PERSONAL
birthday issue
COMPUTER NEWS
50p March 10, 1984 No 52
BRITAIN'S BIGGEST WEEKLY

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52 MICRO TESTS

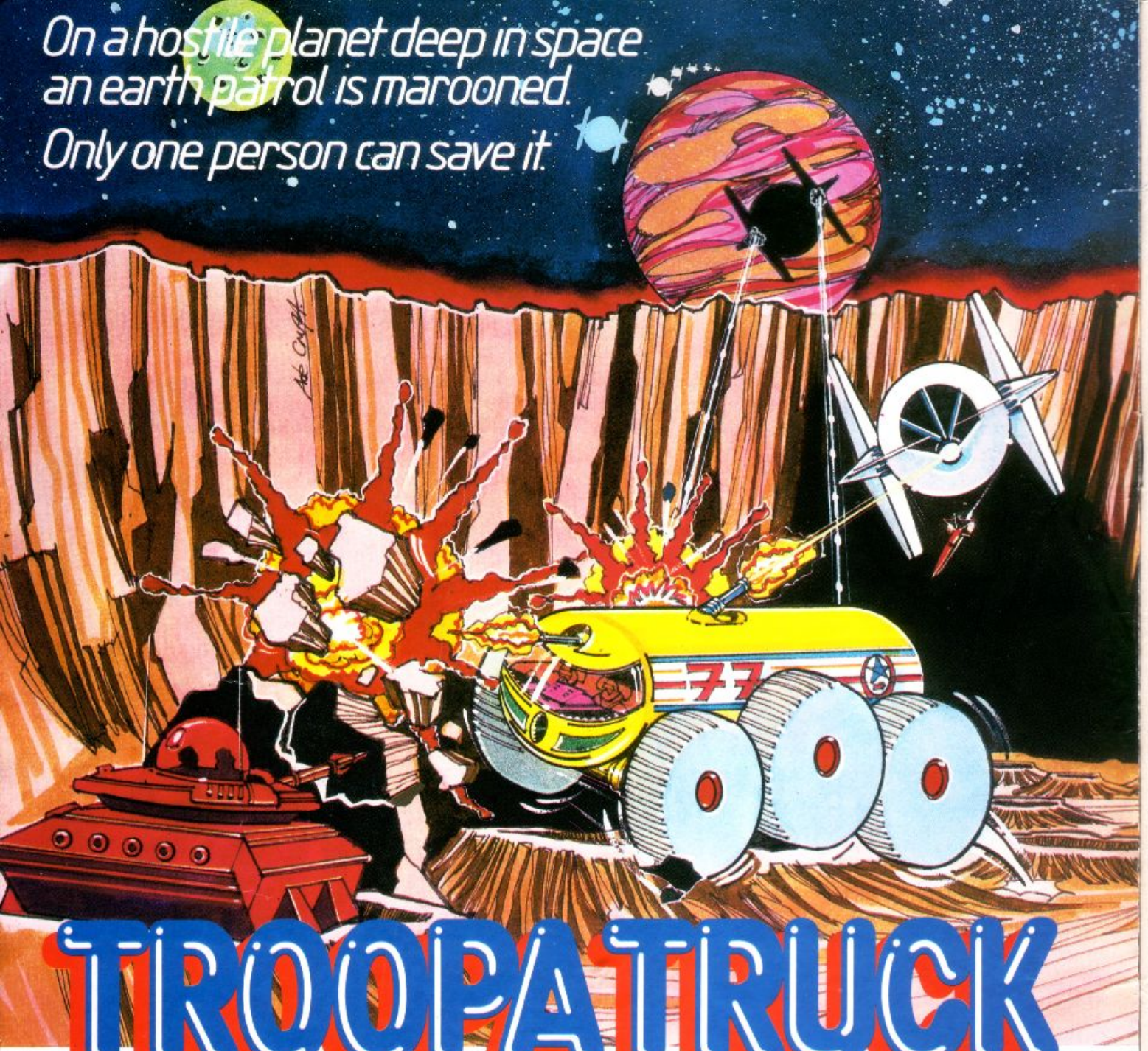
122 PROGRAMS

18 PULL-OUT VOLUMES

...for Spectrum, Commodore 64, BBC, Atari, Apple, ZX81, Oric, Dragon, TI99/4A, Lynx, Vic-20, Electron, Epson HX20, Newbrain, Colour Genie, Atom...

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TROOPA TRUCK

The galaxy's most lovable battle wagon.

Narzon Heatseekers from the back. LasaSlamma Tanks in front. HeliChargas from above.

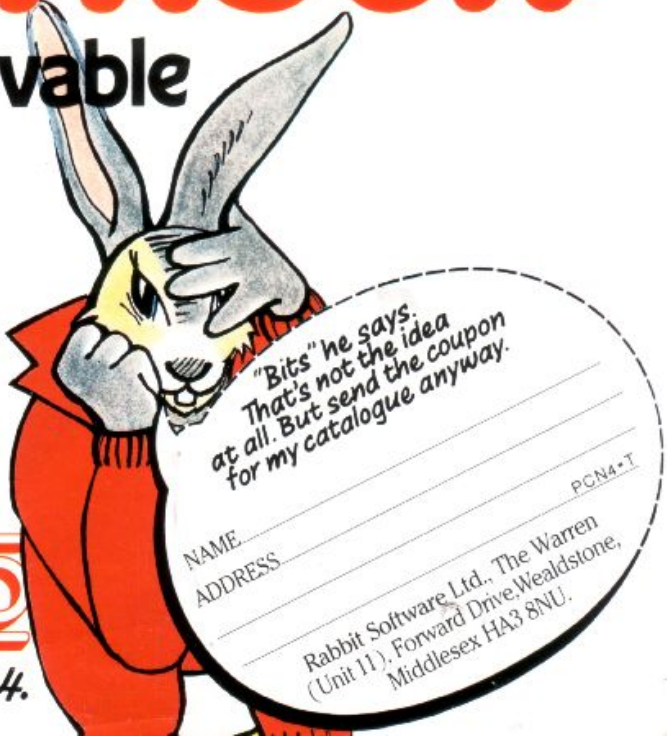
A friendly mission to Zon has become a desperate fight for survival.

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Your Commodore 64 will love it to bits.



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Brilliant on Spectrum, VIC-20 & CBM-64.

MENU PCN

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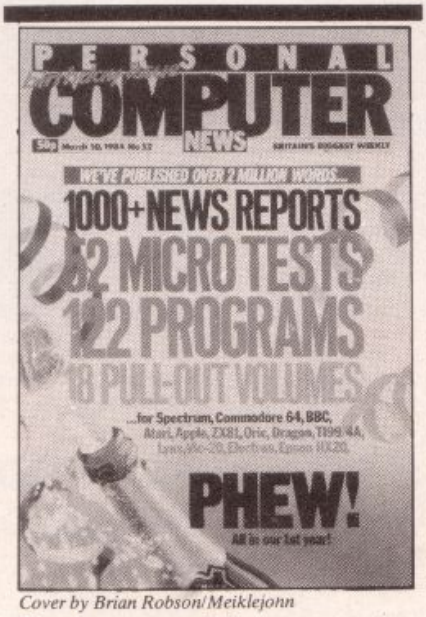
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Ralph Bancroft weighs up the latest entry in one of the hottest areas of microcomputing — a British portable for £1,000.



Samurai standard 21
The Japanese are finally coming — bearing the MSX banner. Ian Scales and Igor Thomas investigate.





Cover by Brian Robson/Meiklejonn

One year old
Corks are popping at *PCN* to celebrate our first birthday — a couple of million words since we put No 1 on the news-stands. Being a forward-looking magazine we're not dwelling on the past, instead we'll thank you all for sticking with us and hope you'll stay for the next 2,600 pages — *Ed*

MICROPAEDIA

Pull out and keep

From quill to Qume
The final part of *PCN*'s complete guide to printers looks at ink-jet technology, offers some advice on printer-related reading matter, and looks into a dot-matrix.

Competition

Five Epson RX80s to be won 16
The final instalment gives you the chance to win one of these superb dot matrix printers. The RX80 is a versatile and reliable machine.



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Adventure in words 24
A while back we asked: Is the text adventure being killed by its graphical counterpart? Mike Gerrard replies with a resounding 'No!'.



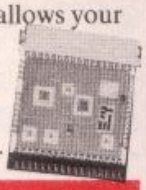
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Despite the claims for micros in education, software has left much to be desired. We round up another batch of the new 'teaching games' to see if standards have improved.

PRO-TEST PERIPHERALS

Oric plug-in power 50
A new 'intelligent' cable allows your Oric to communicate with a variety of peripherals. David Janda looks at the performance.



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Action and strategy in this round-up of the new games for the Welsh micro.

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Lobsteroids can damage your health, or you can do the same to a bunch of snakes.

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Psion gears up for QL support

Sinclair software specialist Psion is gearing up to make sure that if Sinclair ever delivers a QL there will be plenty to run on it.

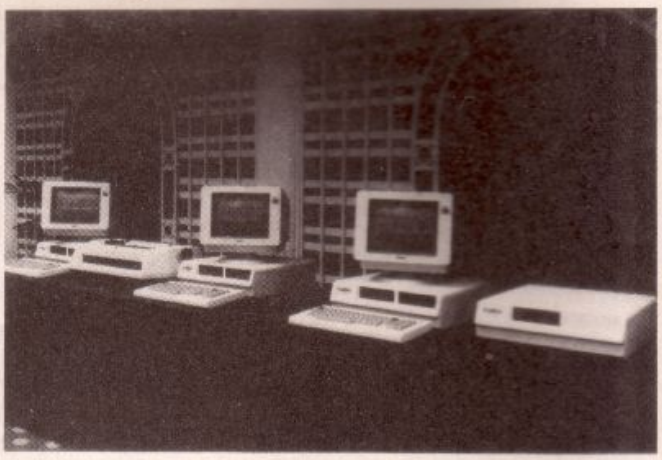
With up to 30 full-time staff it will make the QLUB (QL Users' Bureau) a substantial undertaking. It anticipates a flood of enquiries once the QL starts to find its way into your hands. Psion, the company that produced Vu-Calc, Vu-File, and notable educational games, is also responsible for the applications programs bundled with the new Sinclair micro.

QL owners can join the QLUB for £35 a year. Membership entitles you to phone up for instant hot-line help on specific problems and it offers free software updates and periodic information sheets. It has been set up by Sinclair and Psion jointly.

To help speed the handling of inquiries, Psion is installing its own computer to act as a database for the staff — the company is expecting calls to number about 1,200 a day. This sort of facility can also develop into a database system which QLUB members can access.

The four Psion applications packages which come with the QL may soon be available on a large plug-in ROM cartridge which slots into the machine's left-hand side expansion port.

Undoubtedly such ROM cartridges would be expensive to produce at the moment, but an expected decline in the cost of ROMs and a large consumer demand should allow economies of scale that would make cartridges both affordable and worthwhile. By putting the packages on cartridge, the amount of available memory rockets from about 32K to somewhere close to 90K because the packages no longer sit in RAM.



PC-LINK — Three Krypton micros hanging on a line. Transtec, the Irish micro manufacturer, has brought out its own networking system called Transnet. Apart from linking together the company's own Krypton micros you can also attach IBM PCs. Transtec hopes to add DEC, ACT and Apple links and claims an unparalleled range of mini and mainframe links.

Software branches out

Budding genealogists can watch their family trees bud with a program developed by Bel Tech.

The West Midlands company's Genealogy program gives you a dedicated form of database system that offers you a means of keeping family records and using them in the mysterious ways of the genealogist. At the product's launch the system was demonstrated with data from the Royal Family.

Bel Tech (07462 5420) is a sister company to Bridgenorth Engineering, a manufacturer of tractors and water pumps among other items. The genealogy of software companies will make an interesting study one of these days.

TUG bugged by cash row

The Tangerine Users Group (TUG) is in a state of suspended animation as a legal storm threatens to break over it.

On one side is Colin Nowell, an ex-director of the TUG, and on the other is Bob Green, who originally ran the group and is now in charge of the Oric Owners Users Group. In the middle are group members, who have paid subscriptions for services that may now be suspended.

The dispute revolves around the standing of the TUG at the time of Mr Nowell's appointment.

Weston-super-Mare printing firm Alphaprint says that the TUG owes it about £1,800, but in order to recover the debt it needs to establish whether Mr Nowell or Mr Green is responsible. Until recently the Oric group owed it a similar sum but Alphaprint says that half of this sum has been paid. But it will do no more work for either until it is paid in full.

Another creditor, Fleet Printed Circuits, told *PCN* that it is owed £400 by the TUG.

Mr Nowell is bitter about the affair and Mr Green describes it as a 'domestic dispute'. None of the wrangling will improve the position of group members and in the case of both groups they look increasingly likely to be left out in the cold.

IBM hacks 20 per cent off PC price

IBM has slashed the prices of the two members of its PC family that have made it to the UK, the PC itself and the hard disk XT.

The PC comes down by 20 per cent, which puts it now at £1,914, well below its main rival the Sirius and almost nudging the Apricot. The larger XT, with a price cut of about seven per cent, will now cost £3,958.

Characteristically cagey, IBM UK offered little to explain the price changes but a spokesman commented: 'We've always said that we wanted to be a low cost producer.' This is subtly different from being a low cost supplier.

The spokesman added that production lines in Greenock were now in full swing. but he did not respond to suggestions that IBM was clearing the decks to introduce new products — the PCJr, for example, or the new Portable PC.

IBM is still reluctant to say when these machines might appear in the UK.

Spirit racing game runs off the track

By John Lettice

Spirit Software's racing game has failed to materialise and the company has promised disappointed customers a full refund — but it plans to go ahead with production of the game.

The company has been advertising a Formula 1 racing game complete with a steering wheel instead of a joystick for £8.95, but in the last week *PCN* has received a considerable number of complaints from people who have sent money and received nothing.

Spirit is run by Simon Stevens. Its telephone number is 01-803 6074, but at the time of writing this had only led to an answering machine. A number of *PCN* readers have left messages on this machine and these have not been answered.

The game itself was said to be based on the Silverstone Grand Prix course, and to have been designed with the help of Silverstone's Jim Russell Racing Drivers' School.

Spirit also operated from an accommodation agency, a place where someone answers the phone for you and you collect messages every now and again. This particular agency also took messages for Boom Software, Golden Challenge Software and Silicon Tricks.

Status Report

It's possible that these four companies have more in common than just an accommodation address. Silicon Tricks used the same telephone number as Spirit does — the exchange is West Kensington.

The address in Kensington, West London, where cheques to Spirit were sent, is also apparently an accommodation address. *PCN* spoke to someone at this address who claimed that mail for Spirit was still being collected.

At this point in the investigation Mr Stevens resurfaced, claiming that there had been a misunderstanding, and that customers would be offered their money back. At the time of going to press Mr Stevens said he was writing to the people owed money explaining that production delays would mean the goods wouldn't arrive for another two weeks, and that refunds would be available on demand.

PCN will not be carrying advertisements from Spirit until we are sure that these refunds have been made.

But all this is only the tip of the iceberg. Setting up a software company is childishly simple, and the pages of computer magazines are full of advertisements from companies that are little more than a programmer and an answering machine. Many of these are legitimate, but some are not, and it is frankly impossible for the magazines publishing the advertisements to tell whether or not a company is about to disapear.

Modems off-line

By Ralph Bancroft

The Minor Miracles WS2000 could be all you ever wanted from a modem. It operates at 300/300 baud full duplex, 1200/75 full duplex and 1200/1200 half duplex. It recognises European and American protocols. And it costs just £99.95 plus VAT. You can add an auto-dial/auto-answer plug-in board for £39.

There is just one problem. It is illegal.

Minor Miracles has run into the problem that affects any other manufacturer making equipment designed to hook on to the telephone system — it has to be officially approved first.

Approval used to come from British Telecom itself with the inevitable result that manufacturers seeking approval faced delays and expenses.

All this changed as the Government removed restrictions in the telephone network and handed over the approval procedure to a new body — British Approvals Board for Telecommunications (BABT).

BABT has gone about its task with great gusto and determination. In most of last year it had only approved just one extension telephone.

To be fair, things have improved. Last month it approved some 16 different pieces of equipment.

But this has left modem and computer manufacturers far from happy. They still complain of long delays and the high cost of the procedure.

Part of the problem lies with the Government which insists that BABT should be self-financing.



The Minor Miracles modem — naughty but nice.

The other part is the extremely complex and stringent standards of design and manufacture demanded.

It is not just the design of the hardware that BABT investigates. The board carries out a full inspection of the factory where the product is to be made checks quality control procedures and can insist on changes.

Where the modem is connected to a micro, the board insists on approving the whole set up.

In the case of Torch, the company wanted to include a modem board in its new 68000 machine. Its existing machine already has an approved modem and, with the only differences between the two machines being the second processor board and the external package, you might have though there would be no difficulties. No such luck. The whole machine has to go through the complete procedure.

The financial consequences to both companies and micro users are potentially extensive. The basic approval fees start at £5,000; add to this the cost of making changes to the design of the modem, micro and software you soon see why some companies charge £200-300 for even a simple modem.

