order. Most of the tests just give you the results, but the chromatography test actually draws what happens in a chromatography test. (This is much better in colour).

After all this I filled in my forensic report, answering the various questions and filing the facts. The computer then tells you whether you've cracked the case or not. If you're wrong you have to go away and try again. If you are correct then you get a time and you go on the scoreboard. Oh, by the way there is a give-up option if you get frustrated (yes, I used it once or twice).

Verdict

This is quite an educational game as it teaches you the chemical tests and characteristics for various substances. Personally I found the game quite difficult, but then I was never very good at chemistry. Come to think of it, I'll never be a detective either. With more practice at this game, though, I should improve.

Ken Garroch

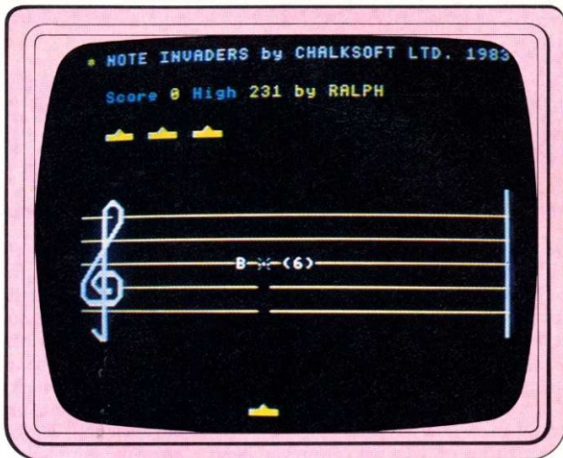
RATING

Lasting appeal

Playability

Use of machine

Value for money



BBC B

Score a tune

Name Note Invaders System BBCB **Price** £?? **Publisher** Chalksoft, Lowmoor Cottage, Tonedale, Wellington, Somerset (082 347 71170) **Outlets** Mail order.

Have you ever wanted to learn to sight-read music, or do you find teaching—or being taught—music boring? Well here's a package of programs that could solve the problems.

Objectives

The cassette contains three programs. On one side is a game called Note Invaders, which is a musical variation on the over-worked theme. On the other side are Staff 1 and Staff 2. Their aim is to help you understand how music is written.

In play

Staff 1 introduces you to the musical staff (pronounced 'stave') and the treble clef. The program is in the form of a lesson, though not a very long one. It starts out by drawing the staff and clef and telling you what they are for.

It then introduces the notes and plays each one while drawing them onto the screen. To help you remember these notes, two sets of mnemonics are given. Every Good Boy Deserves Football—in my day he deserved favour, but times change—and the well known FACE.

That about wraps it up for the lesson so the program chains the next one. In Staff 2 you are

presented with a test, or competition. It can be used by one pupil or by a group of pupils with teacher supervision.

If a group uses the program, it becomes a competition. The pupils are asked to enter their names, then to identify 20 notes, each of which is presented on the screen and played. At the end of each pupil's turn a score is put into a table and the next pupil has a go, giving a list of how good they all are. The program can also be used by one person, in which case you play against yourself.

Note Invaders is an educational game that teaches you to identify notes on sight.

The object of the game is, of course, to get as high a score as possible. The more you play the game the better you get. It can be played with either the bass or treble clef.

In play a staff is drawn on the screen and a note is moved from left to right across it. To shoot down the note, all you have to do is press the note's name on the keyboard. If you get the wrong name then the note changes into a letter and you get a bomb dropped on you.

Verdict

All in all this is a useful educational aid for schools, or for anyone wanting to learn sight-reading.

One problem I found was that on a green monitor there were times when the instructions were a little difficult to read. On a colour monitor there was no problem at all.

Ken Garroch

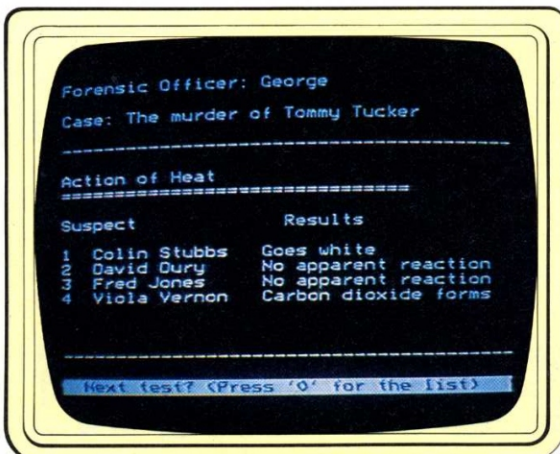
RATING

Lasting appeal

Playability

Use of machine

Value for money



Forensic Officer: George
Case: The murder of Tommy Tucker

Action of Heat

Suspect	Results
1 Colin Stubbs	Goes white
2 David Dury	No apparent reaction
3 Fred Jones	No apparent reaction
4 Viola Vernon	Carbon dioxide forms

Next test? (Press '0' for the list)

PCN ProgramCards

This week ProgramCards presents games for the Oric-1 48K and the ZX-81 16K.

The ZX81 program, from Michael Corral of Wexford in Ireland, is a version of a game last seen on the old 8K Commodore Pet. The object is to retrieve gold from an ancient underwater temple. There are a lot of these around, so all you 81 owners should know how to play.

For those of you who've never been diving for gold, here are a few hints. You are the commander of a micro-submersible, which you control using your computer. The controls are up, down, right and left (cursor keys). The main problem, and there always is one, is that there is a disabled UFO lying on the sea bed, not far from the temple.

The occupants of this Underwater non-Floating Object (probably the ubiquitous aliens) don't seem to like you salvaging the gold. To this end, they try and stop you from getting the gold by firing guided missiles at you.

Once you reach the temple, you have to position yourself to get the gold. Meanwhile another missile has been launched and is homing in on you. The missile will either follow you into the temple or destroy it. Fortunately the temple is equipped with a force-field, which can protect you from the missile (those ancient were very clever old ancients). The only places you are safe are in the ships hold or (perhaps) on the sea surface.

The Oric program, from Richard Bower of Nottingham, turns you into a composer — well almost. You type in the notes, by name (A, B# etc) along with the note length. This length is actually the relative note length, ie if one beat equals one then half a beat is 0.5. When the tune is played back, you have control over the envelope and the speed of the piece.

The program also allows you to print out the notes you have entered to the screen. This then allows you to use the edit function in the program to alter notes you

have entered. The total length of the piece can be 1000 notes, including rests and long notes. When all this is done and you are satisfied with the piece the PRINT option prints the notes to the screen as note names. These can then be transferred to music paper.

Don't forget the PCN Win an Electron Competition at the Personal Computer World Show, see below.

If you have a program that you have written and that you think others would like to use, why not send it in to ProgramCards? Just send a cassette or disk with your program on. If possible send some notes on how the program works and a listing. We pay for all the programs we publish according to originality, good programming and length. All cassettes and disks will be returned as soon as possible, after going through our referee system, at our expense. Send them to: Programs Editor, PCN, Evelyn House, 62 Oxford Street, London W1A 2HG.

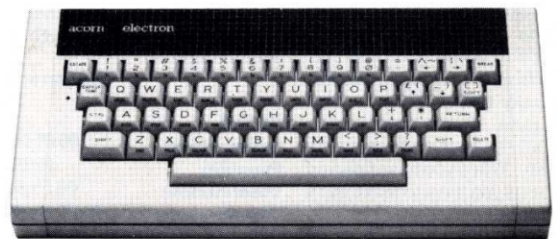
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To enter the competition simply cut out the coupon below and give it to the adjudicator on the PCN stand, which is No 101 on floor A Lower at the Barbican Centre in London.

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You'll find more details of the PCW Show in next week's issue of PCN, on sale at the Barbican as well as at your local newsagent. There's a bonus, too. PCN's writers will be on hand to offer advice on microcomputing problems.

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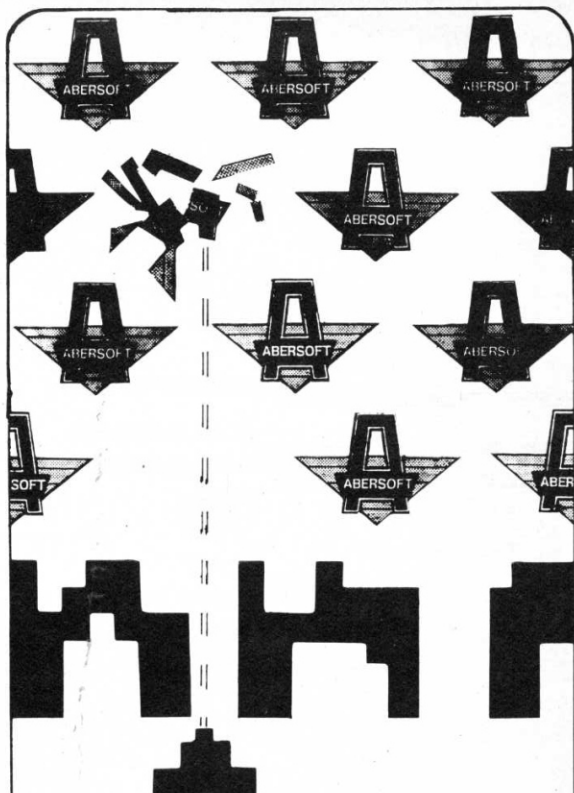
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```

100 REM MICHAEL CARROLL (1983)
400 GOSUB 9999
4010 POKE 16410,B
4020 GOSUB 9999
4030 LET SC=0
700 PRINT AT 0,25;SC
701 LET O=0
800 LET F=0
801 POKE 16410,0
100 FOR A=4 TO 21
110 PRINT AT A,0;"
120 NEXT A
130 PRINT AT 22,0;"
135 PRINT AT 4,0;"
140 PRINT AT 01,0;"          "AT 20
"          "AT 10,0;"          "
150 PRINT AT 00,0;"          "AT 19,
"          "AT 18,0;"          "
160 "          "AT 17,0;"          "AT 2,5;"
161 "          "AT 3,0;"          "
165 LET P=PEEK 16396+256*PEEK 1
6397
    
```

```

170 LET D=0
180 LET B=1
190 POKE 16410,B
200 POKE 16410,B
201 IF A=0 AND RND>.5 THEN GOTO
202 GOSUB 2010
203 GOTO 190
210 INKEY A=10
220 INKEY B=11 AND A=2
230 INKEY C=12 AND B=3
240 INKEY D=13 AND C=4
250 IF INKEY C="0" THEN LET F=1
260 IF INKEY D="0" THEN LET F=0
270 IF F THEN POKE P+(21*33)+30
280 POKE P+(A*33)+0,140
290 POKE P+(A*33)+0,100
300 IF NOT F THEN POKE P+(21*33
)+30,100
310 IF ABS A=19 AND ABS B=31 TH
EN LET O=1
320 IF ABS A=3 AND ABS B=11 AND
O AND INKEY B="L" THEN GOSUB 100
3
270 RETURN
    
```

40	Gosub and print picture of the temple		that points to the beginning of the display file	210	Submersible controls
50	Gosub and print title and instructions	170-180	Set up vars A and B giving the start position	220	subroutine Get up, down keys
60	Set the score to zero	190	Put an inverse= in the display file at D-FILE+110	230	Get horizontal controls and alter B accordingly
70	Print score on the screen		Put filled block char into the display file at D-FILE+110	240	Control to turn the force field on
75-80	Initialise variables	200	Decide whether to fire a missile	242-244	Control to turn the force field off
100-120	Print the sea depths		Gosub and check the subs controls	250	Flash the submersible
130-135	Print the sea surface	205	Jump to 190 to continue	255	If F is true i.e. the field is on then print it by the temple
140	Print the ship	208			If sub is in the temple then set O=1, which gives you the gold
150-160	Print flying saucer and temple				
165	Get address held in D-FILE	209			

```

1000 LET SC=SC+10
1010 PRINT AT 0,25;SC
1015 LET O=0
1020 RETURN
1030 REM FIRE MISSILE
1040 LET D=10
1050 FOR S=00 TO 15 STEP -1
1060 POKE P+(S*33)+0,101
1070 GOSUB 9999+(S*33)+0,100
1080 NEXT S
1090 FOR S=13 TO 32
1100 IF D=1 AND D<20 AND S<29 T
HEN GOTO 4000
1110 GOSUB 2010
1120 LET D=D+(A*D)-(A*D)
1130 IF D<4 THEN LET D=#
1140 POKE P+(D*33)+0,101
1150 POKE P+(D*33)+0,100
1160 IF ABS D=A AND ABS S=B THEN
GOTO 3000
1170 IF F=1 AND D=21 AND S=29 TH
EN GOTO 5000
1180 NEXT S
1190 GOTO 190
1200 PRINT AT 10,0;"YOU HAVE BEE
N HIT
BY A GUIDED
MISSILE..."
    
```

```

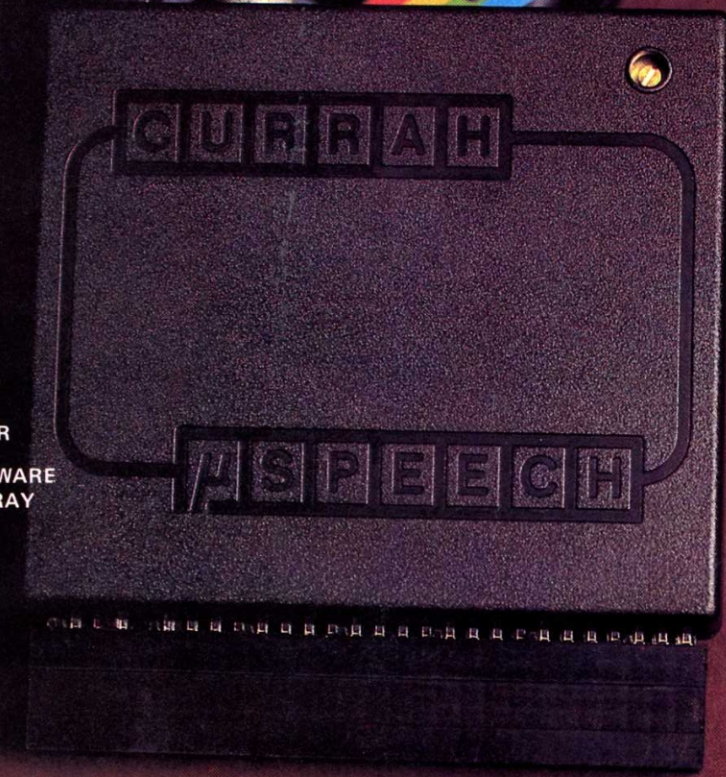
3010 LET Z#=""
3020 PRINT AT 10,0;Z#
3030 LET Z#=(Z#+(O TO )+N*(1)
3040 IF INKEY#="N" THEN STOP
3050 IF INKEY#="Y" THEN GOTO 60
3060 GOTO 3020
4000 PRINT AT 10,0;"THE TEMPLE H
AS HIT BY A GUIDED MISSILE AND
HAS DESTROYED... THE MISSION
HAS BEEN CALLED OFF."
4010 GOTO 3010
4020 LET F=0
4030 GOTO 190
4040 PRINT "ZX81 SEARCH
-----
    
```

```

9010 PRINT "TWO STRANGE OBJECTS
HAVE BEEN
LOCATED BY SONAR ON
THE OCEAN FLOOR.
UNDEERBATH THE OCEAN
RESEARCH VESSEL "DE
FINANCE"
9020 PRINT "LONG RANGE SCANNERS
INDICATE A SUBSTANTIAL QUANTITY
OF GOLD IN AN ANCIENT TEMPLE.YO
U ARE TO LOCATE AND SALVAGE A
S MUCH OF THIS GOLD AS YOU CAN
    
```

1000-1020	Subroutine executed when gold is in the ship Increases the score and sets the gold possession var O to 0	2054	Check to see if missile has hit the temple	2090	Keep moving the missile until it has hit something or runs out of power
2000	Fire missile subroutine	2055	Gosub to submersible controls subroutine	2100	Missile runs out of power, continue at 190
2005	Set position of missile	2060	Make missile a guided one	3000-3060	Print you have been hit and ask if another game is wanted
2010-2030	Print missile movement out of flying saucer	2061	Don't let missile surface	4000-4010	The temple has been hit
2035	Gosub to submersible controls subroutine	2062-2064	Print the missile	5000-5010	Turn off force field
2050	Begin the missile chase	2080	If this IF is true then you have been hit by a missile	9000-9210	Introduction and instructions subroutine
		2087	Check to see if the missile has hit the force field, if so then turn off the field		

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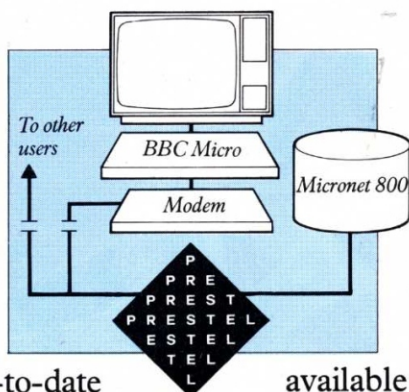
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PCNProgramCards

Card 3 of 4 Search

ZX81
8330SE3/4

```

9030 PRINT " ALSO ON THE SEA-FLO
OR THERE IS THE WRECKAGE OF A FL
YING SAUCER, THE OCCUPANTS OF WHI
CH WILL TRY TO STOP YOU BY LAUNC
HING GUIDED MISSILES AT YOU."
9040 PRINT " YOU HAVE A RADIO TR
ANSMITTER WHICH WAS FOUND NEAR
THE TEMPLE. THIS WILL OPERATE A
FORCE FIELD WHICH WILL DESTROY A
NY MISSILES FOLLOWING YOU ALONG
THE SEA-BED."
9050 PRINT AT 21.0: "PRESS NEW
LINE TO CONTINUE..."
9060 INPUT U$
9070 CLS
9080 PRINT " YOUR MINI-SUBMARINE
CAN PASS THROUGH THIS FIELD UN
DAMAGED, BUT IF ANY MISSILES ATTE
MPT TO TRACK YOU THROUGH THE TEMP
LE DOOR THEY WILL BE DESTROYED AN
D THE FIELD WILL BE TURNED OFF."
9090 PRINT " THE GOLD IS IN THE
UPPER PART OF THE TEMPLE. TO LOC
ATE THE GOLD YOU MUST PILOT YOUR
VEHICLE THROUGH THE TEMPLE DO
OR AND UP BESIDE THE ""C"" MAR
KER."

```

```

9100 PRINT " TO UNLOAD THE GOLD
BRING THE SUBMARINE INTO THE S
HIP WHERE IT STARTS OFF AND PRESS
""L""."

```

```

9110 PRINT "PRESS NEWLINE TO
CONTINUE..."

```

```

9120 INPUT U$

```

```

9130 CLS

```

```

9140 PRINT "YOUR CONTROLS ARE
-THE CURSOR KEYS (5,
6,7,8) FOR LEFT,DOWN,UP AND RI
GHT."

```

```

9150 PRINT " ""9"" TURNS ON THE
FORCE FIELD."

```

```

9160 PRINT " ""0"" TURNS THE FOR
CE FIELD OFF."

```

```

9170 PRINT " ""L"" TO UNLOAD GOL
D."

```

```

9180 PRINT "PRESS NEWLINE
TO CONTINUE..."

```

```

9190 INPUT U$

```

```

9200 CLS

```

```

9210 RETURN

```

```

9500 PRINT AT 21.0: "
"; AT 20.0: "
";

```

9500-9590 Draw the introduction temple

PCNProgramCards

Card 4 of 4 Search

ZX81
8330SE4/4

```

9510 PRINT AT 19.0: "
"; AT 18.0: "
"; AT 17.0: "
";
9520 PRINT AT 16.0: "
"; AT 15.0: "
"; AT 14.0: "
";
9530 PRINT AT 13.0: "
"; AT 12.0: "
"; AT 11.0: "
"; AT 10.0: "
";
9540 PRINT AT 9.0: "
"; AT 8.0: "
";
9550 PRINT AT 7.0: "
";
9560 PRINT AT 6.0: "
";
9570 PRINT AT 5.0: "
"; AT 4.0: "
"; AT 3.0: "
"; AT 2.0: "
"; **
9575 POKE 16416,0
9580 PRINT AT 22.0: "
";
9590 PRINT AT 23.0: " PRESS ""C
"" TO CONTINUE..."

```

```

9600 FOR A=21 TO 18 STEP -1
9610 PRINT AT A,14: "
";
9620 NEXT A
9630 PRINT AT 17,14: "
";
9640 PRINT AT 2,15: "
"; AT 2,15: "
"; AT 2,15: "
";
9650 IF INKEY="" THEN GOTO 9640
9660 PRINT AT 20,0: "
";

```

```

9670 FOR A=21 TO 19 STEP -1
9680 PRINT AT A,15: "
"; AT A,15: "
"; AT A,15: "
";
9690 PRINT AT A,15: "
"; AT A,15: "
";
9700 NEXT A
9710 PRINT AT 18,15: "
";
9715 FOR V=1 TO 3
9720 FOR A=0 TO 5
9730 UNPLOT 22,A
9740 UNPLOT 23,22,A
9750 PLOT 22,A
9760 PLOT 23,22,A
9770 NEXT A
9780 NEXT V
9790 PRINT AT 25,0: "PRESS ANY KE
Y TO CONTINUE..."
9840 IF INKEY="" THEN GOTO 9840
9850 RETURN
9860 SAVE "P"
9899 RUN

```

9600-9820 Print patterns on entrance of temple
9830-9850 Press key to begin the game
9998-9999 Routine to auto-run the game on loading

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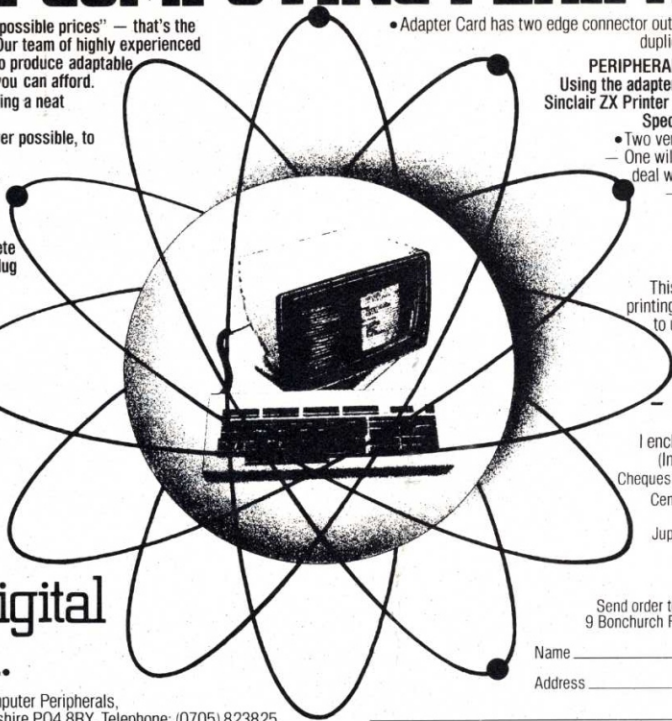
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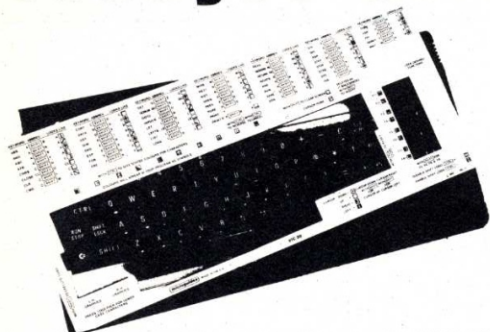
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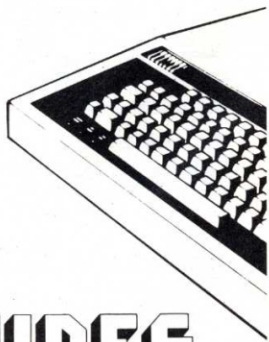
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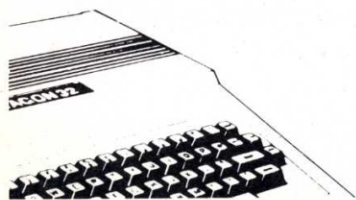
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PCN Program Cards

Composer

Card 1 of 11

8330C01/11

Oric 1 48K
Oric Basic

Application: Music
Author: Richard Bower

```

0 RESTORE:FOR I=1 TO 42:READ DTA#:NEXT I
1 TEXT:GOSUB 10000:REM CHARACTER DEFINITIONS
2 DOKE 621,48000:POKE 623,27:CLS
3 GRAB:HIMEM#B400
4 DIM NT$(1000):DIM NT(1000):DIM RL(1000)
5 DIM OC(1000):PAPER7:INK0
6 GOSUB 6000:INSTRUCTIONS
7 REM ** PRINT STAVE & NOTES **
20 A1#=CHR$(137)+"#####%##"
30 A2#=CHR$(137)+"#*"("###"
40 A3#=CHR$(137)+"-+....."
50 A4#=CHR$(137)+"/012345 "
51 CLS
55 PRINTA1#:CHR$(136);" A ,A#,B ,C ,C#,D REST"
60 PRINTA2#:CHR$(136);" D#,E ,F ,F#,G ,G#"
65 PRINTA3#:PRINTA4#
70 OA=14:OD=3
75 PLOT 35,3,144
80 DOKE 621,48920:POKE 623,4
90 CLS:COUNT=1
100 GOSUB 1000
110 COUNT=0
120 REPEAT
140 COUNT=COUNT+1
150 RESTORE
    
```

0	Reset the data pointer and read the first 42 pieces of data	3	Get memory for user use	90	Clear the window
1	Switch to text mode and gosub and redefine characters	4-5	Dimension the various notes holding arrays	100	Gosub to change octave routine
2	Set the screen size and position in memory then clear the screen	20-50	Set up strings	120	Begin the loop
		51-65	Print staff and notes	140	Increment the note count
		80	Set up screen window	150	Place the data pointer to point to the data at line 991

PCN Program Cards

Composer

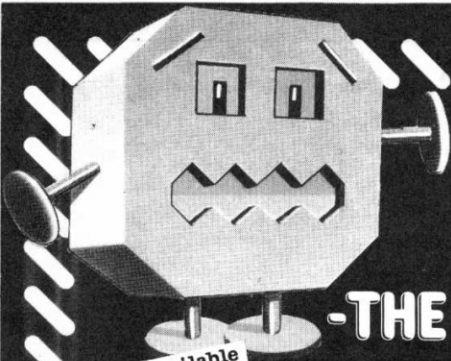
Card 2 of 11

8330C02/11

```

151 C$=STR$(COUNT-1):C#=MID$(C$,2,LEN(C$)-1)
152 IF LEN(C$)=1 THEN C$="00"+C$
153 IF LEN(C$)=2 THEN C$="0"+C$
155 LIN=170:
156 X=150
158 PLOT 36,3,C#
160 CLS:INPUT"which note ";N$
161 REPEAT
162 READ OPT$,DTA
163 IF OPT#=N$ THEN LIN=DTA
164 UNTIL OPT#="END"
165 IF LIN<>170 THEN GOSUB LIN:GOTO X
170 REPEAT
180 READ DTA$,DTA
190 IF N#=DTA$ THEN NT$(COUNT)=N$:NT(COUNT)=DTA
200 UNTIL DTA#="REST"
210 IF NT$(COUNT)<>N$ THEN PRINT"Note not known":WAIT 100:GOTO 150
220 INPUT"Note length (relative)";RL(COUNT)
222 IF CHNG=0 THEN OC(COUNT)=OC(COUNT-1)
223 IF NT(COUNT)=99 THEN NT$(COUNT)=" ":GOTO 230
224 PLAY 1,0,1,100*RL
225 MUSIC 1,OC(COUNT),NT(COUNT),12
226 CHNG=0
230 WAIT 10*RL(COUNT):PLAY 0,0,0,0
300 UNTIL COUNT > 998
310 GOTO 60100
    
```

151-153	Format C\$		get appropriate line number	220	Get relative note length
155-156	Set up variables, default line number and restart line number	165	Execute the subroutine if not at 170 and then goto number X	224-225	Play the note
160	Note prompt	170-200	Get the appropriate note if user input is not a command	230	Delay and switch the off note
161-164	Check input against the data statements at 991 onward and	210	Check whether note is valid	300	Keep getting notes until the number of notes exceeds 998
				310	Jump to run out of notes routine



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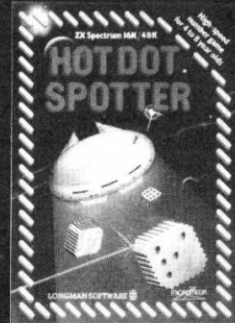
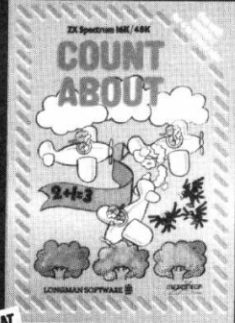
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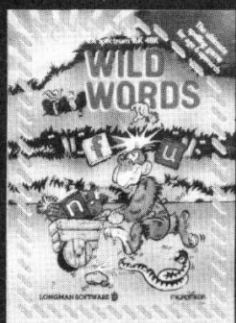
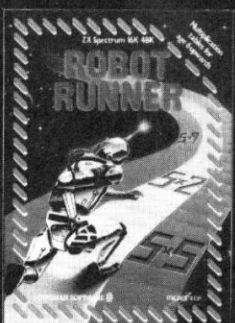
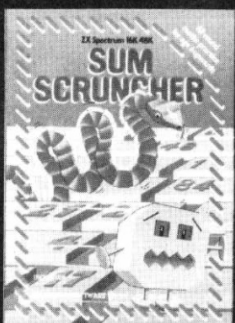
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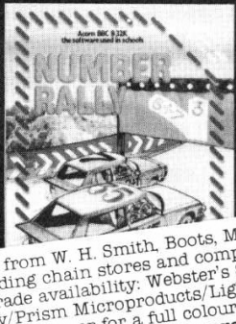
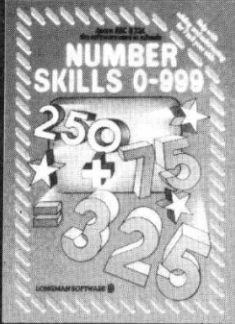
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PCNProgramCards

Composer

Card 3 of 11

8330C03/11