ACT with the Sirius and Apricot, LSI with the Octopus and GRiD with the Compass are just three companies who have announced plans to introduce modems and must now go through the BABT hoops. Minor Miracles has sought to avoid the problems of compliance with the board's requirements by calling in the board at the design stage to provide consultancy and advice.

This has been expensive but it should ensure that the modem will secure approval 'in eight to ten weeks' says the company.

Within that time BABT itself is coming up for approval. The government has commissioned an independent report into the board's sanctioning procedures

Watch this space for further developments.

QL takes another step back

Sinclair Research will not ship its first QL computer to a customer until the end of March.

The company had promised to deliver the first machine by the end of February, but a Sinclair spokesman now says that development problems have put off the initial delivery date by a month. The spokesman maintained, however, that the 'target' delivery dates promised in letters sent out two weeks ago.

Those target dates allowed Sinclair up to four months from the date of ordering to get the machines to customers. On orders placed in late January, for example, customers were told they would receive their QLs 'no later than the end of May'.

Sinclair would not comment on speculation that the delays have been caused by difficulties with the QL's multi-tasking operating system — and would say only that it expects to have overcome development difficulties and have the machine in full production by the month's end.

■ Sinclair has agreed in principle that those who have ordered QL's by cheque will receive a free gift as compensation for lost interest. What the gift will be remains to be seen.

■ If anybody offers you a Sinclair Microdrive order form be sure that you don't pay for it. The Microdrives are available in any quantity by mail order from Sinclair, said a spokesman. Sinclair is concerned that unused forms are being bought and sold by people who don't realise that Microdrives can be obtained without the order forms.

Kaypro's A4

The first of the IBM-compatible book-size micros looks likely to come from Kaypro, one of the most prominent portable micro makers.

A number of companies are known to be working on A4-sized machines that will run IBM software but Kaypro is set to beat them with its machine, built by Mitsui in Japan. The company, represented in the UK by CK Computers of Plymouth, has given no details of price or performance, but it announced in the US last week that it would be selling the micro this summer.

The Kaypro model will be roughly the same size as a Tandy Model 100 but with a bigger screen (80 by 16) and a bigger memory, perhaps as much as 256K.

Again in imitation of Tandy, the company will be supplying bundled business applications software — a word processor and a spreadsheet will be included in the price. The degree of IBM compatibility is expected to take in Lotus 1-2-3 and the Microsoft Flight Simulator.

COMMENT

Fast talking micro

By Piers Letcher

Recent developments in speech synthesis suggest the micro business is finally getting to grips with a technology that has proved elusive until now.

The development of speech synthesizers and recognisers has been slow, and even now most synthesisers sound more or less like Daleks. Voice recognition lags even further behind with most systems, prices running into hundreds of thousands of pounds.

The latest improvement in speech synthesis is to allow full text-to-speech conversion. Until now synthesizers have had to be programmed with a set of allophones (syllables plus emphasis), or had a very limited vocabulary — a few hundred words at the most. But with text-to-speech conversion you can type in what you want said, and the synthesizer tries to say it. Changing spelling where necessary refines the results; 'hellow' sounds better than 'hello'.

This text-to-speech facility is now available for the BBC (in fact any micro with RS232 or RS423 port), with an American unit, the Votrax (0272 710103), which costs about £275. Commodore has plans to bring out a text-to-speech converter cartridge for Magic Voice, its speech unit (Issue 50), allowing you the same facilities as the Votrax. Although text-to-speech is still expensive it represents a significant improvement on more primitive methods, and the price should drop as competition arrives.

New developments are being made in the speech recognition field too. One company, Orion Data (0273 672994), has brought out a speech recognition unit for the Spectrum, Micro Command, costing just £50. It appears to be good value at one ten thousandth of the cost of some systems.

Speech for micros is still in its infancy, but is growing up fast. Within the next few years it will be available on most machines. Whether people want to speak to their micros, and to have them speak back, is another question.

■ *PCN* will be Pro-Testing both the Votrex Type 'n' Talk and Orion's Micro Command in a forthcoming issue.

The Commodore Magic Voice, as noted, was reviewed a fortnight ago in Issue 50.

VIEW FROM JAPAN



Disk debate as diameters diminish

By Serge Powell

Although the dust has yet to settle on the great VHS/Beta video battle it looks as though Japanese electronics giants are already mobilising for the great storage drive contest.

With feints to the flanks from manufacturers in Hong Kong, Korea and Taiwan, the main thrust from Japan is in the new format 3in or 3½in floppies, with the production of 5¼in drives simply a battle for manufacturing efficiency and economies of scale. This 5¼in business could turn out to be no more than a sideshow.

With the rewards at stake in the microfloppy arena, not to mention the profits from sourcing drives for US distributors to put to market, the players in the new format game are playing hardball.

At present the most promising talent is Sony, with a 3½in model that packs a punch of 1Mb. IBM, Apple, Hewlett-Packard and NEC are all opting for the Sony format, and it looks like Sony may regain some of the face it lost over Beta. But the Hitachi/Panasonic group hasn't fully unfurled its standard yet.

The Japanese scene is alive with rumours of a 3in 1Mb drive, up from the 250K and 500K offered at present. But in the meanwhile you can watch the prices of 5¼in drives drift steadily downwards — OEM prices (for system builders) are now approaching the £60 mark compared to £350 last year.

If someone could just combine the capacity of the microfloppy with the pricing of the 5¼in model and couple the result to a decent RAM board we could all stop saving for a hard disk.

At the same time there are other peripherals to catch the eye. I came across one at the local Bit Inn, an NEC retail outlet that you might almost call a shop — in the way that you might almost call an embalmer a brewer and bottler.

It is called the PO-10 and in some ways it is a hangover from a bygone era, when people believed — sensibly enough — that it might be more economical and reliable to get data into a computer through a mechanism that gave rise to the term Optical Character Recognition. In other words, you train the machine to recognise printed or typed characters and all that you do to enter data is put a sheet of paper in front of its scanner.

The PO-10 on show in the Bit Inn costs just over £2,000, and for another £60 you can add a utility that permits it to read documents in our language and create CP/M files. The PO-10 isn't limited to typescript: it can also handle hand printed characters — perhaps you would expect this for £2,000, but believe me, the price is a remarkable reduction on some of the units that have preceded it, mainly in the mainframe arena.

It is hard to say exactly why it has taken so long for OCR techniques to percolate down to micro users in anything like a worthwhile form. The method dates back to computing's equivalent of the last Ice Age, and as you'll have noticed, where a method exists there is usually a research department or two trying to smarten it up.

OCR has frustrated many attempts to spruce it up, but the greatest drawback has probably been the price factor. Large mainframe users — the banks are good examples — find that the current techniques are adequate in certain applications, but that price restricts their use elsewhere. This is changing.

Besides, the price is bound to continue falling — unless OCR equipment starts a counter-trend by growing bigger, slower and more expensive. The type of device that is on the way is easily imagined — a reasonably priced OCR reader that will take in a variety of type styles and sizes and put the documents into files that can be edited and manipulated by word processors.

When these OCR machines are coupled up to the kind of laser disk filing system that is also just around the corner (perhaps by then OCR devices will be able to read round corners into the bargain) the prospects for office automation are considerable. In the first place, you may not need an office. I for one will welcome it.

ACT gears for second stage

With twice the turnover and bumper profits last year, ACT is raising a further £17.2m to finance its plans for new products.

As reported in *PCN* (issue 46), ACT intends to introduce a hard disk option for the Apricot as well as a modem and is working on a new machine that will be compatible with both the Apricot and the Sirius but cost less than either.

In addition to these products the company revealed that it is also planning to launch another new machine. It will be a multi-user system that will take over where the Sirius leaves off.

In the wake of the company's results John Leftwich, ACT's marketing manager, was less than forthcoming on the details of the new machines. 'One will be manufactured by us and the other will be distributed by us,' he said. 'There are gaps in the business market and we intend to take advantage of them.'

More immediately, Mr Leftwich says that negotiations to buy the manufacturing rights for the Sirius from troubled Victor Technologies have reached 'a delicate stage'. ACT has joined forces with Hong Kong based Swire Pacific to make a combined bid. They are the only bidders in the field.

Interestingly, ACT will be paying for the manufacturing rights out of existing resources rather than seeking additional capital financing.

It generally has a policy of maintaining high cash reserves as a buffer against the costs of sustaining its rate of expansion.

ACT is remarkably confident about its prospects, even to the extent of saying that next year's doubled turnover forecast excludes any sales of the Sirius because of the uncertainty over their future supply.

In its annual report the company says that this assumption is made in the interests of financial prudence, not because the directors expect an interruption in supplies.

Bunch of five

Zenith's Z100 micro has become a multi-user machine.

To put the Z100 at the centre of a party line you'll need Z29 workstations, price £595 each, MBOS/5 multi-user operating software and about £8,000 in all for a three-user system. The arrangement can support as many as five users.

The Z100 behaves in much the same way as a larger computer in a time-sharing environment. It activates each screen in turn for a specific period, normally 200 milliseconds, keeping active users in memory and shunting the rest out to disk.

The individual workstations are capable of a degree of multi-tasking with foreground/background modes, in which two processes can be controlled at the sme time on one unit.

With multi-user systems Zenith (0452 29451) is giving away business and office applications software. Other software developed under MBOS for other systems will transfer to the Zenith systems without changes, the company says.

In the US Zenith has launched a range of five personal computers which are reported to be IBM compatible. Three of the new systems are desktop machines, but the other two are portable.



All for one — the Zenith Z100 multi-user system.

Hard luck story

UK micro makers who complain of the unfair advantage enjoyed by foreign manufacturers got one in the eye from a large regional store last week.

The same problem that frustrates users — non-availability of launched and advertised UK products — has forced the Gamekeeper, Birmingham's biggest computer store, to stop selling hardware and confine itself to software and add-ons.

Director Tony Noble says the company's four shops have found it impossible to obtain adequate supplies of hardware from UK companies, and the Gamekeeper has therefore taken the drastic step of pulling out of the market. 'We've had 324 Electrons on order since September, and several hundred Spectrums,' he said. The shops have actually received only six Electrons, and Spectrums have also been scarce. Mr Noble says he got 5,000 calls about the Electron in response to one advertisement, and reckons he could sell 500 Spectrums a week. As it is, Sinclair hasn't supplied the Gamekeeper with any this year.

The only machine the shop has been able to get hold of in anything like sufficient quantity is the Commodore 64 — 'but you can't live on the Commodore 64 alone,' says Mr Noble. He claims the Gamekeeper isn't the only shop to be thinking this way, and is highly critical of the way the UK industry operates. He feels the endemic shortages encourage fraudsters to take advantage of customers, and that the disorganised nature of the market will generate a big retail crash soon, with serious repurcussion for users.

The Gamekeeper is now trying to set up an association of retailers and wholesalers to combat this by formulating a professional code of conduct that would help protect both customers and suppliers, and would cut out the pirates.

The move away from selling hardware is liable to hit one machine particularly hard. The Gamekeeper was one of the major stockists of the Spectravideo MSX-like machines (Issue 49), but not only does the shop no longer stock them — the matter is also in the hands of the Gamekeeper's solicitors. Mr Noble won't comment on what legal action is being taken.

Meanwhile, the stable door is slamming shut as Spectravideo gears up for the launch of the 728. This is a full MSX (where have we heard that one before?) version of the 328, and is to be launched in the US in the very near future.

HMS Minstrel

London-based HM Systems has launched a pair of micros covering the range from 8-bit to 32-bit processors.

The 8/16-bit smaller machine, the Minstrel, uses a Z80 and an 8086; the larger model, called the Minstrel 68K, includes a 68000 processor.

The basic Minstrel can become a multi-user system with the addition of further processor boards — it isn't quite an orchestra but up to seven screens can hang off the main processor complex.

A system with a 5Mb hard disk, dual processor, and the Turbodos operating system, costs £5,000. Extra processor boards cost £465 for the Z80 and £1,000 for the 8086.

The Minstrel 68K runs Unix or Idris, Whitesmith's implementation of the popular operating system. In its minimum configuration it costs £6,497. Range of Rodime hard disks can be added, giving 10Mb to 40Mb capacity.

HM Systems is on 01-328 8737.

PERIPHERALS

The new releases

Printers Dyneer is the name of a range of daisywheel printers from X-Data. The DW16 prints at 16 characters a second on 10, 12 or 15 pitch on paper up to 12in wide and comes with either serial or Centronics interface at a price of £329. The DW20 and DW36 can handle paper 13.2in wide. Contact (0753) 72331 for further details. Meanwhile, if you want to own a Qume, try ISG Data Sales on (0734) 884666 and ask about the Letterpro 20 which, as the name suggests, prints at 20 cps. There is a choice of interfaces and it uses Qume's range of over 100 typefaces, all for £695. Having bought a printer you may get fed up with the untidy piles of paper flowing all over the place. If so, and you have £135 to spare, you might be interested in Inmac's printer stand. Adjustable brackets securely hold the printer and a basket at the rear of the stand catches your continuous stationery. The paper feed basket is a £29 optional extra as are the four castors at a price of £7.50. More details on (09285) 67551.



Qume LetterPro, via ISG Data Sales.

Printer Interface P & P Micro Distributors (0706 212321) are importing the Grappler CD, an intelligent interface onto which to hook your Commodore 64 dot matrix printers. It handles high-resolution and block graphics as well as special characters. It comes complete with cables and its own serial ports at a price of £105 plus VAT.

Hard Disk: Compass Computer has a major advantage to its 11Mb add-in hard disk for the DEC Rainbow — it comes with a 12 months on-site warranty from DEC field service. It also features an additional 64K RAM board with the option of an additional 256K RAM. Contact (0892) 31812 for prices.

Memory Expansion HX-20 specialist Kuma Computers (07357 4335) is claiming exclusive distribution rights for a 16K RAM expansion that fits inside the case of the portable and costs £95.

Monitor Philips is applying its knowledge of TVs to the task of producing monitors for home computers. The V7001 has a 12in green phosphor screen and a loudspeaker and costs £69.95.

Terminal The Esprit 6310 is a dumb terminal at a not so dumb price of £589 from CPU Peripherals. Its major plus point is the ability to pretend to be a Televideo 925/910+, ADDS Regent 25/ Viewpoint or Lear Siegler ADM3A. It has tilt and swivel, 14in non-glare display and low profile sculptured DIN standard keyboard with 22 non-volatile programmable keys.

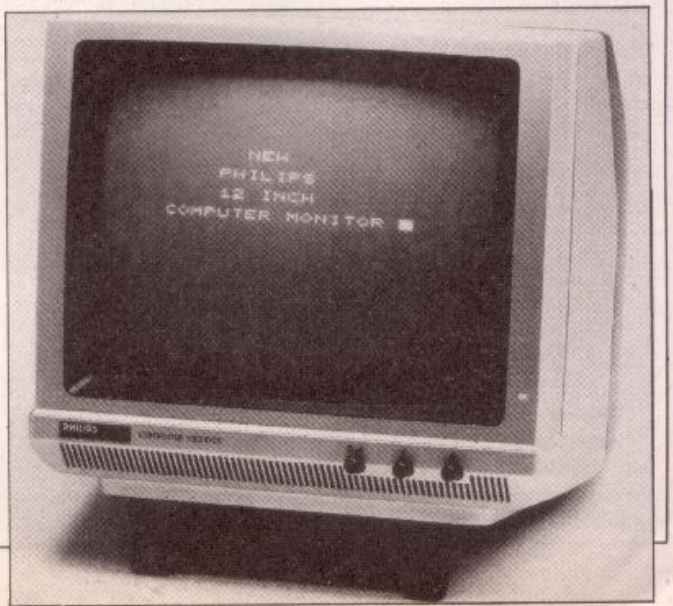
Computer Camera Reflex has become UK agents for the VFR 2000 computer camera. It connects to a wide range of PCs including the IBM PC and captures screen images on 35mm film or instant 35mm slide film. It costs £1,980, and Reflex is on (0734) 884611.

Keyboard Extron has brought out a pad with 25 keys for the BBC micro, with all the numerical and arithmetic operators together with nine commonly used shifted characters all of which can be operated with a single keystroke. It costs £50 and Extron is on (02216) 2936.



Esprit 6310 from CPU.

Image Plotter Reekie Technology (01-892 2877) is a new company which is launching what it calls the image plotter. At £50 it provides an easy way to reproduce diagrams and drawings.



Philips 12in monitor from TV technology.

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PCN charts

Hardware Top Ten up to £1,000

TW	LW	MANUFACTURER	PRICE	DISTRIBUTOR
►1	(1)	Spectrum	£99	(SI)
►2	(2)	CBM 64	£229	(CBM)
▲3	(5)	Vic 20	£140	(CBM)
▲4	(9)	Dragon 32	£175	(DD)
▼5	(3)	ZX81	£40	(SI)
▼6	(4)	BBC B	£399	(AC)
►7	(7)	Oric 1	£99	(OR)
▼8	(6)	Atari 600XL	£150	(AT)
▲9	(18)	Electron	£199	(AC)
▲10	(13)	Apple IIe	£750	(AP)







These charts are compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets from February 10 to February 17. The games chart is updated every other week.

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 is updated every month.

PCN Charts are compiled exclusively for us by RAM/C.