```
625 PRINT"LETTER(sign),e.g. A or D# .           ":PRINT
900 REM OPTION DATA
991 DATACHANGE,1000,DELETE,2000,PLAY,2100,PRINT,3000,HELP,6500,EDIT
,5000
992 DATAINSTRUCTIONS,6000,END,60000
995 REM NOTE DATA
996 DATA C,1,C#,2,D,3,D#,4,E,5,F,6,F#,7,G,8,G#,9,A,10
997 DATA A#,11,BB12,REST,99
999 REM **
1000 :REM CHANGE OCTAVE
1005 CHNG=1
1010 PRINT"Which OCTAVE "
1020 PRINT"(0-6) ":GET OC#
1030 OC=VAL(OC#)
1040 IF OC<0 OR OC>6 THEN 1020
1050 OC#=" Octave-"+OC#+CHR$(151)
1055 PLOT 11,3,CHR$(144)+CHR$(130)+CHR$(136)
1060 PLOT OA,OD,OC#
1065 OC(COUNT)=OC
1070 RETURN
1999 REM * DELETE *
2000 COUNT=COUNT-1
2010 PRINT"Note deleted"
2050 X=150:GOSUB 60300
2060 RETURN
```

991-992	Option data	1065-1070	Set the octave for the next set of notes, and return
996-997	Note data		Note delete routine. Decrement the current number of notes
1000	Change octave subroutine	2000	Gosub and reset the display if necessary
1010-1040	Prompt for, get and check the octave	2050	
1050-1060	Change the current octave display		

PCNProgramCards

Composer

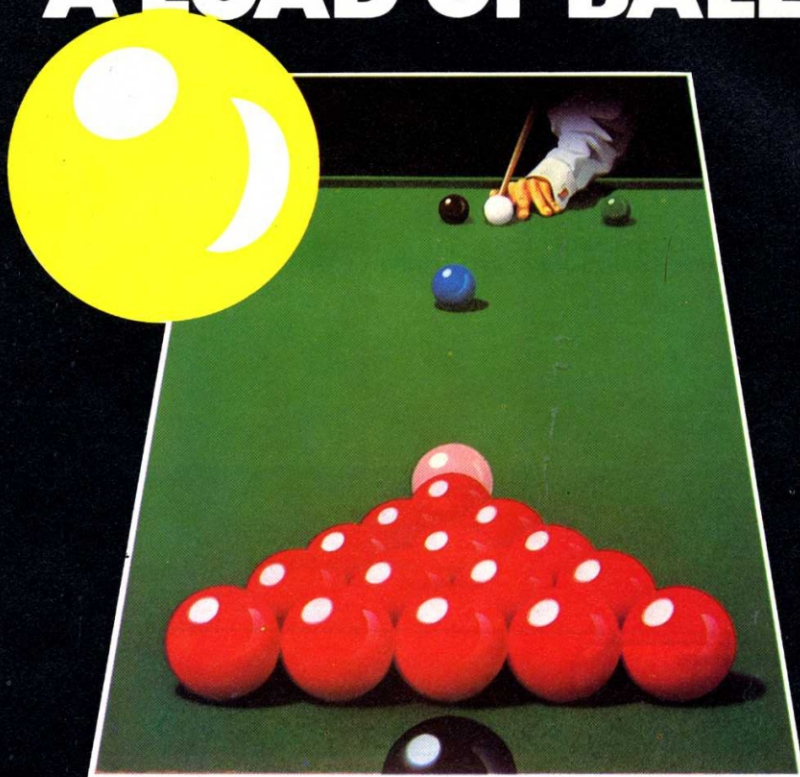
Card 4 of 11

8330C04/11