Top Ten over £1,000

TW	LW	MANUFACTURER	PRICE	DISTRIBUTOR
► 1	(1)	IBM PC	£2,390	(IBM)
► 2	(2)	ACT Sirius	£2,525	(ACT)
▲ 3	(9)	DEC Rainbow	£2,359	(DEC)
▲ 4	(5)	Apple III	£2,780	(AP)
▼ 5	(3)	ACT Apricot	£1,760	(ACT)
▲ 6	(—)	ICL PC	£2,065	(ICL)
▲ 7	(—)	Kaypro 10	£2,595	(CKC)
▲ 8	(—)	Wang Professional	£3,076	(WANG)
▲ 9	(—)	NCR Decision Mate	£1,984	(NCR)
▲ 10	(10)	Epson QX10	£1,995	(EP)

Distributors: **AC** Acorn **ACT** ACT/Sirius **AP** Apple **AT** Atari **BW** Brainwave **CKC** CKC Computers **CBM** Commodore **Dragon Data** **DEC** Digital Equipment **EP** Epson **ICL** ICL **IBM** IBM **NCR** NCR **MD** Midlectron **OR** Oric **SI** Sinclair **Wang** Wang.

Machines: **SP** Sinclair Spectrum **AC** Acorn BBC **64** Commodore 64 **V20** Commodore Vic 20 **81** Sinclair ZX81 **DR** Dragon **OR** Oric **AT** Atari

Games Top Thirty

	GAME TITLE	PUBLISHER	MACHINE COMPATIBLE									PRICE
			SP	AC	64	V20	81	DR	OR	AT	OTHERS	
▲ 1 (2)	Manic Miner	S/W Projects/Bug Byte	★		★							£7.95
▼ 2 (1)	Hunchback	Ocean	★		★				★			£6.90
▲ 3 (9)	3D Ant Attack	Quicksilva	★									£6.95
▲ 4 (7)	Chequered Flag	Psion	★									£6.95
▼ 5 (4)	Stonkers	Imagine	★									£5.50
▲ 6 (8)	Flight	Psion	★									£7.95
▲ 7 (10)	Mr Wimpy	Ocean	★									£6.90
▼ 8 (5)	Space Shuttle	Microdeal	★	★	★			★	★			£8.00
▲ 9 (11)	Alchemist	Imagine	★									£6.50
▲ 10 (—)	Scuba Dive	Durell/Martech	★		★				★			£6.95
▲ 11 (12)	Fighter Pilot	Digital Fantasia	★									£7.95
▲ 12 (13)	Lunar Jetman	Ultimate	★									£5.50
▼ 13 (6)	Death Chase	Micromega	★									£6.95
▲ 14 (22)	Pool	CDS	★									£5.95
▲ 15 (18)	Jet Pac	Ultimate	★			★						£5.50
▲ 16 (25)	Valhalla	Legend	★									£14.95
▼ 17 (3)	Atic Atac	Ultimate	★									£5.50
▲ 18 (—)	Falcon Patrol	Virgin			★							£7.95
▲ 19 (28)	Twin Kingdom Valley	Bug Byte		★	★							£5.95
▲ 20 (—)	Rommels Revenge	Crystal	★									£6.50
▲ 21 (—)	Hobbit	Melbourne House	★	★	★							£14.95
▲ 22 (—)	Crazy Kong	Interceptor			★							£6.95
▼ 23 (16)	Rev Of Mutant Camels	Llamasoft			★							£5.95
▲ 24 (—)	Skull	Games Machine	★									£6.95
▲ 25 (—)	Doomsday Castle	Fantasy Software	★									£6.50
▲ 26 (—)	International Soccer	Commodore			★							£9.95
▲ 27 (29)	Snooker	Visions	★	★	★	★						£8.95
▲ 28 (—)	The Snowman	BugByte	★									£6.95
▲ 29 (30)	Hovver Bovver	Llamasoft			★							£7.50
▲ 30 (—)	Wheelie	Microsphere	★									£5.95



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

Sinclair Microdrive an allergic reaction?

In March 1983 I bought a 48K Spectrum at W H Smith. With Microdrives coming soon I thought this was a good buy.

Now I find myself with my Spectrum, still no Microdrives, and no idea when I will see them in the shops. No disks are at least accepted or supported by Sinclair. Then the QL appeared, but again no disks (Sir Clive is probably allergic). Has Sinclair ever used a computer for anything other than mathematics?

I would like you, or Sinclair Research, to explain how to use a database of 1000 seconds of 1000 bytes (or any combination) on Microdrives (ghosts), or how is it possible to use a hard disk without saving or duplicating?

I am sure that the happy few who got Microdrives agree with me that at £5 each they are not a storage medium.

I am frustrated.

D Koehler,
L'Hayles Roses, France

The QL's halo is knocked off centre

I have just read the shiny silver brochure for the new Sinclair QL, and two reviews of the same, and it seems to me people are over enthusiastic about it.

Issue 47 of *PCN* states: 'Sir Clive's approach to the market is unconventional and brilliant.' The March '84 issue of *Practical Computing* claims that the £399 QL is competition for the £4,000+ IBM. Who wrote these reviews? Sinclair?

The much vaunted Microdrives seem to be a step back from IAS 5¼in floppies, the cartridges being tape, serial access, about ⅓ the storage capacity, and twice the cost of disks; thus the cost of storage on Microdrive cartridges is about six times the cost of storage on disk.

Also, unless you meticulously housekeep the cartridges, programs will get scattered all across them, making the average access time near to 7 seconds (serial access!). This is slower than most (if not all) 5¼in disk drives. Neither can I believe that these tape cartridges will last as long or be as reliable as disks. I can see no advantage that Microdrives offer over disk drives.

Even though I have only seen pictures of the QL, the keyboard does not look to have reached the same quality as such keyboards found on the Apple IIe or 380Z computers. The placing of almost all non-alphanumeric keys on the QL is different to the placing of the same keys on other standard qwerty keyboards that I have used, this lack of standardisation is perhaps not wholly attributable to Sinclair, but nevertheless is an annoyance to an accomplished typist.

And so my last criticism of the QL-standards. The 'unconventional approach' mentioned earlier means that Sinclair Research has come up with a computer which has:

a) non-standard keyboard layout,
b) non-standard operating system (QDOS)
c) non-standard language (Super-Basic)
d) non-standard mass storage system (Microdrives).

Surely what users really want, and need, is standardisation, and any company of any worth should be working towards that goal?

PCN £10 Star Letter



The QL is not the wonder machine, but it is a good machine that will sell well. A new market will open up which, along with the more affluent Spectrum users, will buy the QL, and sales figures for computers like the BBC will probably be untouched.

A Smith
Huddesfield, West Yorkshire

Weaknesses might be revealed on longer use and disk drives might be preferable — they are in the pipeline — but on first look we found the kit most impressive. As ever, we reserve final judgement until PCN's Pro-Test, but few can deny Sinclair's very clever approach.—Ed.

Advertisers get a sound telling off

I am writing to air my view on so-called 'advertising'. I never cease to be amazed by the way firms that sell software can so blatantly abuse the system of advertising a product; if the advert does not contain a wildly exaggerated narrative it contains an artistic and eye-catching display which, in my mind, can only be there to deceive the potential consumer.

How is it that these adverts can escape the scrutiny of the advertising standards people? It seems to me that a little honesty would do no harm here.

One firm that strikes me as having the right idea is IJK Software which, as well as giving an outlandish artist's impression to catch the eye of the reader, also includes a picture of the actual screen display.

I mean, when did you last see a bog-eyed jumping jack leap out of the TV screen at you?

So let us see some standards. It will make it easier for us, the poor consumer.

J Webster,
Essenhall, Warks.

What we got wrong on the Memotech

Many thanks for the very informative article explaining the operation of the VDP in the MTX range of micros (Issues 46 and 47), however I must point out a couple of errors:

When data is being read from VRAM the data is read from port 1 (not as stated from port 2). Also the VDP requires a short amount of time to read the appropriate byte after the address has been set up, thus the programmer must allow such a delay, which is easily accomplished thus:

```
OUT (2), LSB    ; address
OUT (2), MSB    ; set up
PUSH HL         ; delay
POP HL          ; delay
IN A (1)
```

The accumulator now holds the appropriate data.

In listing 2 the stack pointer is loaded from the system stack (&FA96) which is all well and good providing one does not wish to return to Basic from the routine. However, if a return to Basic is required, SP should be loaded from ASTASK (&FD6D), and assuming the stack is kept balanced, a correct return to Basic is achieved.

When testing sprite coincidence it is bit 5 not 6 of the status register which must be tested thus the instruction is:

```
BIT 5,A
```

An undocumented command which the Memotech micro has could prove extremely useful. This is the INP command which acts in a very similar manner to the Z80's IN instruction and takes the form:

```
LET variable=INP(port)
```

Thus there are facilities to read ports via Basic without having to revert to the dreaded machine code.

J Mullins
Microcell Computer Systems

Keith Hook agrees that INP is particularly important. Other available but undocumented commands are USER: FK: FRE. USER jumps to a specified user routine through address FA 89 in the system variable list at the back of the manual.—Ed.

Thouroughly fed up with unreliable Oric

I ordered a 16K Oric-1 in October 1982 as a Christmas (1982 not 1983) present for my wife and small children. A 48K version complete with bugs in ROM arrived in March 1983.

I have had constant problems and difficulties when loading programs from cassette, even with programs I have saved on my own cassette recorder. Because of this problem, added to the fact that educational and utility software of the Spectrum/BBC standard and quality has become only sparsely available, my wife goes nowhere near the machine and my children consider it a toy.

I have waited eagerly for the 'full range of peripherals' to make life bearable. Only the printer/plotter made it to the market place.

I have weakened on several occasions to the point of considering other machines only to be dissuaded by other Oric-1 users.

Now your columns tell me that Oric-1 is out of production. This heralds the death knell of the machine, for what little support was around will tail off to nothing.

When one looks back at the Oric-1 advertisements that appeared in your magazine one wonders if there is a case under the Trades Description Act ('A fully expandable system for home, education and small business use').

One really does wonder. My loyalty is exhausted, I'm throwing in the towel. Anyone want to buy an Oric-1 cheap?

E Bond,
Blackburn, Lancs.

Don't do anything rash, Mr Bond. You will be able to upgrade to the Atmos, which is really a de-bugged and revamped Oric-1. — Ed.

Rockwell's CPU is a boon for buffs

B Tailor's letter (Routine Inquiries, Issue 48) prompted answers regarding Rockwell's new R65C02 CPU, to which I'd like to add.

For the last six months I have used this chip in a Microtan 65 computer. Although Rockwell does not quote a minimum speed, I found that with the clock running at 750kHz, no problems showed up.

Far from being useless, the BIT control instructions can and do tend to shorten programs and in the case of 'Markers' (ie SET, do this, if RESET, do that) 8 Markers can be contained in one ZP memory location.

I did make a half-hearted attempt to find out if any of the instructions were in the old 6502 but could find none.

Of course, there will be problems when upgrading, as you point out. Luckily I had my own disassembler so I was able to upgrade to cover the new instructions. Regarding assemblers, I find it easier and faster to write in machine code anyway. Machine code is not a black art! Well in the case of the 6065 series it isn't. That is a story which was probaly put about by firmware writers so you had to buy their black boxes.

Back to the 65C, I discovered it turns the computer into a rather clever programmable controller which will handle up to 64 I/O lines. Mind you, you will have to have a compiler to write the programs for you, as they can get rather mind-boggling. I use a corrupt form of Boolean algebra as input, not being up to relay logic at the moment.

R Hodgson,
Dursley, Glos.

I suspect there's no minimum speed, the internal registers/RAM being static, it should be possible to single step the CPU with the clock input. The problem is more with the maximum speed most 6502s are run at up to 4MHz. Due to second source manufacture of 6502s, the design of the micro instruction ROM can change. ST2 (store zero) works on a 6502 in PCN's office, yet is not documented. —*Ed.*

Atari software is well worth the cost

In reply to Mr B C Heath (Issue 50), bemoaning the dearth (?) and expense of Atari software, I can only say that he doesn't know how lucky he is.

I, too, have recently bought an Atari. Now, at last, I have some real games to play. Sure they're expensive, but nothing that is any good ever came cheap. Better to have four good games at £30 than a mindless, soon forgotten pile at £5.95 featuring rabid bananas and witless aliens.

I suspect the reason most independent software houses shy away from Atari is because the existing software is a very hard act to follow.

S D Wood,
London NW6

Copy protection is counter-productive

I have purchased numerous items of software, most of which have not been copy protected and which I have made at least two back-up copies of to protect my investment.

The original distribution copy is locked away, hopefully never to see the light of day again. This policy has saved me many problems and kept my programs running and computers operational.

In the last two years software distributors have decided to copy protect their software, but are not prepared to make sure that the customer is not stuck with a useless copy of the software package — duplicate copies are not even made on the reverse side of the cassette or a duplicate disk supplied. This has meant that I have had to use that original copy as my working copy with all the hazards this entails, or to try and defeat the copy protection scheme and possibly lose the original copy by corrupting it.

In most instances you do not discover that the software is copy protected until you try to make a back-up copy, by which time it is too late to decide not to purchase the software.

I feel that computer magazines should publish this information in their reviews and that advertisers should stipulate that the programs advertised are copy protected, then the customer can decide whether to purchase the protected software or not.

I do not purchase software which is copy protected if I am aware of this at the time of purchase, and if I am caught out by a software distributor copy protecting software and cannot get a refund I will not purchase this company's software again.

If all computer owners were to take this attitude, perhaps software distributors would rethink their attitude towards their customers and provide adequate back-up facilities at nominal cost.

W J Whitehouse,
Saundersfoot, Dyfed

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The long tale of Dragon graphics

Q How can I switch from graphics to text mode in machine code on the Dragon 32?
N Dyson,
Irchester,
Northants.

A Thereby hangs a tale . . . to switch screen modes on the Dragon you have to set up the VDG (Video Display Generator) and SAM (Synchronous Address Multiplexor) chips by loading the relevant control registers with the appropriate values.

The whole thing is more than a little complicated and for a full explanation you'll have to get a reference book, such as the detailed 'Inside The Dragon' by D Smeed and I Somerville, published by Addison Wesley, (ISBN 0-201-14523-5).

In fact, most books on the Dragon which have sections on machine code programming, or which deal in detail with graphics, should explain how to set up the chips.

The three SAM 'mode control' register bits (VO to V2) can be accessed via the three pairs of addresses at FFCO/1, FFC2/3 and FFC4/5. These six addresses give access to the many (up to 14) possible screen modes of the Dragon. The table below shows the combinations needed to get them.

One way to 'set' one of the V registers is to POKE the even numbered address of the pair with 255, and do the same to the odd address to clear the register.

The letters G, A and S refer to Graphics, Alphanumeric or Semigraphics types of screen-handling.

R and C refer to whether each bit specifies a pixel (R), or whether a pair of bits is used (C). This obviously relates to the number of colours you can have *ie* the colour set of the mode.

You may also have to set up some other SAM registers which run in pairs from FFC6 to FFD3. These are used to indicate the top left-hand address of the block of RAM to be displayed.

As a simple example one of the 14 possible colour graphics modes (64×64 cells) can be set up in Basic with a few POKEs:

```
POKE & HFFC1,1
POKE & HFFC2,0
POKE & HFFC4,0
POKE & HFF22, & H90
```

The first three POKEs set up SAM, the last configures the VDG chip (bits 3-7 of FF22 control this).

To set up the two-colour PMODE4 graphics screen (with 256×192 pixels), you would use:

```
POKE & HFF22, PEEK (65314)
  AND7+240+V
POKE & HFFC5,1
POKE & HFFC3,1
POKE & HFFC0,0
```

where V is O or 1 for the desired colour set.

It's far from easy to work out how to use each screen using these methods, but you can get some interesting effects. To translate Basic POKEs into machine code is easy. You need only load one of the registers with the value you need, then use the assembler mnemonic ST to get that value stored at the required address. For example, to get 0 into address FFC2, you might use:

```
LDA 0
STA FFC2
```

To answer your question; to get back to text mode in Basic (apart from CLS or PRINT), you could write:

```
POKE 65472,1
POKE 65474,1
POKE 65476,1
```

In machine code this would be:

```
LDA #1
STA FFC0
LDA #1
STA FFC2
LDA #1
STA FFC4
```

MODE(s)	V2	V1	V0
	(Register pairs)		
	FFC5/FFC4	FFC3/FFC2	FFC1/FFC0
G6R/C	set	set	clear
G3R	set	clear	set
G3C	set	clear	clear
G2R	clear	set	set
G2C	clear	set	clear
G1C/R	clear	clear	set
A1/E,S4,S6	clear	clear	clear

Sending games to software houses

Q I am writing games for the Spectrum (so far I have sold two). I would like to make them compatible with most popular joysticks, but so far can handle only Kempston. Can you tell me what signals they (especially Interface 2) deliver on which input port?

Could you also tell me which software houses you would recommend? One I know makes replicas of another's cassettes, while another operates with falsified sales figures to cheat the programmer, and a third needs three to six weeks to say 'no'. Is it right to offer a program to more than one software house at the same time, and finally, in your *PCN* charts, if you can't give the number of sales, why not give a percentage figure?
B Bartis,
Wasterkingen, Switzerland.