```
2100 REM **      PLAY      **
2105 CLS
2110 INPUT" Tone channels on-see P.100";TNE
2120 INPUT" Noise channels -as tone channels";NOISE
2130 INPUT" Envelope mode";MODE
2140 INPUT" Envelope period";TME
2150 PRINT:PRINT:PRINT:INPUT" Basic note length";BNL
2160 CLS
2200 REM ** THE TUNE **
2210 FOR TUNE=1 TO COUNT-1
2220 PLAY TNE,NOISE,MODE,TME
2225 IF NT(TUNE)=99 THEN 2300
2230 MUSIC 1,OC(TUNE),NT(TUNE),0
2240 MUSIC 2,OC(TUNE),NT(TUNE),0
2250 MUSIC 3,OC(TUNE),NT(TUNE),0
2300 WAIT BNL*RL(TUNE)+1
2370 C#=STR$(TUNE ):C#=MID$(C#,2,LEN(C#)-1)
2380 IF LEN(C#)=1 THEN C#="00"+C#
2390 IF LEN(C#)=2 THEN C#="0"+C#
2400 PLOT 36,3,C#
2410 NEXT TUNE
2998 RETURN
```

2105	Clear the window
2110-2150	Get note parameters
2210-2350	Play the tune as far as it goes

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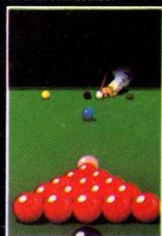
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Which book would your micro want you to buy? PCN's review page helps you choose.



"Teach yourself Electronics" by W P Jolly, published by Hodder and Stoughton at £2.95 (paperback, 212 pages).

It's possible to spend a lifetime merrily computing away without being aware or interested in the most basic level on which a computer works or without knowing a diode from a triode.

Diodes, triodes emissions and injections are the stuff electronics books are made of. This one does the job well by going right back to basic physics

and working steadily through modulation and bandwidth to components like amplifiers and transistors. It ends up appropriately enough at integrated circuits and microprocessors.

These days many people will be interested in working their way back, as it were. Micros are no longer the preserve of the technically qualified. Many people, having grasped programming will want to know how it all actually works, and this book could provide the answers.

It's clearly written, takes nothing for granted and is nicely paced so you can keep your brain in step as the pages turn. **TS**

'The VOR' by Tom Lonergan and Carl Frederick, published by Hayden at £7.50 (paperback, 120 pages)

There's a lot of good to be found in books which fall into the classification 'pop-science', but it's also true that a little knowledge can be a dangerous thing.

The VOR, (which is not about bellicose people with funny accents) is a book which

provides the latter. Perhaps 'dangerous' isn't quite the word — since the subject, building a robot, sounds pretty harmless — but misleading.

It seems that the VOR (Volitionally Operant Robot) project is somehow connected with the magazine Omni, since the result, OMNIVAC — a name lifted from Isaac Asimov — appeared on the Omni TV series.

According to the bookjacket, it's about 'the design and creation of a computer-con-

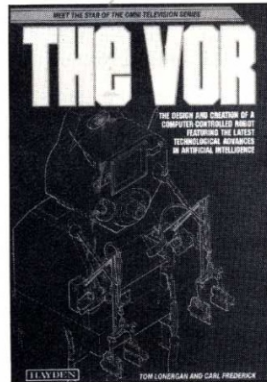
trolled robot featuring the latest technological advance in artificial intelligence.'

The fact is, the book is little more than a who-said-what-and-when account of some meetings and TV shows, all totally swamped by a lot of platitudes couched in fancy language. The object is evidently to make the reader feel he's getting real red meat.

For example: 'Problems arising in a real world environment, however, tend to be more complex than in a game environment'. This translates as: 'It's harder to do it for real, than to pretend'.

The designers wanted (or were told to make) a machine which would be at least recognisably people-shaped, and having decided that, fell into the trap of thinking that by making something that looks intelligent/human, you'll wind up with something that is intelligent/human.

Finally, do not buy this book on the assumption that it will teach you how to build a computer-controlled robot. It won't. **RK**



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Clubnet keeps you in touch with enthusiasts throughout the country. It is divided into clubs and user groups and a list of each is published on alternate weeks.

This week it is the turn of clubs, which are listed alphabetically by county and town.

Competing Essex

Part of the fun at the Brentwood Microcomputer Club has been a series of competitions that were introduced recently.

There have been two so far. The first, for Sinclair machines only, was to design an elephant — on screen only, we trust. This proved a great success, and was followed up by one to create a program with a holiday theme. The competition for the best program written on one line is currently being planned.

The club started up last September on the initiative of Ray Sadler and Allan

Holland, among others. It started with a membership of 30, meeting every two months, but has proved so popular that the club now meets on the third Monday of every month.

The meetings take two forms. Every other month there is a lecture or demonstration lasting around an hour, with a break, and then the gathering is given over to general club activities. The other meetings are user-group nights.

The club has three user groups, for the Sinclair Spectrum, Commodore machines and the BBC.

On the evening PCN visited the club, 60 of the 76 members were present.

If your association has something special on the agenda or if you've just started a new one, contact us at *Clubnet, Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HG.

Our Clubnet report this week focuses on Brentwood Microcomputer Club.

Most of the members are quite young, but John Osborn, the Club's vice-chairman, feels it is a great pity there is not more response from schools. 'We would like teachers to come along and have more liaison.' John sees the club probably ending up as an umbrella for the user groups, but all the organisers want to see the educational aspect emphasised.

'The competitions get the boys thinking,' said Don Clarke, leader of the Spectrum group.

Janice McKenzie

Name Brentwood Microcomputer Club **Venue** The Co-op Hall, Kings Road, Brentwood, Essex **Meetings** Third Monday in the month **Contact** Allan Holland on 0277 221620

CLUBS

AVON

Berkeley Nuclear Laboratories Club. Contact Neil Walker, 53 Wolfridge Ride, Alveston, Bristol, 0454 414262.

Bristol Micro Computer Club. Meets at the Pavilion, Southend Road, Filton, Bristol, every other Tuesday. Darryl Collins, 60 Mackie Rd, Filton, Bristol BS12 7NA, 0272 792982.

Bristol Format 40/80 Disc Club, for BBC disk users. Contact Peter Hughes, Format 40/80 Disc Club, c/o The Lending Library, Five Marshal Street, Bristol BS1 4AA.

Multi-User Club Valerie Boyde-Shaw, Nailsea 851337.

Worcester Computer Club. Meets at Woodsprings Inn Functions Rooms on alternate Mondays at 7-10.30pm. H Bennett, 0934 514902 or F Feeney, 0934 833122.

BEDFORDSHIRE

Bedford Amateur Computer Club. Meets at Star Rowing Club, Bedford, on the first and third Tuesday of month 8pm. Rwan Bird, 74 High Street, Great Barford, MK44 3LB, 0234 870763.

Chiltern Computer Club. Meets at Five Bells, Eaton Bray, Near Dunstable, Leighton Buzzard on second and fourth Monday of each month. Contact Steve Betts, 42 Wallace Road, Eaton Bray, 0166 2DF, 0525 220922.

Luton College Computer Club. John Rodger, 0582 3411.

Luton Computer Club. J P Fletcher, 1 Trowbridge Gardens, Luton, LU2 7JY, 0582 450687.

BIRMINGHAM

Birmingham Amateur Computer Club. Meets at Free Church Hall, Land Lane, Marston Green, Birmingham on first and third Thursday of each month at 7.30pm. Contact Les Moore, Secretary, Wolverhampton 725340.

BUCKINGHAMSHIRE

Aylesbury Computer Club. Meets at Quarrendon Youth Club every Friday at 7.30pm and at Mandsville County Secondary School the first Thursday of each month at 7pm. Ken Knight, 22 Mount Street, Aylesbury, 0296 5181.

Chiltern Microcomputer Club. Meets at the Garden Centre, School Lane, Chalfont St Giles, on the first Wednesday of each month. Mrs W Tibbitts, Elwood, Deanway, Chalfont St Giles. 024 07 4906.

Iver Computer Club. P A Seal, 1 Ormonde Flats, Church Road, Iver Heath, 0753 652792.

Iver Computer Society meets at Huntsmore room, Iver Village Hall on the second and fourth Thursday every month at 7.30. John

Haigh, 141 Leas Drive, Iver, SL0 9RP.

CAMBRIDGESHIRE

Cambridge Microcomputer Club, meets on the third Wednesday of month. Derek Tripp, 3 Spurgeons Avenue, Waterbeach. 0223 315662.

Peterborough Personal Computer Club meets at Crosfield Electronics Social Club, fortnightly on Mondays. Andrew Pike, 0733 44342 after 5pm.

CHESHIRE

Altrincham Computer Club. Meets at N. Cestrian Grammar School, Durham Road, Altrincham, fortnightly. Martin Hickling, 39 Barrington Road, Altrincham, WA14 1HZ, 061 941 4547.

Brunei Computer Club. Meets at St Werburgh Community Centre on alternate Wednesdays at 7 to 10pm. Mr R Simpson, 4 The Coats, Stockwood.

Chester Computer Club. Contact W Collins, 37 Garden Lane, Chester. Cheshire.

Crew Computer Users Club meets at Buffaloes Club, Earl Street, Crewe, on the third Thursday of each month at 8pm. Bram Knight, 0270 623375.

Holmes Chapel Micro Club meets at Leisure Centre, Holmes Chapel at 7.30 to 9.30pm on the first and third Tuesday of month. Margaret Baker, 1 Helton Close, Crewe. 0477 34238.

Kinder Peel Computer Club meets at Bew Mills School every Monday. John Eary, New Mills 43870.

Kettleshulme National Computer Buyer's Club. Send SAE to Barry Edwards, Laneside House, Paddock Lane, Kettleshulme, nr Stockport, Cheshire.

New Mills & District PCC meets at New Mills School, fortnightly on Fridays at 7 to 9.30pm. Mr G M Flanagan, 11 Sundown Close, New Mills, Stockport, SK12 3DH, 0663 44051.

Northwest Computer Club meets fortnightly. John Lightfoot, 13 Aston Drive, Frodsham, Warrington, WA6 7PU. 0728 31519.

Northwest Computer Club, weekly meetings. Tom Wyatt, 29 Summer Lane, Halton, Runcorn Cheshire WA7 5PG. Runcorn 77545.

Mid-Cheshire Computer Club meets at Winsford Library on the second Friday every month at 7.30pm. Simon Sadler, Winsford 53339.

Stockport Software Exchange Club. Send SAE to P Redford, 53 Cavendish Road, Hazel Grove, Stockport, Cheshire.

CLEVELAND

Cleveland Micro Club meets on the second and third Tuesday of each month, under 18s on second of month, over 21s on third Tuesday of month. J Telford, 13 Weston Crescent, Norton.

Stockton Amateur Computer Club meets at YMCA, Stockton, each alternate week at 7-9pm. Peter Cheshire, 60 Croft Road, Eaglescliffe, Stockton-on-Tees, TS16 0DY.

CORNWALL

Cornish Radio Amateur Club — Computing Section. Bob Reason, 24 Mitchell Road, Camborne.

Cornwall Area PAICC meets at the

Penzance Micro Centre every Friday. S Zenith. Hayle 754845.

St Austell Computer Club and Computer Town meets at ECIP Labs, Penpewan Road, fortnightly on Mondays at 7.30pm. N G Day, 2 Cilendale Close, St Austell.

CUMBRIA

Ambleside Computer Club. Contact Jeremy Westerner, 8 Hill Top Road, Ambleside, Cumbria, Tel: Ambleside 2452.

DERBYSHIRE

Derby Micro Society meets at Littleover Church Hall, Sheperd Street, first and third Thursday of each month at 7pm. Frank Taylor, 0332 559334.

Glossop Computer Club. John Dearn, 2 Spinney Close, Glossop.

DEVON

Brixham Computer Users Club. Meets at Computer Systems (Torbay), Pump Street, Brixham, Saturdays at 2.30pm. Ian Chipperfield, 22 Brookdale Court, Brixham, Devon (Brixham 59224).

Computers Against the Bomb. Contact Paul Couchman, 29 Clifton Place, North Hill, Plymouth, Devon.

Exeter & District Computer Club meets at Exeter School, Magdalene Road, Exeter, on the second and fourth Tuesday every month. T G Holden, 14 Greenville Avenue, Teignmouth, TQ14 9NT.

Exeter & District Amateur Computer Club meets second Tuesday every month. Doug Bates, Fortescue House, Stoke Cannon, Exeter. Specialist meetings on third and fourth Tuesday.

Okehampton Computer Club. Contact Cheri Graebe, Okehampton 3523, or Okehampton Community College, Okehampton 3800. Meets 7pm each Monday during term time.

South Molton Computer Club. Meets at South Molton Tool Hire, Dootson House, Cooks Cross Industrial Estate, South Molton, North Devon, each Thursday at 7pm. Contact Nick Hews on 07695 3446.

Torbay Users Computer Club meets at Devon Computers, 39 Totnes Road, Paignton on Mondays fortnightly.

DORSET

Bournemouth Area Computer Club meets at Kinson Community Centre on the third Wednesday every month. Peter Hibbs, 54 Runnymede Avenue, Bournemouth, BH11 9SE. 0202 576547.

TOPIC meets at Canteen English Truck Centre on the second and fourth Wednesday every month at 7pm. David Washford, 1 Alexander Road, Bournemouth, BH6 5JA.

Purbeck Computer Club, contact 31 North Street, Wareham, Dorset BH20 1AD.

DURHAM

Darlington Computer Club, weekly meetings. L Boxell, 8 Vane Terrace, Darlington DL3 7AT. 0325 67766.

ESSEX

Essex Computer Club. 30 Webber House, North Street, Barking.

Great Dunmow Computer Club. Contact T Coombs, 4 Oakroyal House, Oakroyal Avenue, Great Dunmow. Essex CM6 1HQ.

Brentwood Amateur Computer Club, meets

once a month. R Sadler, 18 Warescot Road, Brentwood, CM15 9HD. Brentwood 232463.

Springfield Computer Club meets on the first Friday of every month. Stephen Cousins, 1 Aldeburgh Way, Springfield, Chelmsford, CM1 5PB. 0245 50155.

Canvey Computer Club. Contact Dean Williams, 17 Mornington Road, Canvey Island, Essex SS8 8AT.

Colchester Microprocessor Group meets at University of Essex on the second and fourth Wednesday of every month at 7.30pm. Information Centre, University of Essex, near Colchester.

Colchester Computer Society. Meets at Severalls Hospital Social Club, Colchester. Contact A Potten, 14 Foxmead, Rivenhall, Witham, Essex CM8 3HD. Witham 516335.

National Westminster Personal Computer Society, 412 Eastern Avenue, Gants Hill, Ilford, P J Moore, 01-554 9699.

Stanway School Computing Club, c/o school managers at present. G Floyd, c/o Physics Department, Stanway School, Stanway, Colchester.

Modern 80 Computer Link Club, meets Wednesday evenings. Contact E Ferrant, 55 South Street, Barming, Kent, 0622 27885.

Nailsea Multi-User Club. Contact Valerie Boyde-Shaw, 0272 851337.

Romford Club, a new club. Mr D Norden, 138c Church Road, Romford.

Roundacre Micro Computer Users Club. Meets at the Roundacre Youth House, Laindon Link, Basildon every Wednesday at 7.30pm. Contact Mrs L Daden, Basildon 285119.

South East Essex Computer Society meets at Hockey Club at Roots Hall, near Southend Football Stadium on Wednesday at 7.30pm. Robin Knight, 128 Little Wakering Road, Little Wakering, Southend-on-Sea. 0702 218456.