A Rather than messing around with hearsay technical specifications, your best approach is to contact the companies concerned. As they'll have a vested interest in getting their joysticks compatible with as many games as possible, they should be perfectly happy to give you most of the information you require.

For Sinclair, contact Software Development, Sinclair Research, Stanhope Road, Camberley, Surrey GU15 3PS.

Surprise, surprise, we can't recommend a specific software house. If your programs are any good, you'll get the best deal from the established software houses, and which you know publish good games. Really the only advice we can give you here is to be very careful about the people you deal with and check out adverts before putting anything in the post.

There's no law against sending programs to more than one company at a time, but make sure you tell the companies to whom you send them that they must contact you before they do anything with them. Obviously you can't sell the same program to more than one company, but there is a distinction.

Finally, the charts. We don't include mail order sales in the *PCN* charts, so if we were to include numbers sold or percentage market shares it would imply the charts had a statistical validity which they do not have. They are an accurate league table of what's selling best in shops nationwide.

Stopping the Oric's Auto-RUN isn't easy

Q I find there's virtually no software for my Oric 16K can I get an upgrade to 48K?

Also, how can I change the shape of the cursor and how can I prevent a program from Auto-RUNning once it's loaded?
Adam Durham,
Wakefield, West Yorks.

A Oric Products International (0990 27641) doesn't offer an upgrade path RAM-wise, but you might be able to swing an upgrade to a 48K Atmos. After all, it's only a question of swapping a couple of chips on your circuit board and putting it in a new case.

No, you can't change the shape of the cursor, this is fixed in ROM and cannot be altered by the user.

Preventing programs saved with the 'A' option from Auto-RUNning is not easy. When a program saved as Auto is loaded, address #63 will contain a non-zero value. What you would have to do is to write a short machine code program using the interrupt facility of the 6502. The routine would constantly load #63 with zero.

The Atmos comes with a cassette containing a program which stops a program from Auto-RUNning if any load errors are found. This is to eliminate the possibility of a system crash if an attempt is made to RUN a corrupted program. This implies that it is possible to reset the contents of #63 after a program has loaded, but you'll have to contact Oric for details you would need to write your own program.



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Commodore 64 frozen display

When listing a program on the Commodore 64, you can slow down the display by pressing the CTRL key. The following short program adds the facility to freeze the display by pressing the SHIFT or SHIFT LOCK keys. Run the program and then type NEW (RETURN) load your program and type LIST (RETURN). Pressing the SHIFT key will now freeze the listing.

```
10 REM PAUSE ROUTINE
20 FOR I=49152 TO 49161:READ A:
   POKE I,A:NEXT
30 DATA 72,173,141,2,208,251,
   104,76,26,167
40 POKE 774,0:POKE 775,192:END
```

Brian Rutherford, Coventry, Warks.

Put zoom in your Spectrum programs

The following routine for the ZX Spectrum produces a short 'zooming' noise which may be useful in programs.

When the routine has been loaded CALL IT with RANDOMISE USR 31200

```
10 REM 'ZOOM'
20 CLEAR 31299
30 FOR F=31200 TO 31225
40 READ A:POKE F ,A
50 NEXT F
60 DATA 6, 5, 197, 33, 0, 5, 17, 10,
   0, 229, 205, 181, 3, 225,
   17, 16, 0, 267,237, 82, 32,
   240, 193, 16, 233, 201
70 POKE 32101, 1
80 REM DEMO
90 RANDOMISE USR 31200
```

A Lonsdale,
Chester-le-Street.

Nifty routine for Spectrum printing

There are numerous occasions when printing on the bottom of the Spectrum screen is required.

Of course, the PRINT £0 statement can be used for this purpose, but it is rather unwieldy and cannot be easily incorporated into loops.

The following routine will overcome these disadvantages. It does so by reclaiming the bottom two lines of the screen from the operating system in line 10. No report codes must be displayed after this POKE including Scroll? or a crash will result. In order to prevent the OK report code from being displayed at the end of the program, line 50 is used as a delay and line 60 resets the computer for normal use.

```
10 POKE 23659, 0
20 FOR A=0 TO 23
30 PRINT TAB A; A
40 NEXT A
50 BEEP 10, 10
60 POKE 23659, 2
```

J M Lewis,
Llanelli, Dyfed.

Break into Spectrum line input

In a previous issue of *PCN* Microwaves there was an example of how to break out of an INPUT A$ statement. It is also possible to break out of an INPUT LINE A$ *eg*

```
10 INPUT "THIS IS A LINE IN-
   PUT."; LINE A$
20 GOTO 10
```

To break out of this, just press CAPS SHIFT and 6.

D A Hall,
Newport, Gwent.

Run a 64 program with three keys

Most Commodore 64 users know that pressing a letter then shift with RUN/STOP runs a program.

There is a three key version of this routine which can be more useful.

If you press down the shift key with the number 4 and then 2, this also runs the program and if you press down the SHIFT 4 and 2 keys simultaneously this will load in the next program on tape. There may be a few other variations with these keys that you can find with a little experimenting.

Gareth Wyn Jones,
Bagilt, Clwyd.

Spectrum program stop string along

An alternative way to stop a program on the Spectrum that is waiting for a string input is to press EDIT and (CAPS SHIFT and 1): both the string quotes will disappear, then just enter STOP.

M Terry,
Middlesbrough, Cleveland.

A strange Spectrum scrolling quirk

While I was playing around with inputs from my Spectrum keyboard, I discovered a strange quirk. Type in this short program:

```
10 PAUSE 0
20 PRINT INKEY$; IN 31
30 GOTO 10
RUN
```

Next hold down CAPS SHIFT+9 (Graphics mode) and let it repeat for the whole screen. The usual Scroll? changes to RUN when the above keys are held down. Press ENTER and all the Spectrum keywords go scrolling up the screen, some whole, some with their ends missing. After about two screens full it stops with K INVALID COLOUR. Can anyone explain this?

G Williams,
Hazlemere, Bucks.

Spectrum programs hidden conveniently

POKE 23607, 70 turns the complete character set into a lot of not very useful spaces. This could be used to hide the program from prying eyes, and does not affect the user defined graphics, so if the program does not contain text then nothing will affect the program when run.

If the program does use text then the line before a print statement should be POKE 23607, 60 and the line after, POKE 23607, 70.

Also, if the program has its own custom made character set and you want to list the program after you have broken into it, but you cannot read the characters, try POKE 23606, 0:POKE 23607, 60. After this has been typed in and entered, you should be able to list the program in the Sinclair character set that all Spectrum users know and love.

Paul Hargreaves,
Brentford, Middx.

Compare two methods to fill BBC squares

Filling a square on the BBC is very ugly, as the quickest way in Basic is (or was until now) to draw two triangles next to each other and fill them in with PLOT 85.

This takes quite a long routine. If, instead, you define a graphics window around the place where you want the square and then clear the graphics screen, it is possible to produce the square quicker and more neatly. Here are examples of both methods.

```
10 MODE 1
20 GCOLO, 2
30 MOVE 150, 300
40 MOVE 1100, 300
50 PLOT 85, 150, 700
60 PLOT 85, 1100, 700

10 MOVE 0, 130
20 VDU24, 150; 300; 1100; 700;
30 VDU 16
```

D Abensour,
Potters Bar, Herts.

Spectrum print format effects

The ZX Spectrum does not have print formats but the function command can be used to give the same effect. In the example below, the first function is used to print a column of figures so that the decimal points line up. The second function rounds the figures to two decimal places.

```
10 DEF FN Y(Z)=(LEN STR$ INT ABS Z)+(Z<10)

20 DEF FN W(X)=(INT(X*100+.5))/100

30 FOR A=1 TO 5:READ B

40 PRINT AT 2*A,16-FNY(B);FNW(B):NEXT A

50 DATA 95.376,-100.8952,3.1416,51926.7,12.961832
```

Sean Smyth, Tunbridge Wilts.

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9	Creditors	Payroll Section	24
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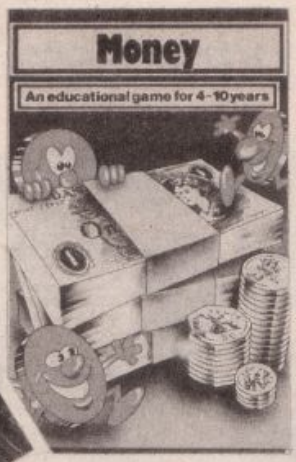
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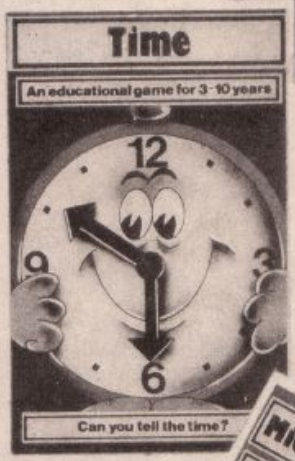


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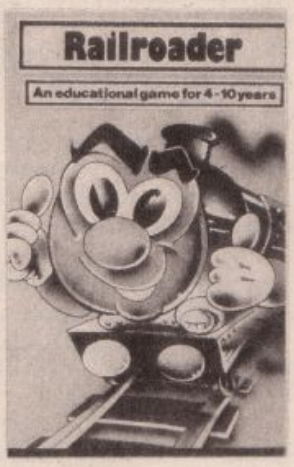




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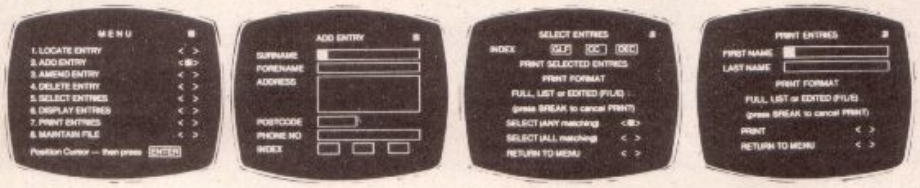


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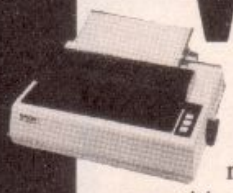
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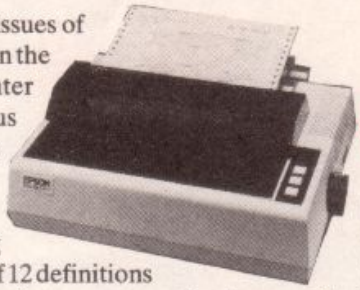
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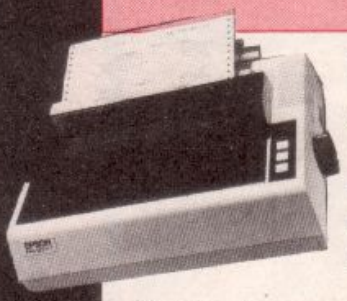
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HERE ARE THE FINAL TERMS AND DEFINITIONS:

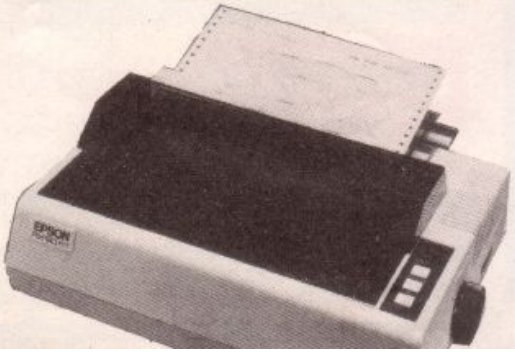


TERM	DEFINITION
Self-test Routine	A plastic cartridge containing the ink-soaked fabric which, when struck by the print head, causes characters to appear on the paper.
Print ribbon	Also known as Centronics.
Parallel interface	Printer paper that consists of connected sheets with perforated edges.
Daisywheel	An instruction to the printer that causes it to advance the paper by one page

And here's your entry form. Fill in the correct term AS PRINTED IN *PCN* in the space opposite the corresponding definition. Then fill in your name, address and current machine owned and send the form to us at the address given below.

TERM	DEFINITION
1	The term that describes the line-by-line movement of a printer.
2	An instruction to the printer that causes it to advance the paper by one page.
3	One of a set of hardware switches that controls the behaviour of a printer.
4	Printer paper that consists of connected sheets with perforated edges.
5	A set of non-standard characters which can be used to generate special functions on a printer.
6	A device which quickly takes information sent from a computer to a printer and holds it until the printer can print it all.
7	A mechanism for putting paper into a printer one sheet at a time.
8	The type of printer technology which uses groups of dots to form the characters and numbers that will be printed out on a printer.
9	A built-in program that resides in a printer's ROM allowing it to display the full printer character set and capabilities without using a computer.
10	A plastic cartridge containing the ink-soaked fabric which, when struck by the print head, causes characters to appear on the paper.
11	Also known as Centronics.
12	An interchangeable wheel which holds the typefaces which are impact-printed onto paper.





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Wren goes cheap

Ralph Bancroft on a sub-£1,000 luggable.



A conventional micro configuration except the Wren is very compact. Points are collected for the restful amber screen but deducted for the flimsy feel of the keyboard.

The £1,000 mark is an important pyschological barrier. Arguably, the transportable Wren is the first business micro to break that barrier. For your £1,000 you get all the hardware including screen and twin disk drives, CP/M, BBC Basic, bundled software and a built-in modem. You only need add a printer for a system that's ready to go.

Of course, you only get what you pay for. In the case of the Wren there are some limitations that have to be taken into account. The disk drives have a capacity of only 200K, puny by today's standards. The built-in screen is monochrome, so you miss out on the glorious technicolour of Prestel that the machine was purpose-built to work with.

The bundled software is, inevitably, from Perfect with all its non-anglicised imperfections. And, while you do get a Prestel program, there is no software enabling the user to exploit the micro-to-micro communications capability.

Still, at £1,000 the Wren is well worth a detailed look if price is the important consideration.

Presentation

The Wren sent for review did not come in any kind of box. It was one of three pre-production machines so some of the criticisms listed here may have been dealt with in the production versions by the time you read this.

With the machine you should get a large shoulder/hand bag that holds the Wren, disks and cables, and documentation. Certainly, these would be essential if you wanted to exploit the machine's transportability. The micro is advertised as a portable, but weighing in arm-wrenchingly at around 20lbs it is more in the category of Osborne-like transportability than the compact lightweights now available.

Documentation

The documentation was a loose bound folder of photocopied typescript that was definitely pre-production. It is, compared to some manuals, well-written. But to the inexperienced user with no knowledge of CP/M some of the sections might be as readable as Dostoyevsky. Much will depend on how well it is laid out and illustrated.

For the Perfect Software you get the usual Perfect manuals complete with the misleading pages that suggest the software has been customised to deal with English, as opposed to American, ways of handling dates and addresses.

Construction

At first sight the Wren is robust if ugly looking. Hardly the small, light, streamlined picture conjured up by its name. The case is a combination of sheet metal and the more familiar injection-moulded plastic.

Howard Kingsnorth

The unusual constructional feature is the sliding monitor/disk drive unit. When not in use, it slides forward to cover the keyboard and reveal the sturdy carrying handle at the rear.

At first sight this appears to be an absurd arrangement. When you carry the Wren around its monitor screen is facing the floor and you might put it down on an uneven surface or sharp object that could damage or scratch the screen. Wren Computers said it was redesigning a screen cover that would be firmly secured to the case when the Wren is in transit. Unfortunately, one was not provided with the review machine.

A plus point for this arrangement is that the Wren can be easily up-ended on a desk when it is not being used thereby releasing the space otherwise taken up by the Wren's large footprint (or should that be claw-print?).

In practice, the monitor unit was very loose with a tendency to wobble when moved and the sliding action was far from smooth. The only way to get it to slide fully forward was to upend it and let gravity do the work.

This wasn't the only tacky feature as the keyboard left much to be desired. There was a distinct lack of travel in the keys and the whole keyboard bent if a key was pressed too hard , as the board carrying the keyboard was screwed to the outer casing rather than supported from behind in the usual arrangement.

The layout of the keyboard is standard qwerty with the addition of a vertical line of five function keys on the left and five cursor control keys on the right. Two nice features are the LED in the caps lock key and the special * and # keys for use with Prestel. These latter keys should only be used with Prestel as they generate different keyboard codes than the usual * and # keys.

The Wren is not the most ergonomically designed machine and I found it a pain to have to crouch to see the whole screen properly. The monitor needs to be moved forward and/or the casing redesigned to allow you to see the screen at a normal viewing angle.

In use

To get the Wren up and running you first plug the power lead into a socket hidden in a compartment on the top of the monitor unit. Also beneath the grill are the on/off switch and controls for brightness and contrast for the screen display. An additional bonus is that the compartment is big enough, just, to stow the power lead with its bulky mains plug when the Wren is in transit.

On powering up the Wren it is immediately obvious that someone has given careful thought to what is described nowadays as the man-machine interface. Instead of the usual few lines of copyright notice and version number appearing at the top of an otherwise empty and far from user-friendly screen a large Wren logo appears with a message prompting you to insert the systems disk into drive A. After you insert the disk and wrestle with disk



Muscles are needed, though the Wren is not as tendon-stretching as some 'portables'. The Wren at roost (below) with socket-protecting flap raised.

drive door (it's the worse design I've come across) the screen clears and a copyright message flashes by as a menu is loaded.

This is undoubtedly the feature of the Wren I liked most. The menu software and executive desktop software was written by Quantec Software, a small CP/M software house better known, perhaps, for its high quality Micromega Spectrum games software and early learning software published under the Longmans label.

The menu appears on screen as a series of overlapping file folders, each file covering a different function. To select a file you simply move a large cursor from file to file using either the space bar or cursor keys and then hit Return when you have found the one you want. A message appears at the bottom of the screen telling you which disk to insert in which drive and



what to do next.

The Executive Desktop suite of programs are nice, neat and not worth having unless they come free. Frankly, if you want to use their features you would probably find good, old manual technology more efficient than the swopping around and loading of disks involved with the Wren.

Executive Desktoy might be a more apt description for this software. It has a number of features that you could always find an excuse for using. It has 'Time Management' (a diary), 'Addresses' (a card index), 'Deskfile' (a note book and simple forms like expenses), 'Filing system' (an index), 'Calculator' (a pocket calculator) and 'Typewriter' (a typewriter).

The software gives a full Prestel terminal emulation and generates the Prestel graphics and codes within the software rather than using a propriatory chip set. Apart from the ability to look at Prestel pages, save them on disk and/or print out you also get a software downloader (very useful when Micronet gets round to launching the much delayed Business Micronet and starts providing downloadable CP/M software) and an off-line message editor. If you have tried to send messages via Prestel you will know why this facility is such a godsend.

However, Prestel looks none too impressive on the Wren's tiny amber screen as some of the colours almost disappear. Regular Prestel users will therefore need to invest in a colour monitor to plug into the Wren. Alternatively, Prism says it will be offering an add-on modulator so you can plug the Wren into your TV.

Although Perfect Writer is a powerful and complex word processing package that is great if you want split screen editing of two documents and automatic placing of footnotes it is user-violent when it comes to learning to use it.

Perfect Calc is a competent spreadsheet. I don't use spreadsheets, but those who do assure me that Perfect Calc is fine.

Perfect Filer is the program I take great exception to. Apart from being a somewhat pretentious database system it has the fundamental disadvantage of being written for the American market. Perfect has told all and sundry that it will be anglicised for the UK market. Unfortunately, they only got as far as rewriting the manuals. Thus, the date fields use the American (month/date/year) format and the address template (essential for generating address labels) has two digit fields for 'state' and a 'zip code' field not large enough to handle UK post codes.

A Wren spokesman assured me the programs will be anglicised 'after the first 200' but I remain a hardened sceptic.

The irritating faults of the Wren are not isolated to the software. Mention has already been made of the bouncing keyboard and disk drive doors but the drives themselves give rise to concern. On the review machine, the top drive had a nasty habit of corrupting disks or simply refusing to read them. This last fault could be cured, but only by asking the Wren to attempt to re-read the disk several times until it eventually found the data that was undoutedly there.

Apart from this curable fault, the drives ran hot and any disk left in a machine for more than an hour was liable to come out with a warped jacket. Over a period of time this could also lead to unreadable disks. Regular backing up of disks is to be firmly advised. Investment in a large fan may not come amiss either.

Verdict

The Wren has an impressive pedigree. Designed by Transam (designers of the Tuscan — remember that?), manufactured by Thorn-EMI and distributed by Prism Microproducts via its Prism Business Systems subsidiary, it has all the hallmarks of a machine that should sell.

The limitations and foibles of the hardware and software are not insurmountable if Prism/Wren puts its mind to it.

The only class of machines that Wren could claim to belong to is the far from crowded communicating micro market. The Tiger is in suspended animation following the collapse of Harrison Industrial Developments and the Torch (like the Tiger) is a desktop machine that nobody except a would-be hernia victim would claim to be a portable (it is also more expensive).

The real test is whether I would be prepared to buy one myself. I must admit, in the end, I'm tempted. Given correction of the design faults and larger capacity disk drives I would be tempted even more. After that the only drawback is the lack of an electronic mail package to allow full micro to micro communication. Then all it would require would be a ray of inspiration at Torch to convert its excellent Mail Plus program to run on the Wren and I would be reaching for a cheque book.

SPECIFICATION	
Price	£1,000
Processor	Z80B running at 6Mhz
ROM	8K with diagnostics
RAM	64K expandable to 256K 50 bytes CMOS RAM with battery back up
Monitor	Integral 7 in amber monochrome
Disk drives	Twin 5¼in single sided drives with 200K each
Text screen	80 by 24 Televideo TVI 910 emulation, 40 by 24 Prestel emulation
Graphics screen	512 by 256 pixels in eight colours or eight shades of grey
Keyboard	67 typewriter style keys, five function keys (shiftable) and five cursor control keys
Interfaces	RS232 serial 75-19200 baud Centronics compatible, parallel port, Left and right paddle controls, Winchester hard disc, RGB, Inbuilt auto-dial modem 1200/75 baud full duplex, 1200/1200 baud half duplex
Operating system	CP/M Plus
Languages	BBC Basic Z80 version
Software Included	Executive Desktop (Time management, Addresses, Deskfile Filing System, Calculator and Typewriter), Perfect Writer, Perfect Calc Perfect Filer, Prestel terminal emulator, CP/M and disk utilities
Distributor	Prism Business Systems, Prism House, 18-29 Mora Street, London EC1V 8BT Tel: 01-253 2277

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Samurai Standard

Japanese MSX is going to raise standards say Igor Thomas and Ian Scales.

The Japanese are very good at producing electronic consumer products. During the 1970s the various corporate giants (Hitachi, Sharp, Sony etc) managed to dominate the markets for TVs, hi-fi equipment, video recorders, cameras — you name it they made it.

It's hardly surprising that these Japanese companies represent something of a recurring nightmare for the diverse mass of UK and US-based computer manufacturers currently squabbling over the home market — a traditional Japanese stamping ground.

Until recently conventional wisdom said that the Japanese would never make an impact on the micro market because they lacked the necessary software expertise. This opinion has almost become an article of faith. Unlike VCRs, TVs and other consumer-electronic categories which use software created by a separate industry, the relationship between hardware and software in the computer industry, it was argued, was so entangled and essential that Japanese companies couldn't just produce hardware (like they do for VCRs or stereos) — they had to produce software to go with it.

This theory had a lot going for it. Good applications software relies on good documentation and an understanding of indigenous business practices. Basically you have to be English-speaking to create software for English-speakers. So while Japanese companies could dominate their domestic market (you have to be Japanese-speaking to create software for Japanese-speakers), it was assumed they'd be a long time before dominating the world computer hardware market.

PCN PRO-FILE HARDWARE

This limitation is even more apparent in the overwhelmingly 'cultural-specific' games/education area of computing. You can't get much of a handle on what UK games-enthusiasts are likely to consider an exciting game from the inside of a different culture and a different language on the other side of the world. Consider the subtleties of nuance and language necessary to create the proper difficulty level in an adventure game, for instance.

But what would happen if a clutch of the largest Japanese electronics giants got 23 ▶

MINIMUM MSX HARDWARE SPECIFICATION

CPU	Z80A or equivalent, bankable 4-window memory control circuitry
MEMORY	RAM: 8K minimum ROM: 32K Basic language
DISPLAY	Text: 32 columns, 24 lines Graphics: 256 by 192 pixels Colour: 16 (8 colours, 2 intensities)
CASSETTE	1200 & 2400 baud FSK formats, motor controlled (default is 1200)
SOUND	3 music channels, 8 octaves each
KEYBOARD	72 keys, JIS standard, software scanned matrix, English & Japanese characters, graphics
CARTRIDGE CONNECTOR	Bankable Z80 I/O type design, built-in power protection during insertion/removal, multi-way plug/socket construction.
EXPANSION CONNECTOR	Bankable Z80 I/O type design, edge-connector construction.

Note that these are only the minimum requirements; most manufacurers will offer many other features as standard, such as joystick and printer facilities.

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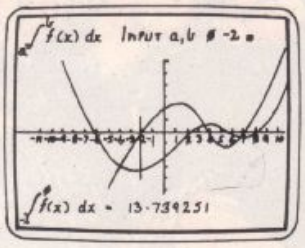
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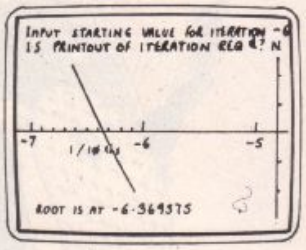
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◀ 21 together and shared a 'standard'? In other words, all the computers that they produced would be completely compatible in terms of peripherals, software, languages and so on. This way the manufacturers could collectively provide a lucrative market for applications software writers and peripherals manufacturers here and in the US.

Surprise, surprise. Although it's early days yet, the big Japanese consumer manufacturers seem poised to group around such a common software/hardware standard, the better to carve out a niche in the lucrative home computer market. The standard in question is called MSX — Microsoft Extended Basic.

'Software houses should gear up for MSX'

If you already have a grasp of Basic programming, operating an MSX machine will be a very simple exercise for you. Should you already have some proficiency in any of the many Microsoft Basic dialects (Apple, Dragon, IBM, Tandy 100, etc), using an MSX machine may even be more fun than work. Lastly, if you really want to think about a career in programming, either Z80 machine code or MSX Basic will provide you with impeccable credentials for employment well into the end of the decade.

Newcomers to Basic language programming, and Z80 machine code may find an MSX machine more economical in the long run than any of the current low-priced micros simply because so many different expansions and cartridges can be plugged into it. Apart from interchanging all MSX plug-ins with all MSX micros, those of you who buy software books and programs will have a far longer-lived collection if they are written for an MSX machine.

Initially developed to use conventional cassette recorders as the long-term storage medium, MSX Basic is in fact designed to operate with a soon-to-be announced disk operating system known as (guess what!) MSX-DOS. When this becomes available, the MSX standard will promptly move up into commercial and business planes. At the moment numerous third parties are tinkering with implementing CP/M on MSX micros, but this will more than likely not be officially sanctioned by Microsoft, and the international value of MSX-CP/M will probably not be as great as that of MSX-DOS.

Undoubtedly, MSX-DOS systems will become commonplace in the commercial business world within a few months of MSX-DOS's release. There is every likelihood that MSX-DOS will bear a remarkable resemblance to MS-DOS, and MS-DOS users will slip into MSX-DOS without a hitch. Any software factories worth their silicon would do well to gear up for MSX as soon as possible, or pay the profitability consequences.

Within the terms of the Microsoft MSX license rigid hardware specifications to which an MSX manufacturer must adhere. These include: a Z80 type microprocessor chip, a three-voice sound chip, a full-colour display, a standard keyboard layout, two MSX connectors for software and hardware expansion plug-ins, at least 8K of RAM memory (with the ability to expand up to 1,024K) and a 32K Basic language ROM.

All this provides wonderful potential for the software marketplace, and even though MSX machines are only at the drawing-board stage in Britain, a number of UK firms are looking more than slanty-eyed already.

English-language applications software is being produced in Japan now, although no official export plans have been confirmed by either Microsoft or any of itslicensees. Any far-seeing British manufacturers (software and hardware) will reap great benefits in being ready when the Japanese invasion begins to make its presence felt later this year.

Having looked at a number of Japanese MSX machines, and even with the numerous variations currently in production, there certainly is still some room for good old-fashioned British innovation. Serious plans are afoot for a British MSX micro although, with the incredibly low prices which Japanese firms can sell machines at, competition will be tough.

The Yamaha YIS503 currently represents a classic example of the new MSX standard, of which much has already and will continue to be said. Over the coming weeks almost all the popular micro journals will be trumpeting more and more about MSX micros, even though none of the machines are currently available outside of Japan.

Standing behind all the furore is the proud parent, Microsoft, which has finally given birth to MSX in a big way. Maybe the MSX standard is not everything to everyone, but you can't argue with the sheer volume of units which will be in use by the end of this year alone.

The MSX concept is a commercially viable proposition, and deserves a good crack at the whip. Hopefully the as-yet anonymous UK developer(s) of an MSX machine will avoid cloning from the Japanese and show the world something Britain can be proud of.



The first full implementation of the MSX standard is soon due in the UK courtesy of Yamaha, traditionally associated with motorcycles. But you won't see blue smoke issuing from this Yamaha which owes much to the company's other product line — musical instruments. This home computer can come with a full synthesiser and keyboard.

Igor Thomas plays the Yamaha YIS503 in next week's Hardware section.

MSX BASIC KEYWORDS

ABS	IF/GOTO/ELSE	PLAY
ASC	IF/THEN	POINT
ATN	IF/THEN/ELSE	POKE
AUTO	INKEY$	POS
BASE	INPUT	PRESET
BEEP	INPUT £	PRINT
BIN$	INPUT$	PRINT £
BLOAD	INSTR	PRINT USING
BSAVE	INT	PSET
CALL	INTERVAL ON/OFF/STOP	PUT SPRITE
CDBL	KEY	READ
CHR$	KEY LIST	REM
CINT	KEY ON/OFF	RENUM
CIRCLE	KEY ON/OFF/STOP	RESTORE
CLEAR	LEFT$	RESUME
CLOAD	LEN	RIGHT$
CLOAD?	LET	RND
CLOSE	LINE	RUN
CLS	LINE INPUT	SAVE
COLOR	LIST	SCREEN
CONT	LLIST	SGN
COS	LOAD	SIN
CSAVE	LOCATE	SOUND ON/OFF
CSNG	LOG	SPACE$
CSRLIN	LPOS	SPC
DATA	LPRINT	SPRITE ON/OFF/STOP
DEF FN	LPRINT USING	SPRITE$
DEF USR	MAXFILES	SQR
DEFDBL	MERGE	STEP
DEFINT	MID$	STICK
DEFSNG	MOD$	STOP
DEFSTR	MOTOR ON/OFF	STOP ON/OFF/STOP
DELETE	NEW	STR$
DIM	OCT$	STRIG
DRAW	ON ERROR GOTO	STRIG ON/OFF/STOP
END	ON INTERVAL GOSUB	STRING$
EOF	ON KEY GOSUB	SWAP
ERASE	ON SPRITE GOSUB	TAB
ERL	ON STOP GOSUB	TAN
ERR	ON STRIG GOSUB	TIME
ERROR	ON/GOSUB	TROFF
EXP	ON/GOTO	TRON
FIX	OPEN	USR
FOR/NEXT	FOR INPUT/OUTPUT/APPEND	VAL
FRE!	AS CAS:/CRT:/GRP:/LPT:	VARPTR
FRE$	OUT	VDP
GOSUB/RETURN	PAD	VPEEK
GOTO	PAINT	VPOKE
HEX$	PDL	WAIT
IF/GOTO	PEEK	WIDTH

Mike Gerrard continues the argument of text-only adventures versus adventures with graphics.

Text-only wins



A few weeks ago (*PCN* issue 44), John Lettice asked if the new breed of graphics adventures was killing off the traditional text-only quest. If the latter weren't quite ready for burial just yet, he suggested, they were at least in the Intensive Care Unit with little hope of recovery.

I don't want to make a simple biased statement for the opposite view, but while it's true that the new graphics adventures are holding centre-stage at the moment, I believe that the text adventure could be on the verge of, and I choose the words carefully, a quantum leap, thanks in part to some of the techniques developed in getting the likes of The Hobbit and Valhalla to the screen.



In talking of those two adventures in particular, John Lettice praised the way they made use of a type of artificial intelligence in the programs so that characters like Thor and Thorin are able to act independently of the player. While I too admire this technique it is of course nothing to do specifically with the graphics elements, but could be used equally to enhance text-only programs.

To some extent this is already being done in the Dungeons and Dragons style of game, where the character set up at the beginning has an influence on the likely outcome of certain events, and although this is nothing in comparison to the characters wandering round at will in The Hobbit, or the fact that the snake in Valhalla may decide to drink the wine, to the bewilderment of all concerned, I'm sure this is one way in which text-only adventures will develop, unhindered by the additional problems facing games with graphics.

Those graphics pages are great consumers of two items that most adventures can little spare: memory and time. Waiting for the picture to be drawn is all very well the first time, but no matter how impressive it may be, do you really want to sit and watch a particular location being drawn for the fiftieth time when you're aching to pass through en route to somewhere else? And is a picture really worth a thousand words? Well, it needs to be in terms of the memory it consumes, but for me a few dozen well-chosen words are worth any of the pictures in recent graphics adventures.

Take The Hobbit, for example, which opens with 'You are in a comfortable tunnel like hall. To the east there is the round green door.' Apart from the fact that it should have a hyphen in tunnel-like, the description is mundane in the extreme and could have come out of a Janet and John book: 'Here is Bilbo. See Bilbo read the map.' Further on: 'You are in a hidden path with a trolls footprints,' which is as unatmospheric as you can get, and should read the trolls' footprints in any case.

Without the pictures the text could draw much more on the words from the original book . . . Tolkein, after all, was a better writer than any programmer could hope to be, and with more room to concentrate on the text you could avoid silly responses, as happens when 'You are at the Great River. What now?' If you reply 'Swim River,' the program answers 'I do not see the river here.'