GLOUCESTERSHIRE

British Amateur Electronics Club. Mr J Margetts, 3 Bishopstone Close, Golden Valley, Cheltenham.

Cheltenham Amateur Computer Club meets on the third Tuesday of each month at 7.30pm. Mike Pullin 0242 25617.

CHQD, D W Adam, 16 Court Road, Prestbury, Cheltenham.

Cheltenham Amateur Computer Club meets at Prestbury Scout Headquarters, on the third Tuesday of every month at 7.30pm. M Hughes, 36 Riverviews Way, Cheltenham.

HAMPSHIRE

Commodore Computer Club. Meets on the first Friday of every month at Bury House, Bury Road, Gosport at 7.30pm. Brian Cox. Fareham 280530.

Fareham and Portsmouth Amateur Computer Club. Alan Smith, c/o Francis Close, Lee-on-the-Solent, Gosport, Hants PO13 8HB. 0705 550907.

RAF Odiham Computer Club. Contact c/o Officer i/c, Royal Air Force, Odiham, Nr Basingstoke, Hants.

Southampton Amateur Computer Club meets at Crestwood Centre, Shakespear Road, Boyatt Wood, Eastleigh, Hants, on the second Wednesday of every month at 7.30pm. Paul Blitz. Chandlers Ford 69050.

HEREFORD

Hereford Amateur Computer Club, proposed new club. Stuart Edinborough, 2 Warwick Walk, Bobblestock, HR4 9TG. 0432 269700.

HERTS

Sawbridgeworth Computer Club, meets at Sawbridgeworth Parish Hall, 7pm, Fridays. M. Marwood, 38 Sayers Road, Sawbridgeworth, Herts, CM21 0EB.

HUMBERSIDE

Bridlington Microcomputer Club, Meets 7.30pm alternate Fridays at Old Star Inn, High Street, Bridlington. Contact D Complanen, 0262-601859.

Grimsby Computer Club meets at Grimsby Central Library fortnightly on Mondays at 7.30pm. Jensen Lee, 29 Park View, Cleethorpes, 0472 42559.

Scunthorpe & District Microprocessor Society meets at Community Centre, Lindun Street, Scunthorpe, every Tuesday at 7.30pm. G Hinch, 21 Old Crosby, Scunthorpe, South Humberside DN15 8PU.

KENT

Canterbury ACC proposed new club. Contact L Fisher, 21 Manwood Avenue, St Stephens, Canterbury, CT2 7AH.

Gravesend Computer Club, Meets at School Room Extra Tuition Centre, 39 The Terrace, Gravesend. Contact c/o The Extra Tuition Centre, 0474 50677.

Medway Amateur Computer & Robotics Organisation, Meets at 7.30pm on first Tuesday and third Wednesday of every month. Annual subs £5. Contact Paul Cameron, Unit 3, Walderslade Centre, Walderslade Road, Chatham, Kent, 0634-63036.

North Kent Amateur Computer Club meets at Lecture Theatre, Charles Darwin School, Jail Lane, Biggin Hill, on the first Thursday of every month at 7.30pm. Iain House, 28 Canadani Avenue, Catford SE6 3AS. 01-690 5441.

Orpington Computer Club meets at The Large Hall, Christ Church, Chaterhouse Road, Orpington, every Friday at 8pm-10.30pm. Mr R Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF. Orpington 20281.

National Personal Computer User Association, Eric Kealey, 11 Spratling Street, Manston, Ramsgate, Kent.

Sevenoaks School Computer Club, G Sommerhoff, Technical Centre, Sevenoaks School, Sevenoaks, Kent, 0732 456340.

Tonbridge & Tunbridge Wells ACC, Ray Szatkowski, 1 Cromer Street, Tonbridge, 0732 355960.

LANCASHIRE

Blackburn Micro Computer Club, Roger Longworth, 12 Sharp Close, Accrington.

Bolton Computer Club meets at E4/24 Bolton Institute of Higher Education, Deane Road, Bolton, on Thursdays. David Atherton, 16 Douglas Street, Asherton, Manchester M29 9FB. 0942 876210.

Burnley Computer Club, Meets at Burnley Technical College on Tuesdays, 7.30-11pm. Contact Clive Tallon, 27 Bassnet Street, Burnley, Lancs.

Chorley Computer Club meets at Townley Arms, Chorley, every other Tuesday at 8pm. Tony Higson, 23 Brock Road, Chorley, Lancs. Chorley 68429.

Ribble Valley Computer Club meets at Staff Canteen, Pendle Carpets Ltd, West Bradford, on the second and fourth Monday of month at 7-9pm. Contact Ian Thornton-Bryar, 25 Southfield Drive, West Bradford, Clitheroe, BB7 4TU.

Lancaster & Morecambe Computer Club, Sarah Blackler, 0524 33553.

South Chadderton Computer Club meets at Turf Lane Centre, Turf Lane, Chadderton, on Thursdays at 7-9.30pm. David Sholes, 18 Beech Avenue, Oldham, Lancs.

LEICESTERSHIRE

East Leake Computer Club, Andrew Jones, 59 Bateman Road, East Leake, Loughborough, LE12 6NN.

Hawker Siddeley Computer Club, Contact R Wrathall, 6 Naseby Drive, Loughborough LE11 0WU.

LINCOLNSHIRE

Lincoln Computer Club, meets at The Cardinal's Hat, 238 High Street, Lincoln (entrance on Grantham Street) on first and third Wednesday of each month, except August. Contact Jeffrey Joy, 23 Cross O'Cliff Hill, Lincoln, 0522 28252.

Skegness Computer Club, meets at County Hotel every other Monday, 7.30-9.30pm.

Reg Potter, 118 Beresford Avenue, Skegness, 0754 3594.

LONDON

Association of Computer Clubs, Contact Rupert Steele, 17 Lawrie Park Crescent, London SE26, 01-778 6824. National Club.

Croydon Microcomputer Club, Meets at Croydon Central Reference Library. Contact Vernon Gifford, 01-653 3207.

East London Amateur Computer Club meets at Harrow Green Library, Cathall Road, E11, on the second and fourth Tuesday of month at 7-10pm. Fred Linger on 01-554 3288.

Forum-80 London, Leon Jay, 01-286 6207.

Forum-80 Wembley, Victor Saleh, 01-902 2546.

Harrow Computer Group meets at Harrow College of Higher Education, Room W24, Northwick Park, on alternate Wednesday at 7pm. Bazyle Butcher, 01-950 7068.

Imperial College Microcomputer Club meets at room 145, level 1, on Tuesdays at 7.30pm. Tim Panton, c/o I.C. Union Office, Prince Consort Road, London SW7 2BB.

London School Computer Club, Burlington Danes School, Dane Building, DuCane Road, Hammersmith.

Metropolitan Police Amateur Computing Club meets on the first Thursday of month at 7pm. S Farley, 01-725 2428.

68 Microgroup meets at Regents Park Library, Robert Street, NW1, on the third Tuesday of month at 7.30pm. Jim Anderson, 41 Pebworth Road, Harrow, Middlesex.

North London Computer Club meets at the Polytechnic of North London, Holloway, N7 8DB, on Monday, Tuesday, Wednesday and Thursday during term time and one evening a week during holidays. Robin Bradbeer, 01-607 2789.

Paddington Computer Club meets at Paddington College, 25 Paddington Green, W2 1NB. Peter Hill, 01-723 5762.

Post Office HQ Microcomputer Club meets at room B145, River Plate House, 12-13 South Place, off Moorgate, on the second Thursday of month. Vernon Quaintance, British Telecom Enterprises, Cheapside House, 138 Cheapside EC2U 6JH. 01-726 4716.

Queens Crescent Computer Club, Meets at Queens Crescent Library, 165 Queens Crescent, London NW5, 01-485 4551.

The SOBAT Computer Club meets once a fortnight. Mr T Kayani, 12 Calderon Road, London E11.

South East London Microcomputer Club meets at Thames Polytechnic, Greens Ends, Woolwich SE18, on alternate Wednesdays at 7pm. Peter Phillips, 61 Grainger Road, SE3, 01-853 5829.

Southgate Microcomputer Club meets at Room B106 Southgate Tech, fortnightly on Thursdays at 7.30pm. Kevin Pretorius, 01-892 2282. See Prestel page 25820645.

West London Personal Computer Club meets at Back room, Fox & Goose pub, Hanger Lane, Alperton, on the first Tuesday of month at 7.45pm. Graham Brain, 01-997 8986.

MANCHESTER

Manchester Computer Club meets at the Department of Computer Science, Manchester University, Oxford Road, on the first and third Thursday of month at 7.30pm. David Wade, 061-941 2486.

Small Business Computer Users Club, Proposed new club to meet the last Tuesday of month. K Wadsworth, 061-740 7232 after 5pm.

South Trafford Microcomputer Club, Meets fortnightly. Contact Ian White, 16 Leicester Avenue, Timperley, Altrincham WA15 6HR, 061-969 2080.

MERSEYSIDE

Merseyside Microcomputer Group meets at Merchant Taylor's School, Crosby, on second Thursday month. Mr F Shaw, 14 Albany Avenue, Eccleston Park, Prescot, 051-426 5536.

Southport Computer Club meets weekly. Ian Bristone, 28 Weld Road, Southport, Merseyside PR8 2DL. 0704 64524.

Wirral Microcomputer Users Group meets at Birkenhead Technical College every Monday. J Phillips, 14 Helton Close, Birkenhead, Merseyside L43 9HP.

Wirral Computer Club, Contact Gary Metcalfe, 24 Mariston Avenue, Irby, Merseyside.

MIDDLESEX

Brigadier Computer Club, Meets on the first and third Monday of every month at

Brigadier Youth Centre, Brigadier Hill, Enfield at 7.30 pm. Subs: £2. Contact Steve Ward, 28 Brodie Road, Enfield, Middx EN2 0EU, 01-363 3786.

Micromodeller User Association, Meets three times a year. Contact Phillip Matthews, Phillip Morris House, 21 High Street, Feltham TW13 4AD, 01-751 6388.

Sunbury Computer Club meets at St Benedicts Hall, Napier Road, Ashford, on the last Tuesday of month at 8pm. Simon Taylor, 8 Priory Close, Sunbury-on-Thames, Middlesex. Simon Clark, 83 Watling Street, Towcester, Northants NW12 7AG.

ZX Micro Club, Contact Paul Hargreaves, 10 The Ride, Brentford, Middx.

NORTHAMPTONSHIRE

Corby Universal Micro Club, Meets at Lodge Park Sports Centre fortnightly on alternate Wednesdays and Thursdays. Contact Peter Wilson, 26 North Cape Walk, Corby, tel: Great Oakley 742622.

Kettering Microcomputer Club, Meets every Wednesday at 7pm. Details from Stephen Bickle on 0536 514381.

South Northants Computer Group meets at Anchor House, Moat Lane, Towcester, on Wednesdays at 7.30pm.

NOTTINGHAMSHIRE

Ashfield Computer Club meets at Carsic Junior School, St Mary's Road, Sutton in Ashfield on the first and third Thursday month. Derick Daines, c/o Cuttings Avenue, Sutton in Ashfield, Notts.

Eastwood Town Micro Computer Club meets at Devonshire Drive Junior School Wednesday at 5.45pm. Ted Ryan, 15 Queens Square, Eastwood, Nottingham NQ16 3BJ.

Nottingham Microcomputer Club meets at Castle Gate Centre, Nottingham, Monday at 7.30pm. Mr E Harvey, 68 Rosehill Avenue, Nottingham NG3 6RF. Nottingham 608491.

Workshop Computer Group, Mr Andrews, Workshop 487327.

NORFOLK

Anglia Computer User Group, Jan Rejzl, 128 Templemere, Sprowton Road, Norwich. 0603-29652.

Brecklands Computer Club, Contact Andrew Hiom, 11 Annafewes Close, Thetford, Norfolk. Meets each Saturday, 5pm at this address.

Dereham & District Computer Club, Meets at Middle School, Westfield Road, Toftwood, East Dereham on every second Wednesday at 7.30pm. Contact Mrs Fran Cook, Dereham 67732.

East Anglian Computer User's Group meets at Cromer Community Centre, Telegraph Lane, Norwich. Gill Rijzi, 88 St Benedicts, Norwich.

Yarmouth Computer Club meets each Friday at 7pm. Contact the club at Unit 26, Longs Estate, England Lane, Gorleston, Great Yarmouth, Norfolk, 0983 662871.

OXFORDSHIRE

Association of Computer Clubs, Rupert Steele, St John's College, Oxford OX1 3JP.

Microcos meets at Clarendon Lab, Parks Road, Oxford, every week during term. Rupert Steele, St John's College, Oxford OX1 3JP.

OXford Personal Computer Club, Len Phelps, Southport Cottage, Sutton Courtenay, Nr Abingdon, Oxon OX14 4AU.

Ridgeway Computing Club meets at Swan Hotel, East Isley, on the second Tuesday month. Mike Magney, Beavers, South Street, Blurbury, Didcot, Oxon OX11 0JU.

SHROPSHIRE

Ludlow & District Microcomputer Club, meets at Diocesan Education Centre, Lower Galdelord, Ludlow, on the second Monday of month at 7.30pm.

Shrewsbury Micro Club meets at Shrewsbury Shirehall once a month. Mr V Ives, 6 Bramley Close, Severn Meadows, Shrewsbury SY1 2TP.

Telford Computer Club meets at Telford ITEC on Monday 6-9pm. John Murphy, 10 Brimsley, Brookside, Telford TF3 1TF, 0952 595959.

SOMERSET

Sharp MZ80 Club, Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset.

Taunton Computer Club, meets 6pm on Tuesdays during term time at Somerset College of Arts and Technology. Contact David Elliott at Fir Tree House, Back Lane, Westbury-sub-Mendip, Wells, Somerset.

Yeovil Computer Club, D G Carrington, 2 Romsey Road, Yeovil, BA21 5XN.

STAFFORDSHIRE

Alsager Computer Club, meets at Alsager Comprehensive School, Stoke-on-Trent, Staffs, fortnightly on Tuesday. Rex Charlesworth, 09363 77270.

North Staffs Amateur Computer Club meets on the third Wednesday of each month. J Roll, 16 Hill Street, Hedsnesford, Staffordshire WS12 5DS.

ICL Birmingham Branch Micro Club, c/o WBA Ecclestone, 26 Browns Lane, Tamworth, Staffs.

Tame Valley Computer Club, Tim Marshall, 32 Milton Avenue, Leyfields, Tamworth, Staffordshire B79 8JG.

SUFFOLK

Haverhill Microcomputer Club, meets at St Marys' Church Hall, Camps Road, Haverhill, on the second, third and fourth Wednesday of month at 7.30 to 10pm.

Andrew Holliman, 5 Trinity Close, Balsham, CB1 6DW, 022 029 583.

Newmarket Home Computer Group, Meets at Anchor House, Moat Lane, Towcester, at 7.30pm. Contact Simon Clark, 83 Watling Street, Towcester, Northants NN12 7AG, 0327 52191.

Suffolk Microcomputer Club meets monthly. Mr S Pratt, c/o Microtek, 15 Lower Brook Street, Ipswich.

SURREY

Ashtead Computer Club meets on the last Thursday of month. Contact P Palmer, 8 Corfe Close, Ashtead.

Deaf Microcomputer Users Group, Contact Chris Marsh, 3 Delaport Close, Epsom, Surrey KT17 4AF.

Thames Valley Amateur Computer Club meets at Griffon, Caversham, on the first Tuesday of month. Brian Quarm, 25 Roundway, Camberley, GU15 1NR, Camberley 22186.

Uxbridge Micro Club, Dave De Silva, 316 Kingston Road, Uxell, KT19 0SU.

Farnham Computer Club, meets at Farnham 6th Form College, Morley Road, Farnham, on the second Wednesday of month. Adam Sharp, 14 Thorn Road, Boudstone, Farnham.

West Surrey Computer Club meets at Paddock Road, Green Man Public House, Burpham, Guildford, the first Thursday of month. Chris Karney, 0483 68121.

ITN Computer Club meets on Fridays. A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE, 0485 62035.

CBBS London meets on Sundays 4-10pm. P Goldman, PO Box 100a, Surbiton, KT5 8HY.

Richmond Computer Club meets at Richmond Community Centre, Sheen Road, on the second Monday of month at 8pm. Bob Forster, 18a The Barons St Margarets, Twickenham, Middlesex, 01-892 1873.

Sutton Library Computer Club meets at Central Library, St Nicholas Way, Surrey, on the first Friday of month at 6pm and second and third Tuesday of month. Dave Wilkins 01-642 3102.

Association of London Computer Clubs, Len Stuart, 89 Mayfair Avenue, Worcester Park, KT4 7SJ.

SUSSEX

Arun Microcomputer Club meets at Wick Amenity Centre, Wick Farm Road, Littlehampton, on the first Monday of month at 8pm, and first Sunday of month at 6pm. P Cherriman, 7 Talbot Road, Littlehampton, West Sussex DN17 7BL.

Brighton, Hove & District Computer Club, Meets 7.30pm every second Wednesday at Southwick Community Centre. Contact J Smith, 30 Leicester Villas, Hove, E Sussex.