Let me say that I am a great fan of graphics adventures, but much as I enjoy playing Valhalla I can't see it becoming an all-time classic, partly because its locations and descriptions are even sketchier than those in The Hobbit: 'You are in the mountains in Asgard,' 'You are in an icy waste in hell,' and 'You are In Hel's hall, which is in hell' being typical examples. How could anyone prefer adventures to develop in this way, after the descriptive traditions established in the original mainframe Adventure:



'You are in a splendid chamber in an east-west canyon. The walls are frozen rivers of orange stone and a carved pillar rises to the ceiling 30 feet above. The floor is formed from smooth marble slabs, and is slightly worn in the centre. There is a little bird here, singing merrily.' Or *'You are in the Hall of the Mountain Kings, a huge room decorated with majestic statues. The east wall is covered by trophies and the mounted heads of elves and monsters, with a carved granite throne standing beneath them. The hall is hung about with the tattered remains of rich tapestries and has large doorways on all sides. A huge green snake hisses fiercely at you.'*



And if anyone who has had their head stuck in The Hobbit for the last six months complains that it's unfair to compare something written on a mainframe with an adventure squeezed into the humble Spectrum, I'm quoting from the excellent Spectrum version from Level 9, which has squeezed the original into Sir Clive's little black box *and* added some locations to the final game.

Not everyone has the imagination and descriptive powers to conjure up the haunting atmosphere suggested in the above locations, but you don't need the Nobel Prize for Literature to use words effectively. Level 9's latest text-only game, Lords of Time, is a clever Dr Who-style adventure where you can travel through time in a grandfather clock and wind up (if you'll forgive the pun, which is also an unsubtle clue) in any of nine different time zones, each with its own adventure.

When you de-clock you may find yourself 'on a flat rocky plain which stretches for miles. It is covered by fine grey dust. The night air is cold. Luminous walkways travel east and west,' or perhaps 'you are on a beach in a small bay surrounded by overhanging cliffs. Breakers roll in from the sea to the north, rocking the Viking longship drawn up on the sand north of you.' Even those simple descriptions couldn't be conveyed fully on any micro, no matter how good its graphics capabilities.

Text and tasks are the two vital factors in an adventure, and it will be intriguing to see the software produced using The Quill, the recent adventure-generating program from Gilsoft. People with imagination but insufficient programming ability will now be able to write their own adventures, and one of the first to use the generator, Denis Through the Drinking Glass, shows how important the text is. Attempts at caricaturing Denis and Maggie on the cassette cover are disappointing, but the amusing rhymes in the text enable you to conjure up your own real picture of goings-on in Number Ten. Graphics would

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Wendy Hoile

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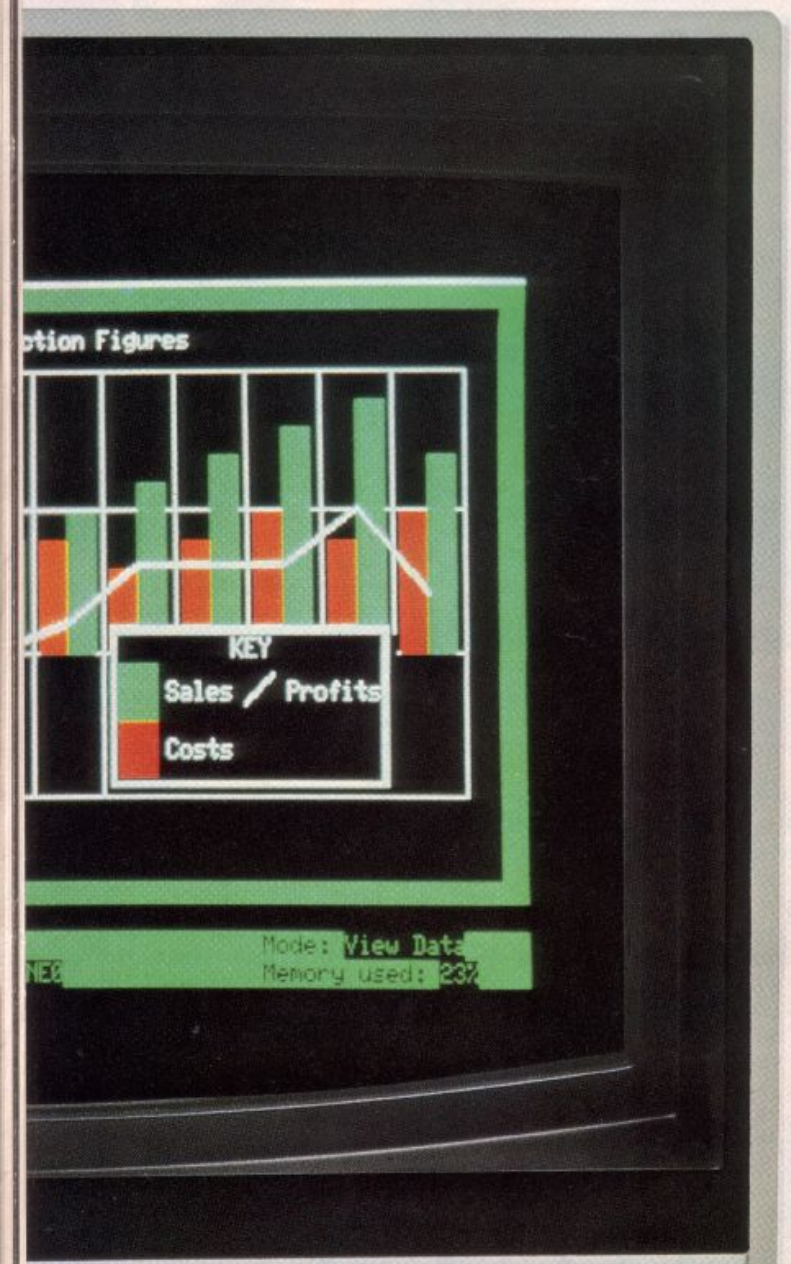
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New-Sinclair QL

There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take... get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

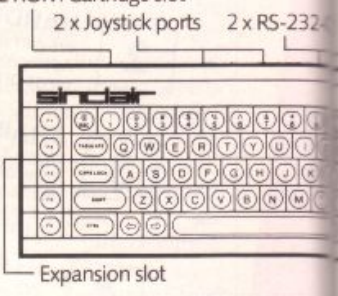
Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports

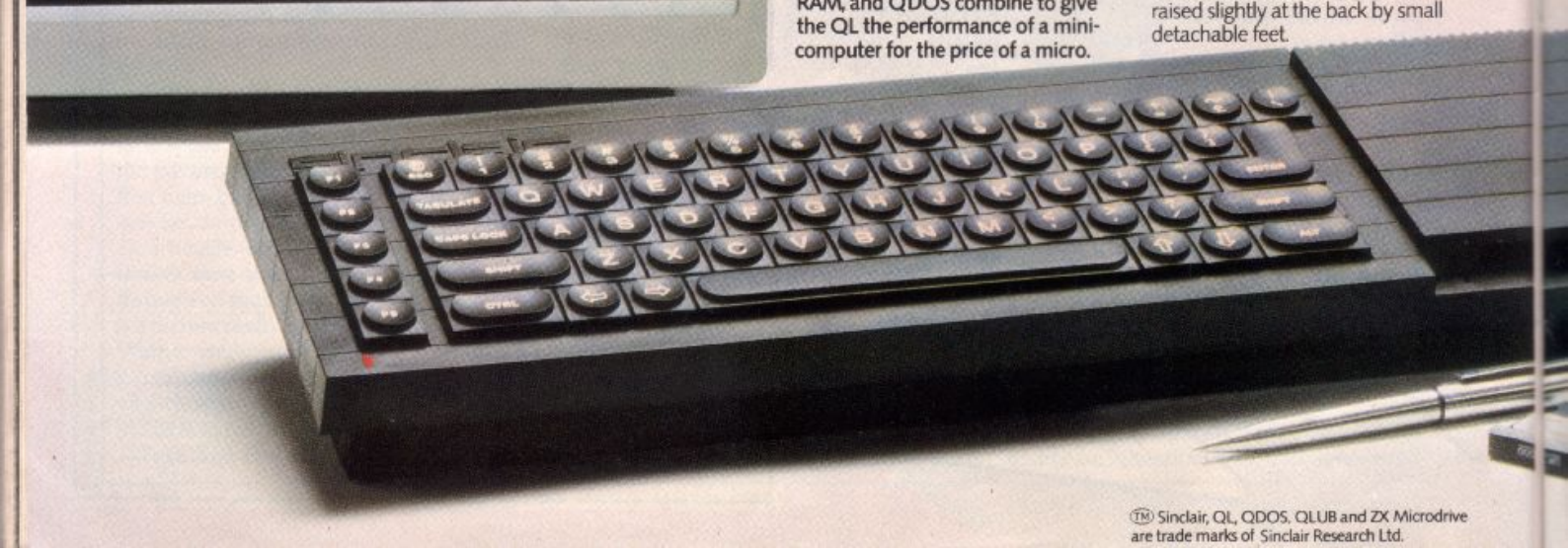


New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.



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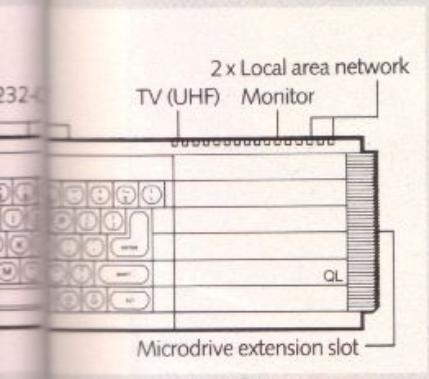
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because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.



Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.



Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

Word-processing

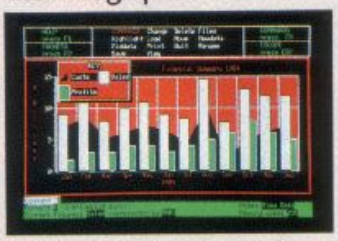


Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

QL Quill brings you all the facilities of a very advanced word-processing package.

Business graphics



QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual! It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Spreadsheet



QL Abacus makes simultaneous calculations and 'what if' model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New -- the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

If you're seriously considering any other computer, post the coupon for a blow-by-blow comparison. We'll take a *published* comparison chart for the machine you're considering (not one we've created ourselves) and give you the Sinclair QL figures, detail by detail.

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◀34 only spoil a game like this, not enhance it.

The managing director of a very successful software house said that he too thought the days of the text-only adventure were numbered, and what the public wanted was graphics quests galore.

It's hard to argue with someone who has a first-class track record of spotting the kind of software people want, but in a way this kind of thinking has always gone on. The invention of photography, for instance, was said to signal the death of painting, TV, the end of both films and radio, and every new invention heralds the end of books.

Conversely, television has been described as radio with pictures, and the same could be said of graphics adventures: they're just text adventures with a few pictures stuck on, but because the pictures are what's new they're getting all the attention at the moment. Just as for many people the goggle-box will never replace the magic of listening to a good radio programme, where you use your mind to create pictures of the people and places, so graphics adventures won't replace text-only adventures.

A classic example of this was the radio comedy program, The Goon Show. An attempt to transfer the show to television with puppets was doomed to failure because no-one, however talented, could create puppets to match the unique pictures everyone held of what Eccles and Bluebottle looked like.

Another advantage that John Lettice saw in the latest graphics adventures was that no two games are ever played the same way. This is true, in a different way, of text-only adventures, as people would hardly play them for months on end otherwise, but in any case, do people stop reading books because the pages never change? The Hobbit is a book that people read over and over again without demanding a different outcome.

There's no doubt that graphics adventures are what's happening at the moment, and both Melbourne House and Legend are working on follow-ups that promise to be bigger and better. A software collection will be the poorer without the best of these, but the text-only type aren't going to disappear, they're going to improve dramatically.

Consider the memory soon to be available on the Sinclair QL, and on machines likely to follow that, and think what could be achieved by using that memory for text alone, yet incorporating the artificial intelligence elements of the graphics adventures.

Soon you'll be able to take the central part in any book of your choice, from Winnie-the-Pooh to Confessions of a Window Cleaner. And who knows, by the end of the year you might even be able to rewrite George Orwell's 1984. . . PCN

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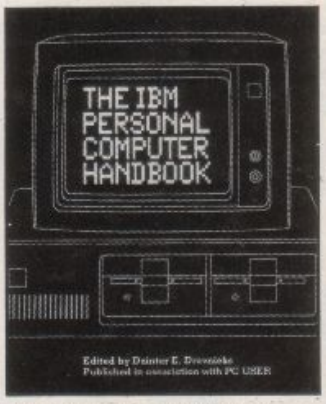
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Suffering from keyboard finger? Take a break with a book.



'The IBM Personal Computer Handbook' edited by Dzintar Dravnieks, published by Prism Press (in association with PC User) at £11.95 (paperback, 240 pages).

It's hard to see who will buy this weighty tome. The 455 pages are divided into two sections; the first ten chapters introduce the world of computers to the newcomer, while the latter half is dedicated to indices which the PC user will find invaluable.

These include lists of software, peripherals (fancy a 1K×1K colour graphics controller card, or a voice recognition board?), suppliers and distributors, periodicals and user groups.

So, while the first section is a good introduction to the machine for those thinking about buying a PC or who've just got into using one, the second part would be of most use to a more experienced user.

The detailed opening chapters (each with its own glossary) include a brief history of computing, using software, how and where to buy the hardware and an introduction to the machine. Other topics are the major uses of personal computers; principles of database management, word processing, spreadsheets, telecommunications and even games. There is a useful section on computerising your busines and a fairly comprehensive list of relevant software (with a brief description of each product) at the end of each chapter.

The English edition has a 41-page supplement giving details of British and European sources of PC software, but lacks such information as where to get peripherals and such novelties as bumper stickers reading 'IBM PC's Eat Apples'. Or how about an 'Anchor Pad' which secures your PC to your desk with 600 pounds of 'grip strength'.

Overall, it's a handy book for the first-time user and would serve those wishing to learn more about the geneal principles behind the micro boom; but those who subscribe to one of more of the many micro magazines and who know the basics will find it largely redundant. **BS**



'40 Educational Games for the BBC Micro' by Vince Apps, published by Granada at £5.95 (paperback, 203 pages).

£5.95 for 40 programs must be a bargain when one cassette game costs as much, and these have the added extra of mixing entertainment with education.

Some old familiars crop up—Hangman, Noughts and Crosses and so on, while maths, geography, grammar, music, weights and measures are dealt with in a light-hearted way.

This book is not for the newcomer, but for someone who knows the BBC and wants to test its capability in handling programs. Each of the 40 programs follows the same format: a brief introduction, how to play and some programming hints followed by the listing itself. However it's a pity the hints do not accompany each program, even though they are only on how to change data. In this book you have to think things out and as your programming skills increase you can change the listings to make tasks more difficult. **SG**

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Spectravideo SV 328: Memory – 32K ROM expandable to 96K, 80K RAM expandable to 144K: **Keyboard** – full word processor type, 87 keys, 10 function keys, built in cursor control: **Graphics** – 16 colours, 256 x 192 high resolution graphics, 32 sprites: **Sound** – 3 channels, 8 octaves per channel: **CP/M* compatibility** – over 3000 existing software packages: **Storage** – cassette drive, 256K disc drive capacity: **Suggested retail price** – £262.

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PCN PRO-TEST SOFTWARE

A MICRO OF NOTE

Pete Gerrard plays Commodore keyboards.

With the sound capabilities of the Commodore 64 as they are, and with Quicksilva being one of the top software suppliers for home computers, what better than to see a marriage between the two producing a synthesiser for the Commodore 64 called Ultisynth 64.

Objectives

Quicksilva prefers to call the program a music processor rather than a synthesiser, and in fairness the program is closer to the former, since it possesses few of the capabilities of a true, dedicated synthesiser. But what a food processor does for food, Ultisynth does for music. Even the musically incompetent should find themselves capable of producing excellent sounds and rhythms within a couple of minutes at the keyboard.

In use

Ultisynth presents you with a seven option menu. Two options are for the loading and saving of tunes, background rhythms, or any piece of music that happens to be in the machine at the time.

Like a good word processor, Ultisynth won't automatically save everything onto tape: instead it asks you which sections of the music you wish to store. Every note entered has an associated number, and in total, Ultisynth is capable of storing over 7,000 notes.

When in record mode, it is possible to enter music a note at a time. You won't hear it being played in this mode, but you can set up pre-defined rhythms by moving notes up and down the screen, deciding what key or octave to play them in, and also for how long they are to be played.

These compositions can be stored as one of the two user-defined background rhythms, of which there are eight, accessible by either voice 2 or voice 3 of the three available on the 64.

Voice 1 is used for the actual playing, and upon entering keyboard mode this voice does the talking. The keyboard is treated as a piano keyboard, with notes being played by simply pressing keys. All of the features associated with each voice can be easily altered, such as the shape of the envelope, the level of filtering, pulse widths and so on. Such advanced features as ring modulation and synchronisation are also adequately coped with.

Other musical effects such as glissando (the sweeping of notes) are included. But the highlight of the Ultisynth package is the Pretab feature, which gives control of the filter cutoff frequency and resonance, pulse width, and the frequency of voice 1 in real time, by altering a pre-defined table of values.

Verdict

By the time you've got two background rhythms going in synchronisation with voice 1 playing the leading melody, you're well on your way to joining Mike Oldfield at the keyboards.

A couple of minor complaints prevent this program from receiving an A1 rating. As you merrily plough through the manual, following the instructions and altering everything, you rapidly find yourself in chaos, and there is no way of resetting everything back to normal, short of re-loading the program.

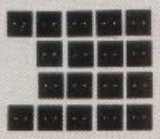
Finally, altering the tempo of the voices is a rather hit and miss affair, since the method used to control this is not the easiest to master.

Despite that, a triumph for Quicksilva which anyone remotely interested in music should consider.

Ultisynth gets my approval because it's easy to use, offers good control, works with all three voices and allows you to save your music to tape.

RATING (/5)

Lasting appeal
Usability
Use of machine
Overall value



Name Ultisynth 64 **System** Commodore 64 **Price** £14.95 **Publisher** Quicksilva Ltd, Palmerston Park House, 13 Palmerston Road, Southampton SO1 1LL (0703-26515) **Format** Cassette **Language** Machine code **Other versions** None **Outlet** Mail order/Retail

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Romik Software's early synthesiser for the Vic 20 was well-received. Now this has been upgraded to run on the Commodore 64, but has it been worth the wait?

Objectives

Some music programs set out to be simply programs that play music, but right from the start Multisynth has its heart set on being a true synthesiser, since in use it is very similar to using a dedicated machine.

Of course, you can use it to play music, but it is as an impersonation of a synthesiser that it will stand or fall.

In use

Multisynth has a number of different screen displays, with the principal one being of the keyboard used to play the music. Unlike some other programs, Multisynth uses almost the whole of the keyboard for playing notes, and in feel it is very similar to playing an electric organ with two keyboards: deep notes at the back, and higher up the octave at the front.

This can be misleading, since sharps and flats are played by individual keys, rather than pressing the shift key and another key. Consequently some keys on the keyboard do not produce any sounds when pressed, but are just left there to make up the numbers.

This is apart from two of them, which can easily be pressed by mistake, and instead of playing a note the 'A' and 'S' keys will send you up and down the octaves with many a dire consequence.

One nice point about this display is that a little blob lights up on the key that you're pressing to show you where you are on the keyboard.

To leave this display and move onto the first menu screen, you press the left arrow key, and then feel faint at the sight of a million and one options open to you.

These are not quite as frightening as they seem, since they are used mainly for voice 1, to set up the shape of the envelope, the pulse widths, and so on. However, pressing another key takes you onto the master control panel, and if you didn't faint before, you will when you see this, since there are at least two million and two options to this one.

But, hang on, there aren't — half the options shown here work on the previous menu, but weren't displayed on the screen due to lack of space. This is confusing and misleading, and causes many a strange note to be played.

Verdict

It doesn't appear to be possible to have all three voices playing at once, and at first the package presents itself as a very confusing one if you want to do anything other than just play a few notes.

The effects are all in there, somewhere, but finding them is the problem. The preliminary version of the manual that I had certainly needs some work done on it. But overall it was definitely worth the wait.

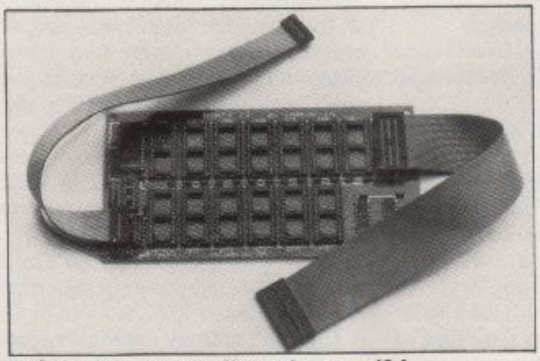
RATING (/5)

Lasting appeal
Usability
Use of machine
Overall value



Name Multisynth 64 **System** Commodore 64 **Price** £14.99 **Publisher** Romik Software, 272 Argyll Avenue, Slough SL1 4HE (0753-71535) **Format** Cassette **Language** Machine code **Other versions** Original version for Vic 20 **Outlets** Mail order/Retail

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PCN PRO-TEST SOFTWARE

Play and Learn

Colin Cohen on educational software for the Dragon, Spectrum, BBC and Commodore 64

IN *PCN* 48 I mentioned there were certain conventions observed by book publishers. One of the most obvious is that in the better class of production the publisher take a certain amount of care to ensure that the pages don't fall out. This is the nearest equivalent that I can think of to a series of programs that won't load.

Good Housekeeping

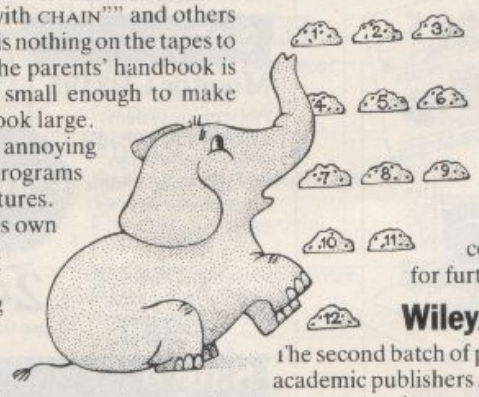
When I received the first series of *Good Housekeeping* software (it is available for the Spectrum as well as the Beeb) they would not load. Or rather, out of a whole series, only one program would load and the usual operating system fixes had no effect. All the programs had to be returned for replacement.

It would seem that all National Magazine's resources have been concentrated on protecting the tapes against copying — indeed you are even warned that attempts of copying may affect the tapes themselves.



My major complaint is that some of the programs start in Basic while others are in code. While it is not expected that a child should start the programs on their own it seems quite reasonable that they should be able to use them unsupervised subsequently. This is made difficult because some of them are loaded with CHAIN"" and others with *RUN. There is nothing on the tapes to indicate this and the parents' handbook is printed in a type small enough to make *PCN*'s small ads look large.

Apart from this annoying idiosyncracy the programs have common features. There is Nat Mag's own 'Mr T' who does a neat little dance if you get something right, and turns some fairly odd colours if you have a load error (there was only one on the replacement tapes). All the programs have a common title page and the block numbers count back to zero through the lengthy load. There are also common parent screens.



Number Games is a pre-school teaching aid. In the first stage the spots jump off a ladybird and then have to be counted back on again. A nice touch is the way the ladybird is animated and walks off the screen when the child gets it right. A later version requires the child to count the spots and then tap the appropriate number key — as opposed to the earlier version in which the learner counts the spots out loud and taps 'N' once for each spot.



Other programs on the tape draw large numbers of the child's choice on the screen and have a splendidly-animated elephant eating a number of buns.

The Money Box program seems to be a perfect example of what a micro is not good at. The graphics are simply not up to depicting the different coins on the screen and even the relative sizes are not clear. All its other failings relate to this. Alphabet Games draws groups of letters on the screen. You choose which group, depending on any problems the child may have. I have to say that I preferred the Chalksoft version (*PCN* 16) and the parent screen that came with the program was not the one described in the documentation. I do, however, feel that one is entitled to expect the BREAK key to be adequately trapped (it is not trapped at all and the program can't even be OLDed) just as ESC can be used to take one back to some form of menu (it is).

After all if one really needs to BREAK or ESCAPE this can always be done by a final option on the menu.

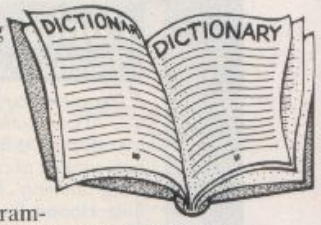
Our favourite was Mr T Tells The Time. We especially liked the way in which numbers fell off the dial if you try to put them in the wrong position on a good old-fashioned analogue clock. Unfortunately, the real problem with telling the time is the minutes rather than hours and this is beyond the scope of the program. A good word can be said for one aspect the documentation — all the programs come with suggestions for further related activities.

Wiley/Sulis

The second batch of programs comes from academic publishers John Wiley who have a very good reputation in the higher education market and are marketing software produced for them by Sulis of Bath. I admit that my very high expectations were sadly disappointed. Having cut my way through the adhesive tape that implied at least a short, sharp sentence in the Tower if I even thought of copying the programs, I was rewarded by two of the three loading without error, while the third could be loaded with *OPT2,0, though I had to use my back-up recorder for them all.

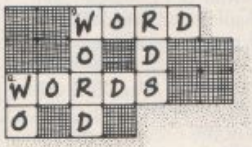
While the lengthy load goes on the screen displays another copyright warning — it's a pity as much effort did not go into on-screen documentation. For instance, ESCAPE is trapped, but while BREAK is not, the program can be OLDed.

There are all the usual options of difficulty in Wordpower and several different ways of playing each game. In one way or another you have to match opposites, similies, collectives, adjectives, nouns and synonyms. The graphics are totally without imagination, the sound bored me and al but half of the program consists of DATA statements.



It's also irritating to have 'The right answer is . . .' displayed every time you enter the correct word.

Besieged is for the dedicated anagrammer — the best one can say is that the anagrams are often very difficult indeed; I suspect too difficult for most secondary children. Up to ten letters may be shown, but as few as four are sometimes needed.



WordSplits invites the child to match the second half of a word with the first. It is probably the best of the bunch, though like the other two it has boring sound and graphics. None of them do anything that could not be done better by a book of the same price or cheaper.

Verdict

All six programs were grossly overpackaged. Of the programs in this review only one of the cassettes could be removed from its box without resorting to a screwdriver each time I wanted to use it.

It seems to me that no-one would spend about £10 on a book that taught as little as these programs. In particular, book publishers have long since given up binding books in this price range as expensively as the average program. The inevitable conclusion is that too much of the final price relates to the packaging and not enough to the contents. More effort needed.



PCN

Name Mr T's Number Games, Mr T's Money Box, Mr T Tells The Time **System** BBC, Spectrm, Commodore 64 **Price** £12.95 each **Publisher** Ebury Software, National Magazine House, 72 Broadwick Street, London W1V 2BP **Outlets** Mail order/Retail

Name Wordpower, Besieged, Wordsplits **System** BBC, Spectrum, Dragon, Commodore 64 **Price** £8.95 to £11 **Publisher** John Wiley, Baffins Lane, Chichester, Sussex PO19 1UD **Outlets** Retail

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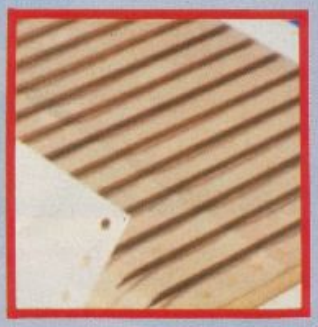
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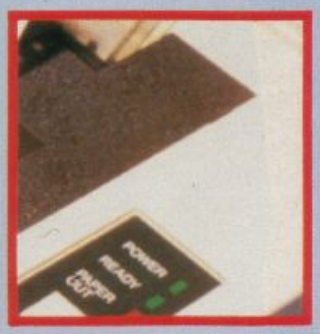


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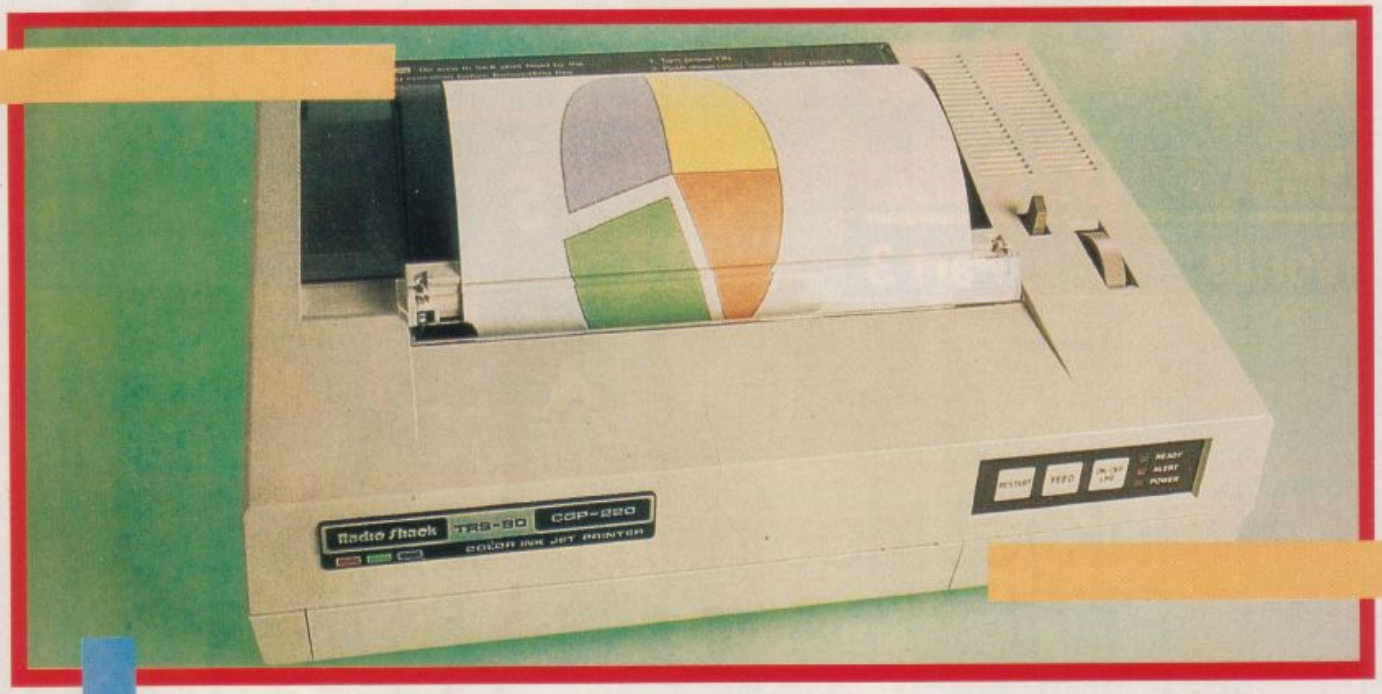




PRINTERS

The closing chapter

PRINTERS

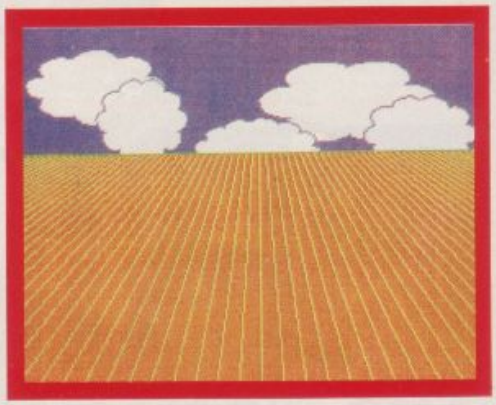


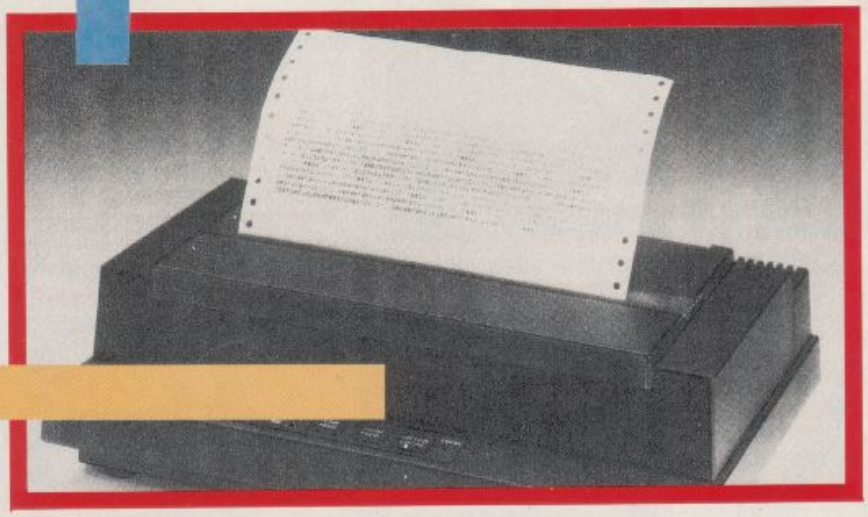


Above is the Tandy inkjet colour printer. This printer uses inkjet technology and a series of jets with different coloured inks to produce the most fantastic screen dumps and colourful text. It shares the inkjet technology with the Integrex.

Directly below you'll see two brilliant examples of what can be produced with colour inkjet printers.







Twin Jets: The Olivetti and Acorn inkjet printers, which amount to the same printer bearing different labels.



INKJET INQUISITION

It all started with the quill. Then came the fountain pen, and now the inkjet printer. What they all have in common is the use of ink in tubes and fountains to achieve written script on paper. In fact, the inkjet printer probably has more in common with the fountain pen than with the dot matrix printer.

An inkjet printer doesn't contain a ribbon or conventional print head; instead, an inkjet cartridge is propelled across the paper inside a small plastic carriage. Inkjet cartridges comprise a sealed narrow glass tube with a pinhole-size nozzle at one end. Inside the tube is a rod of compacted ink powder held against the nozzle by a spring.

When it's all set up and running, the nozzle travels just above a metal plate which runs the full width of the paper. So to print a single dot, an instantaneous high voltage is applied to the plate. The voltage discharges through the cartridge, causing a spark which fragments a tiny quantity of ink from the rod. The pressure of the spring forces the now-powdered ink out as a jet through the nozzle, printing as a dot on the paper.