CVGC Video Games Club, Contact G Bond, 7 Swift Lane, Langley Green, Crawley Sussex.

Midhurst & District Computer User Group, Meets at the Grange Centre, Midhurst, at 7pm on the second and fourth Thursday of every month. Contact Val Weston, tel: Midhurst 3876.

Mid-Sussex Microcomputing Club, Contact Jeff Hayden, 2 Hillary Close, East Grinstead, RH19 3XQ.

West Sussex Microcomputer Club meets at Room R06, Robinson Road Annexe, Crawley, on the first and third Monday of month. J Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, 0293-884207.

Worthing & District Microcomputer Club meets at Rose Wilmot Youth Centre, Littlehampton Road, Worthing, on alternate Sundays 11am-1pm. B. Thomas, 11 Gannon Road, Worthing, W. Sussex, BN11 2DT, 0903 36785.

CLUBNET

TYNE & WEAR

Newcastle upon Tyne Personal Computer Society meets at Room D103, Newcastle Polytechnic on the first Tuesday of every month. Pete Scargill, 21 Percy Park, Tyneworth, 0632 573905.

WEST MIDLANDS

Cannock Computer Society meets at Cannock Computer Systems, Old Penkridge Road, Cannock, fortnightly. Terry Sale, 20 Redwood Drive, Chase Terrace, Walsall WS7 8AS.

Coventry Computer Circle. Contact Chris Baugh, 9 Hillman House, Smithford Way, Coventry CV1 1FZ.

Coventry Micro Club meets on Wednesdays at 7.30pm at Walsgrave Junior School. Jack Hewitt, 3a Boswell Drive, Walsgrave-on-Sowe, Coventry. Tel: 615543.

Walsall Computer Club meets at Park Hall Community School on the second and fourth Monday month 6.45-9.45pm. Alison Hunt, 58 Princes Avenue, Walsall, WS1 2DH, 0922 23875.

West Midlands Amateur Computer Club meets at Enfield School, Love Lane, Stourbridge, on the second and fourth Tuesday of month. John Tracey, 100 Bouth Close, Brierley Hill, Kingswinford, 0384 70097.

WILTSHIRE

Chippenham and Calne, proposed new club. Matthew Jones, Pinhills, Calne SN11 0LY.

WORCESTER

Worcester & District Computer Club meets at Old Pheasant Inn, New Street, Worcester, on the second Monday month at 8pm. D Stanton, 55 Vauxhall Street, Rainbow Hill, WR3 8PA.

YORKSHIRE

Barnsley Co-Operative Computer User Group meets at Co-Op Social Club, Pogmore, Barnsley, on the last Tuesday month at 7.30pm. James Bridson, c/o 39 Kereforth Hall Road, Barnsley, South Yorks S70 6NF, 0226 41753.

Greenhead Grammar School Computer Club. Brian Smith, Greenhead Road, Keighley, West Yorks BD20 6EB, 0535 62828.

Huddersfield Computer Club meets every Monday. Chris Townsend, 760/4 Manchester Road, Linthwaite, Huddersfield, 0484 657299.

Keighley Computer Club. Meets each Wednesday at 7.30pm at Methodist Church Hall, Market Street, Keighley, West Yorks. Contact Simon Midgley on 0535 681463.

Leeds Microcomputer Users Group meets at 8 Regent Street, Chapel Allerton, fortnightly on Thursday at 6pm. David Parsons, 22 Victoria Walk, Horsforth LS18 4PL.

Program Power, R Simpson, 5 Wemsley Road, Leeds LS7 2BX, 0532 683186.

Shipley College Computer Group meets on Tuesdays. Paul Channell, tel: 0274 959731.

South Yorkshire Personal Computer Group meets at General Lecture Theatre, St Georges Building, Mappin Street, Sheffield, on second Wednesday month at 7.30pm. Paul Sanderson, 8 Vernon Road, Tetley, Sheffield S17 3QE.

Thurnscoe & District Micro Users' Club meets at Thurnscoe Comprehensive School, Physics Lab, Clayton Lane, Thurnscoe, Wednesday at 7.30pm during school term. Mr James Davis, 62 Tudor Street, Thurnscoe East, 0709 893880.

West Yorkshire Microcomputer Group meets on Tuesdays. Phillip Clark, c/o Suite 204, Crown House, Armley Road, Leeds LS12 2ES, 0532 632532.

York Computer Club meets at the Enterprise Club every Monday at 8pm. K Thomas, Green Lea, Ripon Road, Harrogate, HG1 2BY, 0904 38239.

SCOTLAND

Bishopton Computer Club meets at 'Cwa Ben', Sachelcourt Avenue, Bishopton, Renfrewshire, on Sunday once a month Alasdair Law, 10 Dunglass Road, Bishopton, Renfrewshire PA7 5EF.

Edinburgh Home Computing Club meets at Clarendon Hotel, Edinburgh, on the 2nd, 3rd and 4th Wednesday of month. I. Robertson, 031 441 2361.

Scottish Amateur Computer Society, Mike Anthony, 46 Moredun Park Gardens, Edinburgh EH17 7JR.

Central Scotland Computer Club meets at Falkirk College of Technology, Grangemouth Road, Falkirk, on the first and third Thursday of month. James Lyon, 78 Slamannan Road, Falkirk FK1 5NF.

Five Computer Users Club meets fortnightly. Murray Simpson, 31 Tom Steward Lane, St Andrews, Fife, KY16 8YB.

Grampian Amateur Computer Society meets at 35 Thistle Lane, Aberdeen, on the second and fourth Monday every month at 7.30pm. Alan Morrison, 21 Beech Road, Westhill, Skene, Aberdeenshire AB3 6WR.

Kemnay Computer Club meets weekly. S Stubbs, 15 The Glebe, Kemnay, Inverurie, Aberdeenshire.

Inverness Personal Computing Club meets every second Tuesday at 7.30pm. Gyl Mackenzie, 38 Ardconnell Street, Inverness IV2 3EX, 0463 220922.

Perth & District Amateur Computer Society meets at Hunters Lodge Motel, Bankfoot, on the third Tuesday of month at 7.30pm. Alastair McPherson, 154 Oakbank Road, Perth PH1 1HA.

Skye and Lochalsh Computing Society. Contact C Manvell, Tigh na Paic, 25 Lower Breakish, Isle of Skye IV42 8QA, 04712 317.

Strathclyde Computer Club meets at Wolfson Centre, 106 Rottenrow, Glasgow, on the third Wednesday of month. B Duffy, 24 Lomand Drive, Condorrat, Cumbernauld G4 8NW.

WALES

Abergele Computer Club meets at Abergele CI Offices every Thursday at 7.30-10pm. W Jones, 77 Millbank Road, Rhyll, Clwyd.

Beddau & District Computer Club, meets at Beddau Community Centre, 7pm, Mondays. Nigel Butters, Newtown, Llantwit 206305.

Clwyd '80 Computer Club. Contact Allan Jones, The Island, 1 High Street, Connah's Quay, Deeside, Clwyd, 0244 816893. Meets at Deeside Community Centre, Queensferry, Deeside on Thursday at 7pm.

Colwyn Computer club meets at the Greens Hotel, Colwyn Bay, at 7pm. Contact D Bevan, c/o Abergele Road, Colwyn Bay,

Clwyd LL29 7PA.

Connah's Quay Computer Club. Meets second and fourth Thursday of each month at the Community Centre, Cable Street, Connah's Quay, at 7pm. Contact G Johnson, tel Deeside 821945.

Gwent Amateur Computer Club meets at St Mary's Institute, Stow Hill, Thursday at 7.30pm. Rothery Harris, 16 Alanbrook Avenue, Newport, Gwent, Wales NPT 6QJ.

Llantwit Major Computer Club. Meets at Adult Education Centre, Llantwit Major, every Tuesday. Contact Douglas Mountain, 16 Denbigh Drive, Llantwit Major, South Glamorgan CF6 9GQ.

Mold Computer Club. Meets 7.30pm on first and third Thursday of each month at the Daniel Owen Centre, Earl Street, Mold. Contact G Johnson, 18 Daytona Drive, Northop Hall, Mold, Clwyd, Wales. Tel Deeside 821945.

Milford Central Computer Club. Open to schoolchildren, meets every lunch hour and evening. Contact Harry Evans, Milford Central School, Prioryville, Milford Haven, Dyfed, 043 784 571.

Pencoed Amateur Computer Club meets fortnightly on Saturdays at Pencoed Welfare Hall. Philip Williams, 38 Bryn Rhedyn, Pencoed, Bridgend, Mid-Glamorgan CF35 6TL, 0656 860307.

Pontypool Computer Club meets at The Settlement, Roackhill Road, Pontypool, Gwent, on Friday. Graham Loveridge, on Pontypool 2827.

Swansea & Southwest Wales Amateur Computer Club meets on the last Friday every month. Paul Griffiths, 1 Prescelfi Road, Penlan, Swansea SA5 8AF.

Swansea Computer Club. Meets at No 10 (pub), Union Street every Tuesday at 7.30pm. Contact Robert Palmer, 044 123 602.

Wrexham & District Computer Club. Meets each Thursday. Contact Mike Houghton, 1 Snerwell Avenue, Wrexham, Clwyd, Wales.

NORTHERN IRELAND

North Down Micro Users Club. Meets at Bangor Central Library, Hamilton Road, every fourth Monday. Contact A Robson, 0247 67060.

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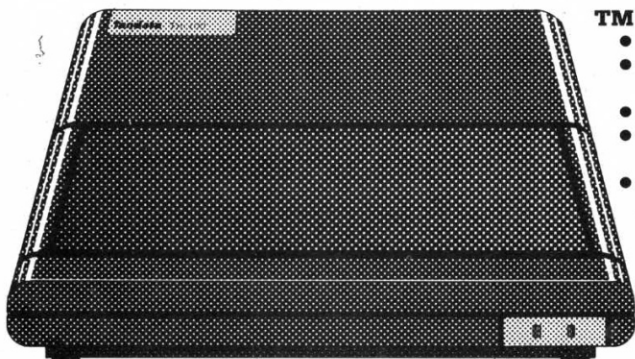
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This six-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

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, 5 1/4" 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	Nascom 3	£549	Globe 101	£1,850	Sharp PC3201	£2,300	Logica VTS Vitesse	£2,863	Panasonic JD800M	£3,795	Superstar	£6,296
Casio PB100	£50	Casio MZ80A	£549	Genie III	£1,897	HP 85	£2,360	Kemtron K3000	£2,869	Kemtron K3000	£3,795	Racal 6000	£6,327
TRS-80 PC4	£50	Commodore 4016	£632	Toshiba T-100	£1,900	HP Series 100, 120	£2,362	DEC PC 350	£2,875	DEC PC 350	£3,850	Eagle 1600	£6,497
Sharp PC1251	£80	Research Machine 480Z	£650	Sord M23	£1,932	Sord M23P	£2,369	DMS Fox	£2,950	Vector 4	£3,852	TI System 200-250	£6,695
Aquarius	£90	DAIPC	£684	Kaypro II	£1,949	TI Prof. Computer	£2,386	Zenith 289-81	£2,978	Sage II	£4,019	CompuCorp 675	£6,780
Casio FX702P	£90	Apple II	£776	Transtec BC2	£1,949	IBM PC	£2,392	Monroe EC 8800	£2,990	Eagle IV	£4,190	Wicat 150	£6,846
Jupiter Ace	£90	Commodore 500	£799	Kenilworth 83G	£1,953	Xerox 820 Model II	£2,415	Philips P3500	£3,000	C-1010	£4,197	Sundance I	£6,969
Sinclair Spectrum	£99	HP 75C	£883	Transam Truscan	£1,983	Haywood 3000	£2,439	Tanberg EC10	£3,000	Tandy TRS-80 Model 16	£4,199	Pascal Mod. Microengine	£7,003
Comx35	£120	Sharp MZ80B	£900	Epson QX10	£1,995	LSM4	£2,472	Archives I	£3,003	Hytech H4500	£4,310	Diablo 3000	£7,250
Tandy TRS-80 Pocket2	£130	Apple IIe	£972	IDS Datamachine	£1,995	Canon CX-1	£2,500	Cromemco System 1	£3,025	BMCOK11F800.Model20	£4,360	Onyx 5001 MU	£7,607
Oric 1	£139.95	Commodore 8032	£1,129	Tandy TRS-80 Model II	£1,999	Adler Alphatronic P2U	£2,524	DECPC325	£3,080	ADS42	£4,500	Sundance II	£8,205
Acorn Atom	£150	Commodore 710	£1,144	Kenilworth 83N	£2,012	IO Tech Iona	£2,539	Direct 1000	£3,093	Televideo TS-80ZH	£4,533	Haywood Hinet	£9,550
Atari 400	£150	Microdecision	£1,144	Caltext Micro	£2,019	HP 87XK	£2,571	Equator	£3,099	Country Computers C1000	£4,542	Altos 856-10	£9,631
Sord M5	£150	Fujitsu FM8	£1,150	LSIM3	£2,064	Quantum 2000	£2,587	Clenio Table-Tops 925	£3,105	Corvus Concept	£4,887	Apple Lisa	£9,775
TI-99/4A	£150	Sanyo MBC 1000	£1,195	Haywood 9000 Composite	£2,064	Canon AS100	£2,633	ITT 3030	£3,105	ICL PC Model 31	£4,939	Micro Five 3000	£10,350
Colour Genie	£168	Pied Piper	£1,226	Hawk Model 110	£2,070	CP1100	£2,639	Monroe OC8810	£3,162	Cromemco System 3	£5,170	Sundance 16	£10,480
Commodore VIC20	£170	Positron 900	£1,259	Positron 9000	£2,134	Seed System 19	£2,600	HF Series 200 Model 16A	£3,211	Micro Five 1000	£5,175	Spectrum	£11,442
Sharp PC1500	£170	Tandy TRS-80 Model III	£1,299	Research Machines 380Z	£2,147	Enterprise 1000	£2,645	Cifer Series 1	£3,214	Fortune 32:16 System 2	£5,204		
Dragon 32	£200	Commodore 8096	£1,374	Superbrain JR	£2,150	Facit 6520	£2,645	Samurai	£3,214	Zeus 4	£5,400		
Computers Lynx	£225	Pasca 640	£1,437	Future Computers FX-20	£2,156	Orion Boss Model A	£2,645	Torch	£3,214	Hawk Model 2110	£5,405		
Commodore 64	£229	NEC PC8000	£1,454	Comart Communicator	£2,180	Britannia Baby	£2,657	Sord M223	£3,277	Molecular M200	£5,462		
Tandy TRS-80 Colour	£240	Signet 2	£1,483	Adler Alphatronic P2	£2,197	Adler Alphatronic P3	£2,696	Kontron RS180	£3,306	Altos 800/15	£5,663		
New Brain A	£269	Irvine Business Systems	£1,489	Country Computers C3000	£2,242	Eagle II	£2,702	Columbia PC 1600-1	£3,392	Durango F85	£5,744		
Multitech MPS II	£269	Televideo TS-800 Series	£1,495	Kemtron K2000E	£2,242	Amarc 801	£2,708	Digico Prince	£3,392	Triton 4	£5,744		
BBC Micro Model A	£299	HP 86A	£1,541	Rair Black Box 320S	£2,242	DEC Rainbow 100	£2,714	OEM Orion	£3,392	Marin Chip M9900	£5,750		
Genie II	£299	Osborne I	£1,581	Sanyo MBC 2000	£2,242	ICL PC Model 10	£2,754	Ajile	£3,400	SW Tech. Products S0/9	£5,750		
Atari 800	£300	Signet 10025	£1,599	Toshiba T-200	£2,242	Millbank SX10	£2,754	Barcellos AMT 100	£3,450	BASF 7100	£5,805		
Nascom 2	£327	APL Signet	£1,610	TMK 332	£2,242	Olivetti M20D	£2,754	Kalamazoo 1050	£3,450	Comstar	£5,837		
Genie I	£330	Zenith 289-81	£1,668	Bonsai MC 3000	£2,294	Sirius I	£2,754	Cromemco System 2	£3,560	Sord M243	£5,842		
Microtan 65	£389	Basis 108	£1,683	CALPC	£2,294	Victor 9000	£2,754	Digital Microsystems 3	£3,560	Archives IV	£5,905		
BBC Micro Model B	£399	Commodore Spr. Pet 9000	£1,719	North Star Horizon	£2,294	North Star Advantage	£2,766	Decision-1 Computer 012	£3,674	Sage IV	£5,962		
Datac Micro Controller	£431	Gemini Galaxy 2	£1,719	Sanyo MBC 1250	£2,294	Apple III	£2,780	Televideo TS 1602-C	£3,714	ICL PC Model 32	£6,037		
Cortex	£454	British Micro Mini 803	£1,720	Casu Mini C2	£2,300	Sanyo MBC 4050	£2,817	Adds Multivision	£3,795	Rair Business Computer	£6,037		
Epson HX20	£472	Microsolution Brit. Genius	£1,840	Seed System I	£2,300	Bonsai SM 4000	£2,842	Clenio Pronto	£3,795	Digital Microsystems 4	£6,210		

ABBREVIATIONS

Ap: APL
As: Assembly
Ba: Basic
Co: Cobol
Cr: Comal
Fr: Fortran
Pa: Pascal

Make and model

HARDWARE

Make and model	Price inc.VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard			Interfaces built-in				Storage		Operating system	Languages inc	Other languages available	Distributor	Comments	
						Max characters columns x lines	Method (at extra cost)	Colour capability		Max dot resolution	Type of keyboard	No of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots						Cassette facility
Acorn Atom	£150	6502	1	2K	40K	32x16	Tv(M+)	●	256x192	W					1	●		Cassette	BaAs	●	A1	Hobbyist micro		
Adds Multivision	£3,795	8085A	5	64K	256K	80x25	M		640x240	W	28		1		1		1x350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system		
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80x24	M			W	6	●	2		1	3	2x160K5¼F	CP/M	Ba	●	T1	Good software choice		
Adler Alphatronic P2U	£2,524	8085A	3	64K		80x24	M			W	6	●	2		1	3	2x320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage		
Adler Alphatronic P3	£2,696	8085A	3	64K		80x24	M			W	6	●	2		1	3	2x790K5¼F	CP/M		●	T1	16 bit option-promised		
ADS 42	£4,500	8085A	4	32K		40x8	M		40x8	W		●	3			3	1x82K5¼F	Holland Automation	Ba	●	A3	Intelligent cash register		
Ajile	£3,400	8088	4	256K		80x25	M		640x250	W	10	●	1	1		2	2x320K5¼F	MS-DOS	BaAs	●	A9	16-bit portable micro		
Almarc 801	£2,708	Z80	4	64K	512K	80x25	(M+)	●		W			2			11	2x800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb		
Almarc 1601	£3,445	8086	8	128K	1Mb	80x25	(M+)	●		W			2			11	2x800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb		
Aquarius	£90	Z80A	4	4K	52K	40x24	TV	●	320x192	C						1	●	Cassette	Ba	●	M7	Competition for Uncle Sir Clive		
Altos 800/15	£5,663	Z80	4	192K	208K	80x24	M			W	8	●		1			1x450K5¼F	MP/M		●	L1	Multi user business machine		
Altos 856-10	£9,631	8086	10	512K	1Mb	80x24	M			W	16	●	6				2x500K5¼F	Xenix	Xenix	●	L1	The 16-bit version		
APL Signet	£1,610	Z80A	4	64K		80x25	Tv(M+)*	●		*			2				2x188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended		
Apple II	£776	6502	1	48K	128K	40x24	Tv(M+)	●	256x192	W						8	●	CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras		
Apple IIe	£972	6502		64K	128K	80x24	M+	●		W				1		8		DOS	Ba	●	A8	Not an Apple III!		
Apple III	£2,780	6502	2	128K	256K	80x24	(M+)	●	560x192	W		●	1			4	1x140K5¼F	SOS, DOS		●	A8	Will emulate Apple II		
Apple Lisa	£9,775	68000	8	1Mb		120x30	M		792x360	W		●	2	1		3	2x860K5¼F	Lisa		●	A8	Learning time 30 mins		
Archives I	£3,003	Z80	4	64K		80x25	M	●	240x100	W	23	●	2	1		5	2x386K5¼F	CP/M		●	S1	Standard CP/M + graphics		
Archives IV	£5,905	Z80	4	512K		80x25	M	●	240x100	W	23	●	1		1	3	1x10Mb5¼H+1x7445¼F	CP/M, MP/M		●	S1	Hard disk version		
Atari 400	£150	6502B	1.79	16K		40x24	Tv	●	320x192	T	3					7	●	Cassette	Ba	●	A5	Games computer, Basic extra		
Atari 800	£300	6502	1.8	48K		40x24	Tv(M+)	●	320x192	W	3					7	4	●	Cassette	Ba	●	A5	Versatile, good graphics	
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80x24	TvM			W	8	●	1	1		2	3	2x500K8F	CP/M	BaCo	●	B1	Up to four users	
BASF 7100	£5,805	Z80A	4	64K		80x24	M			W	26	●	1	1				3x163K5¼F	BOS	Ba	●	C1	Hard disc promised	
Basis 108	£1,683	6502	1	64K	126K	80x24	TvM	●	820x168	W	15	●	1	1			6	●			●	C12	Apple bus, Z80, 80 columns	
BBC Micro Model A	£299	6502	1.8	16K	32K	40x30	Tv(M+)	●	320x256	W	10				1		●	MOS	BaAs	●	A1	Upgradable to Model B		
BBC Micro Model B	£399	6502	2	32K		80x30	Tv(M+)	●	640x256	W	10			1		5	3	●	MOS	BaAs	●	A1	Versatile and expandable	
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80x25	M	●	640x200	W	15	●	1					2x340K5¼F	CP/M	Ba	●	E1	Built-in printer	
Bonsai SM 3000	£2,294	Z80	2	64K		80x24	M		80x24	W	14	●	1	1				2x350K5¼F	CP/M		●	B2	CP/M business machine	
Bonsai SM 4000	£2,842	8088	5	128K	256K	80x24	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		80x25	Tv(M+)		80x25	W	11	●	2	1				2x500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included	
British Micro Mimi 803	£1,720	Z80A	4	64K		80x25	(M+)		512x256	W	17	●	1	1		1		2x400K5¼F	OS/M		●	B4	This is CP/M compatible	
C-1010	£4,197	6502	1	64K	128K	80x24	TvM		256x192	W	12	●	1	1	1	8	●	1x1405¼F+1x10MbH	CP/M, DOS, UCSD-P	Ba	●	C2	Apple II compatible	
CAL PC	£2,294	8088	5	128K	256K	80x25	TvM	●	256x512	W		●	2	1		1	5	2x400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor	
Caltext Micro	£2,019	Z80A	4	64K	256K	80x24	TvM			W	36	●	1	1		3	2x400K5¼F	CP/M		●	C3	Range of software included		
Computers Lynx	£225	Z80A	4	48K	192K	40x24	Tv(M+)	●	248x256	W			1	1			●	Cassette	Ba	●	C5	Unusual — promise of CP/M		
Canon AS100	£2,633	8088	4	128K	512K	80x25	M	●	640x400	W	12	●	1		4			2x640K5¼F		●	C4	Choice of CP/M86 or MS-DOS		
Canon CX-1	£2,500	6809	4	128K	256K	80x24	M		80x25	W	15	●	3	1	1	2	2x320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras		
Casio FX 702P	£90	Cust.		2K		20x1	LCD			C							●	Cassette	Ba		●	C6	Pocket computer	
Casio PB100	£50	Cust.		0.7K	1.7K	60x1	LCD			C							1	●	Cassette	Ba		●	C6	Business pocket computer
Casu Mini C2	£2,300	Z80A	4	64K		*	(M+)	*	*	*			4	1				2x1Mb8F			●	C7	*Choose your own terminal	
Cifer Series 1	£3,214	Z80	4	128K	320K	132x32	TvM			W	40	●	3	1				2x800K5¼F	CP/M		●	C17	Other models available	
Clenio Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)	*	*	*			2	2		18		2x600K8F	CP/M	Ba	●	C8	*Choice of terminal	
Clenio Table-Top 925	£3,105	Z80A	4	64K	128K	80x25	M			W	11	●	2	2				2x600K8F	CP/M		●	C8	Watch out for the weight	
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80x24	M	●	640x200	W	10	●	2	1		8	2x320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike		
Commodore VIC 20	£170	6502	1	5K	32K	22x23	Tv(M+)	●	176x158	W	8					3	1	●	Kernal	Ba	●	C9	Very popular home micro	

Commodore 64	£229	6510	1	64K		40x25	Tv(M+)	●	320x200	W	8				3	●		Kernal	Ba	●	C9	Good value for money		
Commodore 500	£799	6509	1	128K	896K	40x25	Tv(M+)	●	320x200	W	10	●	1		1	3	1	Kernal	Ba	●	C9	Available by summer?		
Commodore 4016	£632	6502	1	16K	32K	40x25	TvM			W	●				1	1	3	Cassette, PETDOS	Ba	●	C9	The original PET		
Commodore 710	£1,144	6509	2	128K	896K	80x25	TvM			W	10	●	1		1	2	1	Kernal	Ba	●	C9	Might be a long wait		
Commodore 8032	£1,129	6502	1	32K	96K	80x25	TvM			W	●				1	1		Cassette, PETDOS	Ba	●	C9	The 80-column PET		
Commodore 8096	£1,374	6502	1	96K		80x25	TvM			W	●				1	1		Cassette, PETDOS	Ba	●	C9	Fully expanded PET		
Commodore Super Pet 9000	£1,719	6502	2	96K		80x25	TvM			W	●	1			1	1	2	Cassette, PETDOS	Ba	●	C9	Top of the range		
CompuCorp 675	£6,780	Z80	4	64K	256K	80x20	M			W	20	●	1				4	2x655K5/4F	CompuCorp	●	C10	Unusual O/S		
Compustar	£5,837	Z80A	4	64K		80x25	M			W	●	2						1x10Mb8H+1x350K5/4F	CP/M	Ba	●	I10	Networking system	
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80x24	M			W	●	2	1				10	2x390K5/4F	CP/M	●	C13	Business CP/M micro		
Comx 35	£120	1802		35K	67K	40x24	Tv	●		C									Cassette	Ba		C14	Built-in joystick	
Cortex	£454	9995	12	64K	1Mb	40x24	Tv(M+)	●	256x192	W	12	●	1							BaAs		M2	Mainly sold as £340 kit	
Corvus Concept	£4,887	68000	8	256K	1Mb	120x60	M		720x560	W	10	●	2			1	4		Merlin	Pa	●	K1	A4 shaped screen	
Country Computers C1000	£4,542	6502	1	64K	128K	80x24	M		280x192	W	12	●	1				3	1x10Mb5/4H+1x140K5/4F	DOS, CP/M	Ba	●	C16	Runs all Apple software	
Country Computers C3000	£2,242	Z80A	4	64K	256K	*	*		*				1	1				1x5Mb5/4H+1x500K5/4F	CP/M	●	C16	*Terminal own choice		
CP1100	£2,639	8086	6	128K	1Mb	*	(M+)*		*				2	1			7	2x390K5/4F	CP/M 86	●	C13	Choose your own terminal		
Cromemco System 1	£3,025	Z80	4	64K		80x24	(M+)	●	450x735	W	20	●	1				8	2x390K5/4F	CDOS, Crom	●	C13	Designed for business		
Cromemco System 2	£3,560	Z80	4	64K		80x25	(M+)			W	20	●	1				21	2x390K5/4F	CDOS, Crom	●	C13	Large business machine		
Cromemco System 3	£5,170	Z80	4	64K		80x25	(M+)			W	20	●					21	2x1.2Mb8F	CDOS, Crom	●	C13	Top end Cromec		
DAI PC	£684	8080	2	48K		60x24	Tv(M+)	●	255x335	W					1				Cassette	Ba		D9	Optional maths chip	
Data Micro Controller	£431	Z80	2	16K		40x24	Tv(M+)		80x60	W			1			1	1			Ba	●	D1	Mainly used in labs	
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132x24	M	●	960x240	W	20	●	2				3	2x400K5/4F	CP/M	●	D2	Competitor for IBM PC		
DEC PC 325	£3,080	PDP11/23	N/A	256K		132x24	M	●	960x240	W	20	●	2				1	2x400K5/4F	P/O/S	●	D2	Mini in micro clothing		
DEC PC 350	£3,850	PDP11/23	N/A	256K		132x24	M	●	960x240	W	20	●	2				4	2x400K5/4F	P/O/S	●	D2	Mini in micro clothing		
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*		*				3	1		1		2x400K5/4F	CP/M	Ba	●	I2	*Buy your own terminal	
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*		*				3	1		1		1x400K5/4F+1x5Mb5/4H	CP/M	Ba	●	I2	*You choose the terminal	
Diablo 3000	£7,250	8085	3	32K	64K	80x24	M			W	8	●	1				4	2x1.8Mb8F	DACL	Ba	●	B5	Unusual O/S	
Digico Prince	£3,392	Z80A	4	64K		80x25	M			W	50	●	2				7	2x400K5/4F	CP/M	●	D3	Unusual keyboard		
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*		*				3			1		2x512K8F	CP/M	●	D4	*Choice of terminal		
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	1/2Mb		(M+)*		*				4					2x512K8F	MP/M	●	D4	*Depends on terminal chosen		
Direct 1000	£3,093	Z80	4	64K		80x25	M		132x28	W			2					2x300K5/4F	CP/M	●	D5	Standard CP/M machine		
DMS Fox	£2,875	Z80A	4	64K		80x24	M			W	16	●	3	1		1		1.2Mb5/4F	CP/M	●	D4	Portable machine		
Dragon 32	£200	6809E	1	32K	64K	32x16	Tv(M+)	●	256x192	W					1	4	1		Cassette	Ba		D6	Tandy colour lookalike	
Durango F85	£5,744	8085A	5	64K	196K	80x64	Tv(M+)			W	●	4					1	12	2x1Mb5/4F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80x24	M		80x24	W	●	2	1			1		2x500K5/4F	CP/M	Ba	●	M3	Includes WP/SS software	
Eagle III	£2,950	Z80A	4	64K		80x24	M		80x24	W	●	1						2x1Mb5/4F	CP/M	Ba	●	M3	Includes WP/SS software	
Eagle IV	£4,190	Z80A	4	64K		80x24	M			W	●	2	1			1		1x1Mb5/4F+1x12.5Mb5/4H	CP/M	Ba	●	M3	Includes WP/SS software	
Eagle 1600	£6,497	8086	8	128K	512K	80x25	M	●	720x352	W	24	●	2	1		1	8	1x1Mb5/4F+1x12.5Mb5/4H	MS-DOS, CP/M 86	●	M3	High speed IBM copy		
Enterprise 1000	£2,645		8	64K			M			W	10	●	2				2	2x358K5/4F	Enterprise	●	D7	Micro Nova 16-bit		
Epson HX20	£472	6301	1	16K	32K	20x4	LCD		120x32	W	13	●	2				2		Cassette	Ba		E2	Powerful portable	
Epson QX10	£1,995	Z80	4	192K	256K	80x25	M		640x400	W	18	●	1	1				2x320K5/4F	CP/M	Ba	●	E2	Expansion required for Valdocs	
Equator	£6,842	Z80A	4	64K	448K	80x24	M		255x560	W	14	●	7	1		1	8	1x5Mb5/4F+1x750K5/4F	CP/M, MP/M, Turbo DOS	●	E3	Two bigger models available		
Facit 6520	£2,645	Z80	4	64K	128K	80x24	M		80x24	W	8	●	2					2x320K5/4F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing	
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80x24	M	●	1024x1024	W	16	●	1				20	2x800K5/4F	Unix	●	I3	Genuine 16-bit		
Fujitsu FM8	£1,150	6809	1	64K		80x25	(M+)	●	640x200	W	10	●	1	1			4	1	●	Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80x25	M		800x400	W	20	●	2				2	2x800K5/4F	CP/M 86, MS-DOS	●	E1	Still on a promise		
Genie I	£330	Z80	1.7	16K	48K	64x16	Tv(M+)		128x48	W			1	1					Cassette	Ba	●	L2	Compatible with TRS 80/1	
Genie II	£299	Z80	1.7	16K	48K	64x16	Tv(M+)		128x48	W	4	●	1						Cassette	Ba	●	L2	Speeded-up Genie I	
Genie III	£1,897	Z80A	3.2	64K		80x24	M		160x72	W	8	●	1	1		1	3	2x700K5/4F	New DOS	Ba	●	L2	CP/M costs extra	
Colour Genie	£168	Z80	2.2	32K		40x24	Tv(M+)	●	160x96	W	8	●	1	1		2	1	●	Cassette	Ba		L2	Home games machine	
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80x25	M		160x75	W	10	●	1	1		1	5	●	2x400K5/4F	CP/M	●	G1	Low cost British system	
Globe 101	£1,850	8085	3	64K		80x24	M			W	20	●	3					2x325K5/4F	CP/M	●	G4	Wordstar plus Mail Merge inc.		
Hawk Model 110	£2,070	Z80A	4	64K	256K	*	(M+)*	●	*				2	1			3	2x390K5/4F	CP/M, MP/M2	●	L6	*Choose your terminal		
Hawk Model 2110	£5,405	Z80A	4	64K	256K	*	(M+)*	●	*				2	1			3	1x390K5/4F+1x21MbH	CP/M, MP/M2	●	L6	*Choose your terminal		
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80x25	M		64x255	W	34	●	2				8	2x320K5/4F	CP/M	As	●	H1	Designed for network	

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display			Graphics	Keyboard		Interfaces built-in					Storage	Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters columns x lines	Method (at extra cost)	Colour capability		Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others						

HARDWARE

Haywood Hinet	£10,982	Z80	4	64K	128K	80x24	M			W	34	●	3	1	1		1x11Mb8H	CP/M		●	H1	Large network machine	
HP 75C	£883	Cust.	N/A	16K	24K	32x1	(M+)			C					1	4	1.3K card reader	HP	Ba	●	H2	Calculator/computer	
HP 85	£2,360	Cust.	N/A	16K	32K	32x20	M	255x191		W	8	●	1		4	4		Cassette	Ba	●	H2	Engineers' machine	
HP 86A	£1,541	Cust.	N/A	64K	512K	80x24	M	544x240		W			1	1	2	4		HP	Ba	●	H2	CP/M optional	
HP 87XM	£2,571	Cust.	N/A	128K	640K	80x24	M	544x240		W	14	●	1	1	1	3	4	HP DOS	Ba	●	H2	Special technical uses	
HP Series 100, 120	£2,362	Z80A	3.68	64K		80x24	M	80x24		W	8	●	2			1		CP/M	Ba	●	H2	Top end HP business system	
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80x25	M			W	5		1	1	2		HP		●	H2	Genuine 16-bit		
Hytch H4500	£4,310	Z80	4	64K	208K	80x25	M	80x25		W	26	●	1			3	2x403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro	
IBM PC	£2,392	8088	4.7	64K	576K	80x25	(M+)	640x200	●	W	10	●		1		5	1x360K5¼F	MS-DOS	Ba	●	I9	Slow but reliable	
ICL PC Model 10	£2,754	8085	3	64K	256K	80x24	Tv(M+)			W	11	●	2			8	2x700K5¼F	CP/M	Ba	●	I4	Repackaged Rair Black Box	
ICL PC Model 31	£4,939	8085	3	128K	256K	80x24	(M+)	80x24		W	11	●	4			8	1x250K5¼F+1x5MbH	CP/M, MP/M	Ba	●	I4	Multi user Black box	
ICL PC Model 32	£6,037	8085	3	256K		80x24	(M+)	80x24		W	11	●	8			8	1x250K5¼F+1x5MbH	CP/M, MP/M	Ba	●	I4	Top of ICL range	
IDS Datamachine	£1,995	Z80	4	64K	1Mb		Tv(M+)						2		15		2x400K5¼F	CP/M	Ba	●	I8	*Depends on terminal	
IO Tech Iona	£2,539	Z80	4	69K	960K	80x24	M	160x75	●	W	12	●	1	1		8	2x400K5¼F	CP/M		●	I5	Good colour versatility	
Irvine Business Systems	£1,489	Z80	4	64K		80x25	M			W		●	2				2x400K5¼F	CP/M		●	I6	Inexpensive CP/M machine	
ITT 3030	£3,105	Z80A	4	64K	256K	80x24	Tv(M+)	80x24		W	8	●	1	1		1	2x280K5¼F	CP/M, BOS			●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32x24	Tv(M+)	64x46		C		●				1				Fr		J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80x24	Tv(M+)	80x24		W	10		1				2x250K5¼F	Kalamazoo		●	K3	Only Kabol language	
Kaypro II	£1,949	Z80	4	64K		80x24	M			W		●	1	1			2x200K5¼F	CP/M	Ba	●	C15	A portable business machine	
Kemtron K2000E	£2,242	Z80	4	64K		80x24	(M+)	80x24		W			2	1		11	1x300K5¼F	CP/M		●	K4	Scientific Keyboard	
Kemtron K3000	£3,795	Z80	4	64K	256K	80x24	(M+)	80x24		W		●	2			14	2x1Mb8F	CP/M, MP/M		●	K4	For scientific use	
Kenilworth 83G	£1,953	Z80A	4	64K		80x25	TvM	160x75		W	10	●	1	1		5	2x350K5¼F	CP/M		●	K5	British portable	
Kenilworth 83N	£2,012	Z80	4	64K		80x25	TvM	160x75		W	10	●	1	1		5	2x350K5¼F	CP/M	Ba	●	K5	Includes Basic	
Kontron RSI 80	£3,306	Z80	4	64K	128K	80x25	M	256x512		W	16	●	2	1		8	2x303K5¼F	Kontron	Ba	●	K6	O/S CP/M based	
LSI M3	£2,064	Z80	2.5	64K		80x24	M	80x24		W	31	●	1	1			2x200K5¼F	CP/M		●	L3	Big, British and CP/M	
LSI M4	£2,472	8088	5	128K	256K	80x24	M	160x72		W	31	●	2		1		2x400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software	
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80x24	M	640x288	●	W	12	●	1	1		4	2x1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics	
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24x80	M	24x80		W	8	●	4		12		2x1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit	
Micro Five 1000	£5,175	8088	8	128K	512K	25x80	TvM	512x512		W	20	●	10		2		2x1Mb5¼F+2x6.3Mb5¼H			●	F2	*Choose your own O/S	
Micro Five 3000	£10,350	8086	5	128K	1Mb	25x80	TvM	512x512		W	20	●	5		3		1x10Mb8F			●	F2	*Choose your own O/S	
Microdecision	£1,144	Z80	4	64K		80x24	(M+)						2				1x200K5¼F	CP/M	Ba, Pilot	●	I2	*Terminal extra	
Microsolution British Genius	£1,840	Z80	4	64K		80x24	TvM	80x24		W	21	●	1	1			2x160K5¼F	CP/M		●	M4	'Genius' by nature?	
Microtan 65	£389	6502	1	8K	48K	25x64	(TvM+)			W		●	1	2				Tanbug	Ba	●	M8	Expandable in many ways	
Millbank SX10	£2,754	Z80A	4	65K	256K	80x25	M	80x25		W	10	●	2		1		2x350K5¼F	CP/M	As	●	M5	Scientific applications	
Molecular M200	£5,462	Z80	4	64K	320K		(M+)*						2		1	16	1x10Mb8H+1x500K8F	CP/M	BaAs	●	G2	*Terminal required	
Monroe EC8800	£2,990	Z80A	3	128K		40x24	M	240x240		W	32	●	3		3		1x320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen	
Monroe OC8810	£3,162	Z80A	3	128K		80x24	M	80x24		W	32	●	3	2	1		1x320K5¼F	Monroe	BaPa	●	F3	Bigger model available	
Multitech MPFI	£269	6502	1.2	64K		40x24	Tv(M+)	280x192	●	C			1	1	1			Cassette	Ba	●	S8	Apple soft compatible	
Nascom 2	£327	Z80A	4	2K	64K	16x48	Tv(M+)	48x96		W			1		4			NAS, SYS	BaAs	●	L5	Old reliable	
Nascom 3	£549	Z80	4	48K		16x48	Tv(M+)	48x96		W			1		4			NAS, SYS	BaAs	●	L5	Fully expanded Nascom	
NEC PC8000	£1,454	Z80	4	32K	64K	80x25	M	160x100	●	W	10	●	2	1			2x300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics	
New Brain A	£269	Z80A	4	32K	512K	80x30	Tv(M+)	640x220		C			2		1			Cassette	Ba	●	G3	A lot of promise	
North Star Advantage	£2,766	Z80	4	64K		80x24	M	640x240		W	15		1		6		2x360K5¼F	CP/M		●	T9	16-bit option	
North Star Horizon	£2,294	Z80	4	64K	512K		*						2	1	1	9	2x360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal	
OEM Orion	£3,392	8086	8	128K	896K	80x25	TvM	800x400		W	13	●	11			6	2x500K5¼F	CP/M 86	BaCo	●	O5	*Full communications machine.	

Olivetti M20D	£2,754	Z8000	3	160K	512K	80x25	M	●	512x256	W	●	1	1		5		2x320K5¼F	PCOS	Ba	●	B6	Real 16-bitter	
Olympia Boss Model A	£2,645	Z80A	4	64K		80x28	M	●	80x28	W	10	●	1		4		2x140K5¼F	CP/M		●	O1	Useful 28 lines on screen	
Onyx 5001 MU	£7,607	Z80A	4	128K	256K							5	1			●	1x7Mb5¼H	CP/M	Ba	●	O2	*Terminal extra; other models	
Oric 1	£139.95	6502A	1	48K		40x28	Tv(M+)	●	240x200	C			1		1	●		Cassette	Ba	●	T2	*16K promised	
Osborne 1	£1,581	Z80	4	64K		52x24	M		128x32	W	10	●	1		1		2x185K5¼F	CP/M	Ba	●	O3	Portable, includes software	
Panasonic JD 800M	£3,795	8085A	4	60K		80x24	M		80x24	W	21	●	3				2x250K8F	CP/M	Ba	●	P1	Larger model costs £5,002	
Pasca 640	£1,437	Z80A	4	64K		80x24	M			W		●	1	1			2x250K8F	CP/M		●	W1	Regular CP/M micro	
Pascal Modular Microengine	£7,003	WD9000	2	128K								4			8		2x1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra	
Pied Piper	£1,226	Z80A	4	64K		80x24	Tv			W	36			1	1		1x1Mb5¼F	CP/M			S11	Incl. four software packages	
Philips P3500	£3,000	Z80A	4	64K	320K	80x25	M			W	11	●	2				2x0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard	
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	80x24	TvM	●	480x240	W	12	●	4		1	3		O/S 9	Ba	●	P4	Multi user version	
Quantum 2000	£2,587	Z80A	4	64K	192K	80x25	M		160x75	W	18	●	1	1	5		3x860K5¼F	CP/M		●	Q1	Mono, low-res graphics	
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80x24	(M+)					2			8		2x1Mb5¼F	CP/M	Ba	●	R1	*VDU extra; many versions	
Rair Business Computer	£6,037	8088	5	256K	1Mb	80x25	M	●		W	10	●	2		4	8	1x19Mb5¼H+1x1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit	
Racal 6000	£6,327	Z80	5	64K	256K	80x26	M		80x26	W	21	●	1	1			1x600K8F	CP/M		●	R2	CP/M languages available	
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40x24	Tv(M+)			W		1	1		4		2x144K5¼F	CP/M	Ba	●	R3	Widely used in schools	
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40x24	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			2x640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra	
Sage IV	£5,962	68000	8	128K	1Mb		(M+)	●				6	1	1			2x640K5¼F+1x6MbH5¼	UCSD-P System	PaBaFn	●	T10	*Terminal own choice	
Samurai	£3,214	8086	4.6	128K	768K	80x25	M	●	720x400	W		●	3	1	3		2x1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics	
Sanyo MBC 1000	£1,195	Z80A	4	64K		80x25	M		80x25	W	17	●	1	1			1x320K5¼F	CP/M	Ba	●	L1	Standard CP/M model	
Sanyo MBC 1250	£2,294	Z80	4	64K		80x40	M		640x400	W		●	1	1			2x640K5¼F	CP/M	Ba	●	L1	High-res graphics	
Sanyo MBC 2000	£2,242	8085A	5	64K		80x24	M		80x24	W	24	●	2	1	2		2x328K5¼F	CP/M	Ba	●	L1	Big disc model costs £3,622	
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80x24	M		80x24	W		1	1				2x640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit	
Seed System 1	£2,300	6800	2	32K	64K	80x24	M		80x24	W	3	●	2		8		2x160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine	
Seed System 19	£2,600	6809	2	48K	1Mb	80x24	M			W	3	●	2		8		2x160K5¼F	OS-9		●	S3	Latest from Seed	
Sharp MZ80A	£549	Z80	2	48K		40x25	M		80x50	W		●						Sharp Basic	Ba	●	S4	CP/M facility extra	
Sharp MZ80B	£900	Z80A	4	64K		80x25	M		320x200	C	10	●						Sharp Basic	Ba	●	S4	Unusual keyboard	
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24x1	C	18	●						Sharp Basic	Ba	●	S4	Pocket computer	
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26x1	LCD		156x7	C	6	●	1	1	2			Cassette	Ba	●	S4	Optional 4-pen plotter	
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80x25	M		160x50	W	10	●			5		2x500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic	
Signet 10025	£1,599	Z80B	6	64K		80x24	M	●	512x512	W		●	2	1	1		2x200K5¼F	CP/M, Macnos		●	S9	Choice of keyboards	
Signet 2	£1,483	Z80	4	64K		80x24	(M+)	●	512x256	W	18	●	2				2x200K5¼F	CP/M			S9	Multi-user system	
Sinclair ZX81	£40	Z80A	3.5	1K	16K	32x24	Tv		64x44	C					1	●		Cassette	Ba	●	S5	Sold a million	
Sinclair Spectrum	£99	Z80A	3.5	16K	48K	32x24	Tv	●	256x192	C					1	●		Cassette	Ba	●	S5	Very popular home micro	
Sirius 1	£2,754	8088	5	128K	896K	80x25	M		800x400	W	7	●	2		1	4		2x600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£150	Z80A	4	4K	16K	40x24	Tv(M+)	●	256x196	C			1		2	●		Cassette	Ba	●	S6	Japanese home computer	
Sord M23	£1,932	Z80A	4	128K		80x25	M	●		W	14	●	2	1	2	3		2x330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80x25	Tv(M+)	●	640x200	W	14	●	2	1	2	2		2x290K3¼F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80x25	M			W		●	2		4			2x350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80x25	M	●	640x400	W	15	●	4	1	4			2x1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80x24	M			W	15	●	1	1			2x1.5Mb5¼F	Flex, Uniflex		●	S7	Top end SWTP	
Spectrum	£11,442	68000	8	256K	4Mb		(M+)					4			16		2x720K5¼F	Mirage	Ap	●	M1	*As terminal	
Sundance I	£6,969	Z80A	4	64K	256K	132x24	M			W	4	●	1	1			1x7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine	
Sundance II	£8,205	Z80A	4	128K	256K	132x24	M			W	4	●	1	1			1x7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance	
Sundance 16	£10,480	Z8001	6	256K	1Mb	80x24	M			W		5	1			●	1x14Mb5¼H	BOS		●	T2	Tape backup for hard disc	
Superbrain JR	£2,127	Z80A	4	64K		80x24	M		560x240	W		●	2		1		2x160K5¼F	CP/M	Ba	●	I10	Bigger models available	
Superstar	£6,296	Z80	4	64K		80x24	Tv(M+)		80x24			1	1		8		1x10Mb5¼H+1x400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk	
Tandberg EC10	£3,000	8080A	2	64K		80x25	M			W		7					1x250K8F	CP/M, TOS	Ba	●	T3	Very early machine	
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80x24	M		80x24	W	2	●	2	1			1x500K8F	TRS-DOS	Ba	●	T4	Big business machine	
Tandy TRS-80 Model III	£1,299	Z80A	2	48K		64x16	M		128x48	W		●	1	1	1		2x184K5¼F	TRS-DOS	Ba	●	T4	Latest TRS80	
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80x24	M			W	2	●	2	1			2x1.2Mb8F	TRS-DOS	BaAs	●	T4	True 16-bit	
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32x16	Tv	●	256x192	W		1				●		Cassette	Ba	●	T4	Very popular	
Tandy TRS-80 PC4	£50	Cust.	N/A	½K	1½K	12x1	LCD		12x1	C	9	●			1	1		Cassette	Ba	●	T4	Low-cost pocket computer	

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Make and model	Price inc. VAT	Processor type	Speed in MHz	Standard RAM	Max RAM - normally at extra cost	Display			Graphics	Keyboard	Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters columns, 7 lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots					

HARDWARE

Tandy TRS-80 Pocket Computer 2	£130	Cust.	1.3	2.6K	16K	26x1	LCD		156x7	C	6	●						Cassette	Ba	T4	Plotter available		
Televideo TS-80ZH	£4,533	Z80	4	64K		80x24	M		80x24	W	15	●	2			1		1x256K5¼F+1x7Mb5¼H		●	C11	Recently upgraded	
Televideo TS-800 Series	£1,495	Z80A	4	64K		80x24	M		80x24	W	15	●	2			1		CP/M		●	C11	Standard CP/M machine	
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80x24	M		576x424	W	15	●	2			1		2x256K5¼F		●	C11	Graphics, but no colour	
TI Professional Computer	£2,386	8088	5	64K	256K	80x25	M			W	12	●		1				1x320K5¼F		●	T5	Choice of operating systems	
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32x24	Tv(M+)	●	256x192	W						2				●	T5	This is sprite graphics	
TI System 200-250	£6,695	9900	4	64K		80x24	M		80x24	W	12	●	1					1x5Mb5¼H	UCSD-P, PX10	●	T5	Bigger version available	
TMK 332	£2,242	8085A	5	64K		80x24	M		190x96	W	22	●	2	1				2x320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80x30	TvM	●	640x256	W	15	●	1	1		4		2x400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80x25	TvM	●	640x200	W	8	●	1	1	1	2		2x256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80x24	M		80x24	W	15	●	1		1			2x256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80x24	TvM		640x288	W		●	2	1		1	5	2x190K5¼F	CP/M		●	T7	S-100 machine
Transtec BC2	£1,949	Z80A	4	64K	256K	80x24	M		80x24	W	13	●	2	1		8		2x386K5¼F	CP/M		●	T8	Fully definable characters
Triton 4	£5,744	Z80A	4	64K	160K	80x24	M			W	8	●	1	1		3		2x1.2Mb8F	MPSL-BOS		●	T11	Upgradable to Winchester disk
Vector 4	£3,852	8088	5	128K	256K	80x24	M	●	640x312	W	15	●	1	1		1	2	2x630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80x25	M		800x400	W	7	●	2	1		4		2x600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wicat 150	£6,846	68000	8	256K	1.5Mb	80x25	M		400x300	W	20	●	2	1		1		2x616K5F	MCS	Ba	●	S10	Upgradable to 32 user system
Wilkes YD8110	£4,025	8086	5	128K	896K	80x24	M	●	960x624	W	21	●		1		6		2x1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
Xerox 820 Model II	£2,415	Z80A	4	64K		80x24	M		1024x512	W		●	2	2		2		2x160K5¼F	CP/M		●	R4	Powerful graphics
Zenith 120-22	£2,978	8088	5	128K	192K	80x25	M		640x225	W	18	●	2	1	1	1	5	2x320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80x24	M			W		●	2	1				1x100K5¼F	CP/M	Ba	●	Z1	Elderly CP/M machine
Zeus 4	£5,400	Z80	4	64K	320K	80x25	(M+)		80x25	W	11	●	10					1x6Mb5¼H+1x250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

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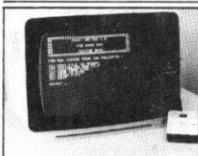
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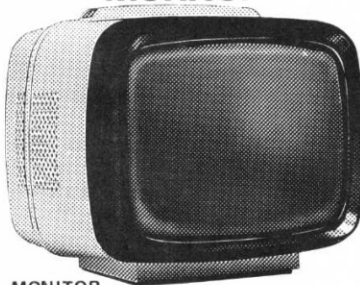
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Both positions are based in Surrey and demand experience and maturity. Although detailed technical knowledge is not required, a proven interest in computing is essential. Candidates for either position will probably be aged 25+ and be able to demonstrate an outstanding track record in their chosen career.

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Unfortunately an error was published in Softek's August Advertising. Softek does not guarantee a full refund should a program fail to load, however, it does guarantee a replacement cassette.

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Syntax Errors

Missing Lynx

Two small ripples disturbed the surface of Microwaves last week.

In 'Get your Lynx into shape' the program in figure 1 had a slight error in lines 120 and 130. They should have read:
120DRAW X+A*(RAD(S)),
Y+B*COS(RAD(S))
130NEXT S

In 'Lovely Listings' to obtain the colour blue use a left pointing arrow and to obtain red use the £ sign.

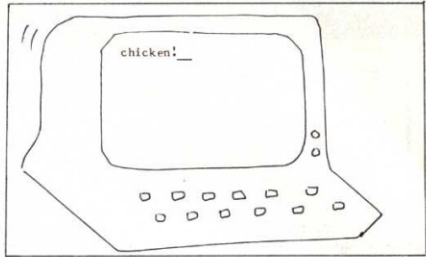
Benji boob

In our review of Benji — Space Rescue (*issue 27*) we mistakenly gave the supplier's name as EPYX Inc. This should have been HesWare — our thanks to them for calling us from the US to rectify this.

Innumerate

Spurious digits were our downfall last week in the review of Californian Gold Rush. The game's publisher, Anik Microsystems, is to be found on 0604 411013.

PAL-2000
by Mellusc.



Dragon alive

Perhaps it was wishful thinking on the part of games software company Microdeal, but a recent press release issued on the company's behalf included the passage 'With the demise of Dragon Data and the launch of these strong titles, Microdeal will continue its monopoly of Dragon 32 Software.'

Dragon Data wishes to assure readers that reports of its death have been greatly exaggerated.

Indeed, it claims that it is far from moribund but rejuvenated by an injection of £½ million. Who wouldn't be?

A picture, as they say, is worth a K of words. Here's two K's worth which even the groggiest should be able to appreciate. With the increasing use of portable computers and the mounting road toll this floppy disk protection unit should prove a winner. Just in case you think somebody out of camera shot is balancing a spare tyre, the Design Council has given the UK-manufactured Sternstat Disk Case its approval.

This is not recommended treatment for floppy disk cases but if your storage media has warped during the summer, this could be one way of restoring them to flatness.



NEXT WEEK

Does Atari XL? PCN has the new 600XL in pride of place. **Condor** — a database for the IBM PC. Put that in your pipe and smoke it.

Oric cheap — not a price cut but a sound generator for the Oric.

BBC extras — we look at rom extensions and a CMOS diary.

Games — for the Spectrum, the Commodore 64, and the Dragon 32.

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.

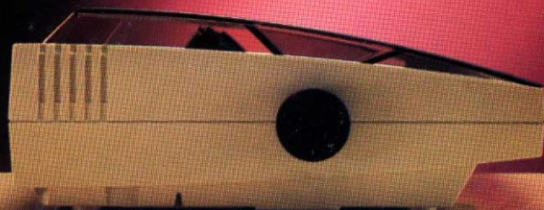
UK EVENTS

Event	Dates	Venue	Organisers
Business Opportunities with the IBM PC	September 29-30	Europa Hotel, London	EEC Publications, 01-359 3525
Personal Computer World Show	September 29 October 2	Barbican Centre, London	Montbuild Ltd, 01-486 1951
Computer Fair	October 2	The Sir Frederic Osborn School, Welwyn Garden City	R Brown Welwyn Garden City 23367
European Computer Trade Forum	October 4-7	NEC, Birmingham	Clapp & Poliak, Europe Ltd, 01-747 3131
Computer Open Day Exhibition	October 6	Albany Hotel, Birmingham	Tony Kaminiski, Couchmead Communications, 01-788 1102
Leicester Apple Village	October 9-12	Leicester Exhibition Centre	Database Publications, 061-456 8383
The Professional Personal Computer: Markets and Strategies	October 11-12	Intercontinental Hotel, Hamilton Place, London W1	Financial Times Conference Organisation, 01-621 1355
Computer Graphics European Conference & Exhibition	October 18-20	Wembley Conference Centre	Online Services, 09274 28211
Lancaster & Morecambe Computer Club Open Day	October 29	Lower Town Hall, Lancaster	Brian Sheldon, 0524 61831
Software Expo	November 8-10	Wembley Conference Centre, London	Interco, 01-948 3111

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Info '83	October 10-13	New York, USA	Cahners Exposition Group, 0483 38085
Computer Systems International Trade Fair & Congress	October 17-21	Munich, West Germany	ECL Exhibition Agencies, 01-486 1951
Computer Technology Exhibition	October 18-21	Kuala Lumpur, Malaysia	Conference & Exhibition Management Services SDN BHD, 9-A Jalan SS24/8, Taman Megah, Petaling Jaya, Selangor.

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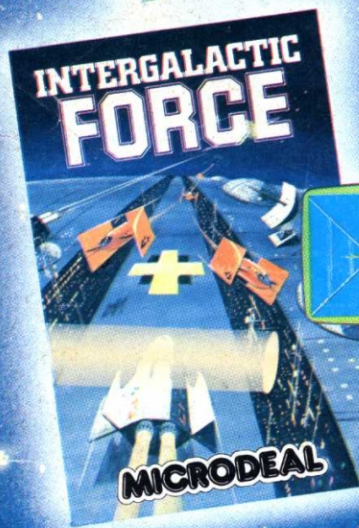
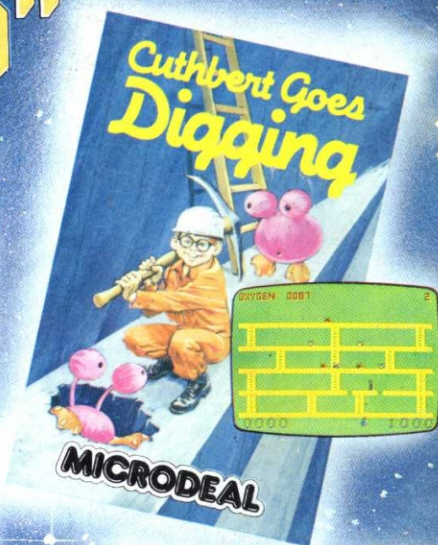
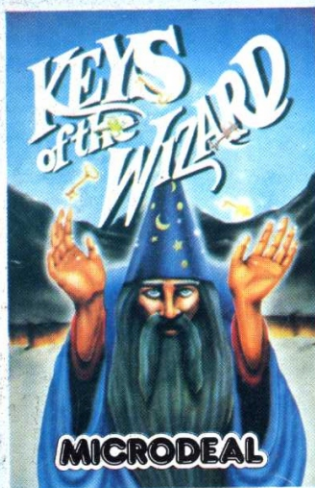
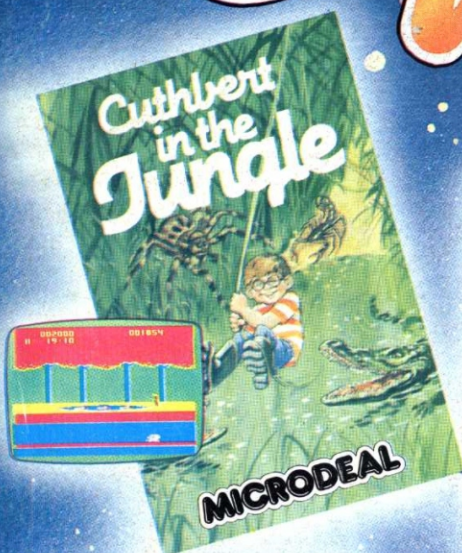
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