You can use ordinary paper to produce text on an inkjet printer, but several passes of the cartridge are required to produce a single line of text, so alignment of the machine is very important in producing acceptable print quality.

Perhaps one of the bigger plus points in this technology is the ability to do graphics since image size is not bound by a matrix and both horizontal and vertical dimensions are easily programmable.

Returning to the quill and fountain pen — you can now see that the inkjet (or sparkjet, as it's sometimes called) printer forces ink onto a page by having pressure applied to it with an electrical spark forcing it through a pinhole. In a fountain pen, that force is provided by gravity.

The inkjet printer unfortunately exhibits some of the drawbacks of the fountain pen. Ink has a tendency to 'spread' on glossy paper as well as 'blotting' on more absorbent paper. Thus the print quality of these inkjet machines tends to be inferior to their dot-matrix counterparts.

The use of jets of ink rather than ribbons does have some great advantages. For example, you can quite easily change the colour of the jets of ink — and with a few minor modifications to the internal circuitry of the machine turn it into a full colour printer.

Several companies have made these modifications — both Integrex and Tandy have released inkjet colour printers that can print actual colour representations of screens as well as text (see pictures).

The inside of the machine uses four cartridges instead of one and can mix colours to produce a total of seven possible colours each of which comes through a single nozzle. Piers Letcher, writing in *PCN* Issue 44, described the system; 'The colours are accessed by control codes, though without documentation it is difficult to know what these are. The standard control codes used by the BBC *(eg* CONTROL B and C to switch the printer on and off) are all accepted, and make the printer easy to use. The international variations on the character set are also selectable . . . Inside the printer is neat and the simple ink jet mechanism shows its advantages compared to, for example, the Seikosha GP700A which uses ribbons and a dot matrix, but is both noisy and wearing on the ribbon . . . Getting into the printer is simple, though a manual would have helped. Of the six screws on the bottom, three hold the top and bottom parts of the case together. Selecting the correct three gets you inside. The top comes off easily, and enables you to change the settings on the dip switches.'

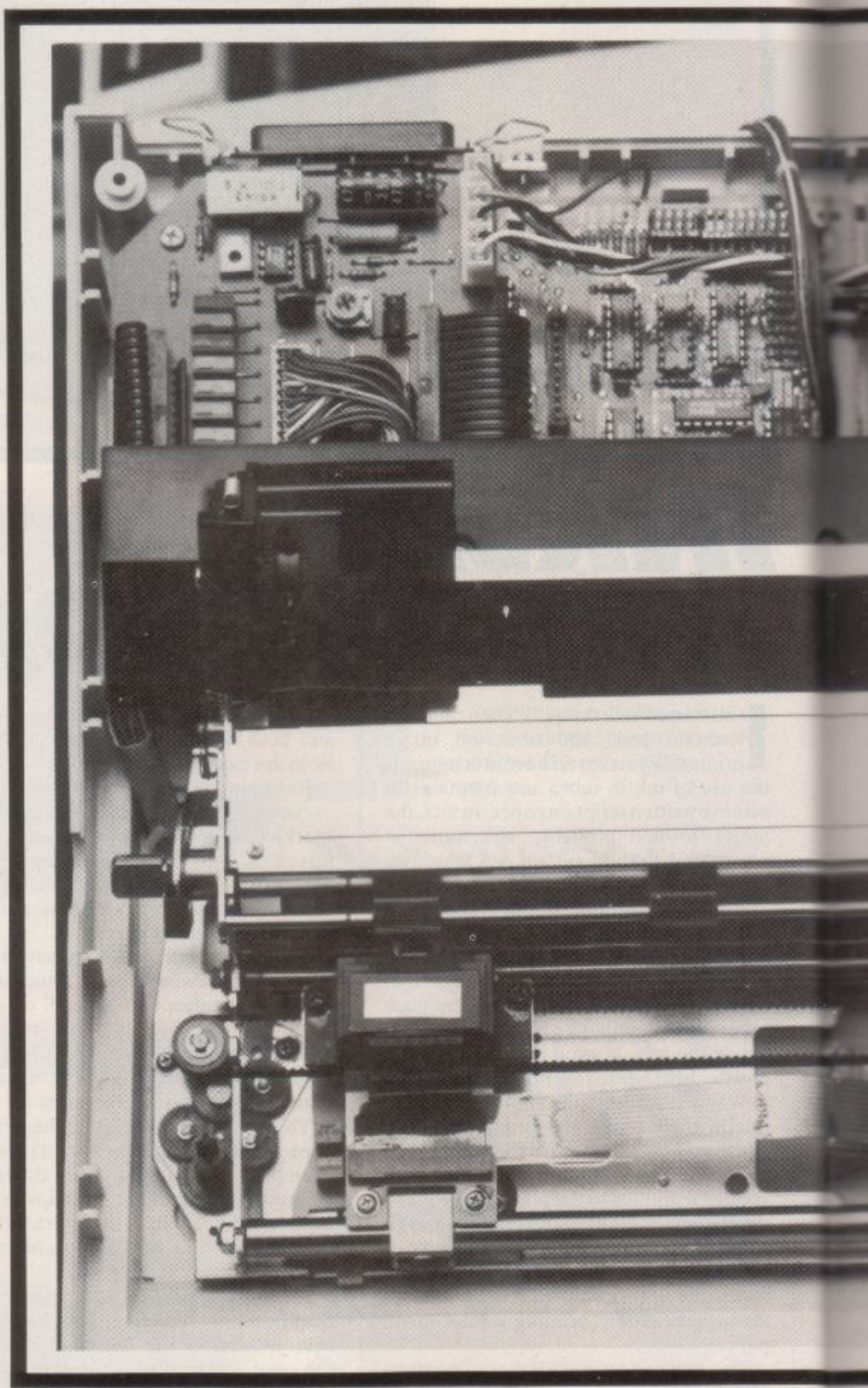
Because the Integrex and Tandy machines are just different badges on the same piece of kit commands and capabilities on the two machines should be pretty much the same.

The Tandy printer was reviewed separately from the Integrex in *PCN* Issue 39. Bill Davies explained the workings of the colour system; 'In television and monitors, colours are produced by mixing light rays. In this system — commonly known as the RGB method — red, green and blue light rays are projected on a surface and mixing these three colours generates all others.

'A second method is based on the mixture of pigments such as ink or paint. In this method, the colours yellow, magenta and cyan are mixed in different combination to produce other colours. The Tandy printer uses the second method. The built-in software in the printer converts what the monitor sees as RGB into the mixture of coloured inks available.'

The dip switches — Two sets of sometimes maddening, but ultimately helpful switches which decide on how your printer is going to act. They can control the style of typeface your printer is going to use, how large that print will be and how long the machine will take to print something out. They may also set things like automatic linefeed and skip-over-perforation which may clash with some of your software packages. The annoying problem with the vast majority of such switches is that they are secreted away either inside or at the back of printers and usually protected by an easy-to-remove panel.

The parallel or Centronics printer port — This — perhaps the commonest and easiest of printer interfaces to use — is found in a wide variety of popular printers, including this Mannesmann Tally Spirit 80. The Centronics parallel interface is a high-speed one-way communications device. Among the micros that have this standard interface are the BBC, the Dragon 32, the Oric-1 and Atmos computers and the NEC PC-8201A.

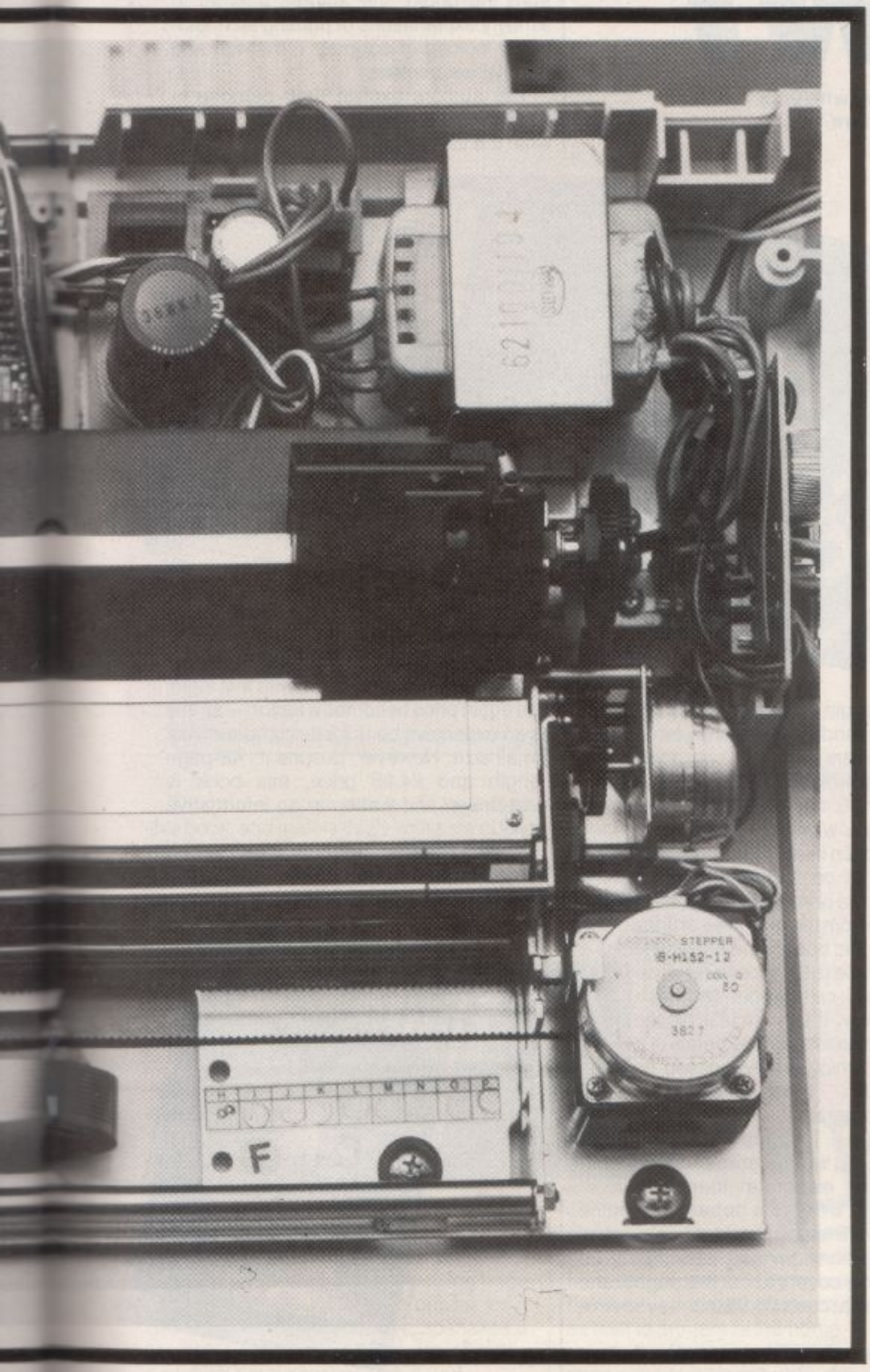


The tractor feed mechanism — This allows you to use perforated 'computer paper' with a printer. The paper has holes down either side and is perforated such that the track of holes through which the paper is fed can be ripped away from the main sheet of paper when printing has been successfully completed. Spring-activated clamps hold the paper firmly in place.

The print head — The print head contains the tiny wires which bash against the inked printer ribbon which finally hits the paper in your printer and creates a character. The wires in print heads vary immensely in numbers — with the proviso that the greater number of print wires in a print head, the greater the density and quality of image it will produce. The paper only moves up and down, the print head itself does all the work of moving back and forward by a system of motors, pulleys and moving gears. You'll also see that the print head is attached to a long, thin flexible electric cable which moves back and forth underneath the printer ribbon.

LOOKING INSID

The optional RS-232 serial board plug connection — Which provides an option for serial interfacing to many popular computers. Although Centronics became the standard some time ago for most home computer printers it still has not totally caught on in the business world where daisywheel serial printers and on-line communicating mainframes alike can take advantage of the sometime-standard serial RS232 ports.



The power supply — A part of your printer that's worth keeping a very careful eye on. Aside from the moving parts, the power supply ranks highest among the devices you shouldn't let go wrong in your machine. If, for example, there is an electricity line surge and your printer cannot handle the magnitude of such a surge it will either blow a fuse or some of the silicon chips inside the machine. One solution to this is to buy a line surge filter.

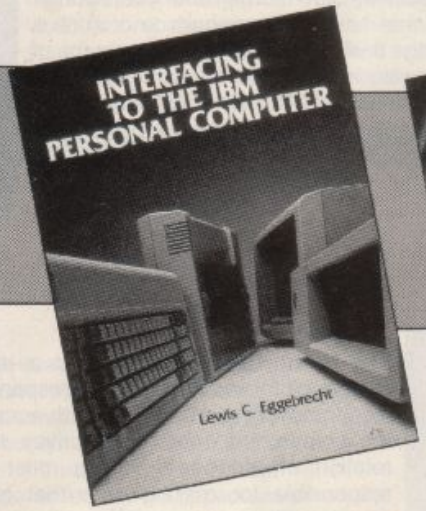
The roller mechanism — Just as the stepper motor and print head are responsible for moving text back and forth across the screen, the motor that drives the rotation of the paper in the roller is responsible for making sure that text moves up the paper and doesn't all get printed on one line. It's important that the motor driving the roller is carefully sychronised with the print head.

The stepper motor — This is the print head's way of moving around the printer. The stepper motor is provided with power from the printer's power supply and uses that to go about the business of driving a sort of electronic 'fanbelt' on a pulley system which moves the print head back and forth in front of a piece of paper. This belt is tracked on the inside — like the outside of the 'wheels' used in an army tank — and it is those wheels which provide the precision grip and tension needed by the print head to work quickly and effectively. This highly precise mechanism is typical of the many parts which make printers relatively expensive.

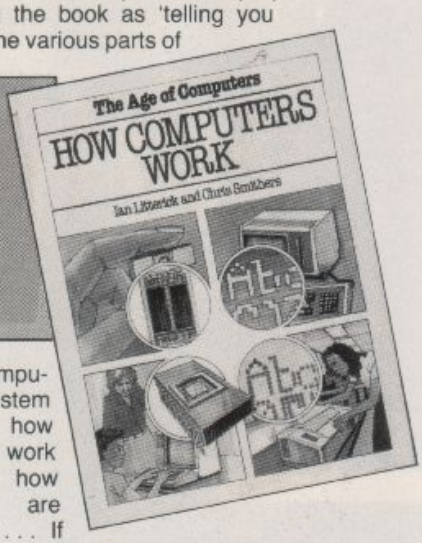
DE THE ATMOS

PRINTERS IN PRINT

If you've been unable to find a book to help you with your printer, we might have some answers here.







There aren't many books just about printers — in fact we had a hard time even finding one — but there are a number of books that, in the course of dealing with their main topics, contain illuminating and helpful discussions of printers and how to use them.

If you're looking for information on using printers with the IBM Personal Computer you might want to pick up Lewis Eggbrecht's *Interfacing to the IBM Personal Computer* published by Howard W Sams & Co.

Printers come into the picture on several occasions in this book, the first of them being in an overview of the system. But the really useful bits for printer interfacing don't present themselves until chapter 18 where full I/O configurations and addresses are detailed.

The parallel printer interface on the IBM isn't built into the main board, but comes on an adaptor card, which can also be used as a digital input and output point for interfacing other devices. You don't have to use an IBM printer with the parallel printer interface, but if you do, you'll get a per second wire-matrix printer using a 9-wire pin head and characters formed in a 9×9 matrix.

The book also reveals the obvious fact that the IBM printer isn't much more than a re-boxed Epson MX-80 using all the same control codes and graphics characters. It was recently published in the US where it sells for $15.95.

The Penguin Computing Book by Susan Curran and Ray Curnow also doesn't cover printers directly, but does have some worthwhile things to say about them. In chapter 16, the authors have a crack at explaining how printers work and how they are most often used. They trace the history and style of computer printing from the early teletype printers to the modern laser.

A quote from the text gives an idea of the flavour of this book; 'The daisy wheel is a similar device to the typewriter-style golfball, but it can be operated much more rapidly. It is a circular plastic disc, with spokes (like the petals of a daisy) on which are embossed its characters . . . Daisy wheels provide comparatively high-quality printed output. They are often found in specialised word processing systems, with elaborate formatting capabilities, where the appearance of the finished work is all-important.'

The section devoted specifically to printers only covers about five pages, and for a book that costs £5.95 this may seem a bit steep.

However, a large range of topics that are helpful in understanding both printer and computer fill the pages of this tome. There's a good deal about programming in Basic, storing data, looking at microprocessors, artificial intelligence programming and Computer-Aided Design work.

On a more elementary level, *How Computers Work* by Ian Litterick and Chris Smithers gives a good start towards understanding the mechanisms of printers. In a very colourful and illustrative fashion (see Figure 1 which depicts a page from the book), the authors attempt to simplify explanations of printing technology by looking at dot-matrix, thermal and daisywheel printers.

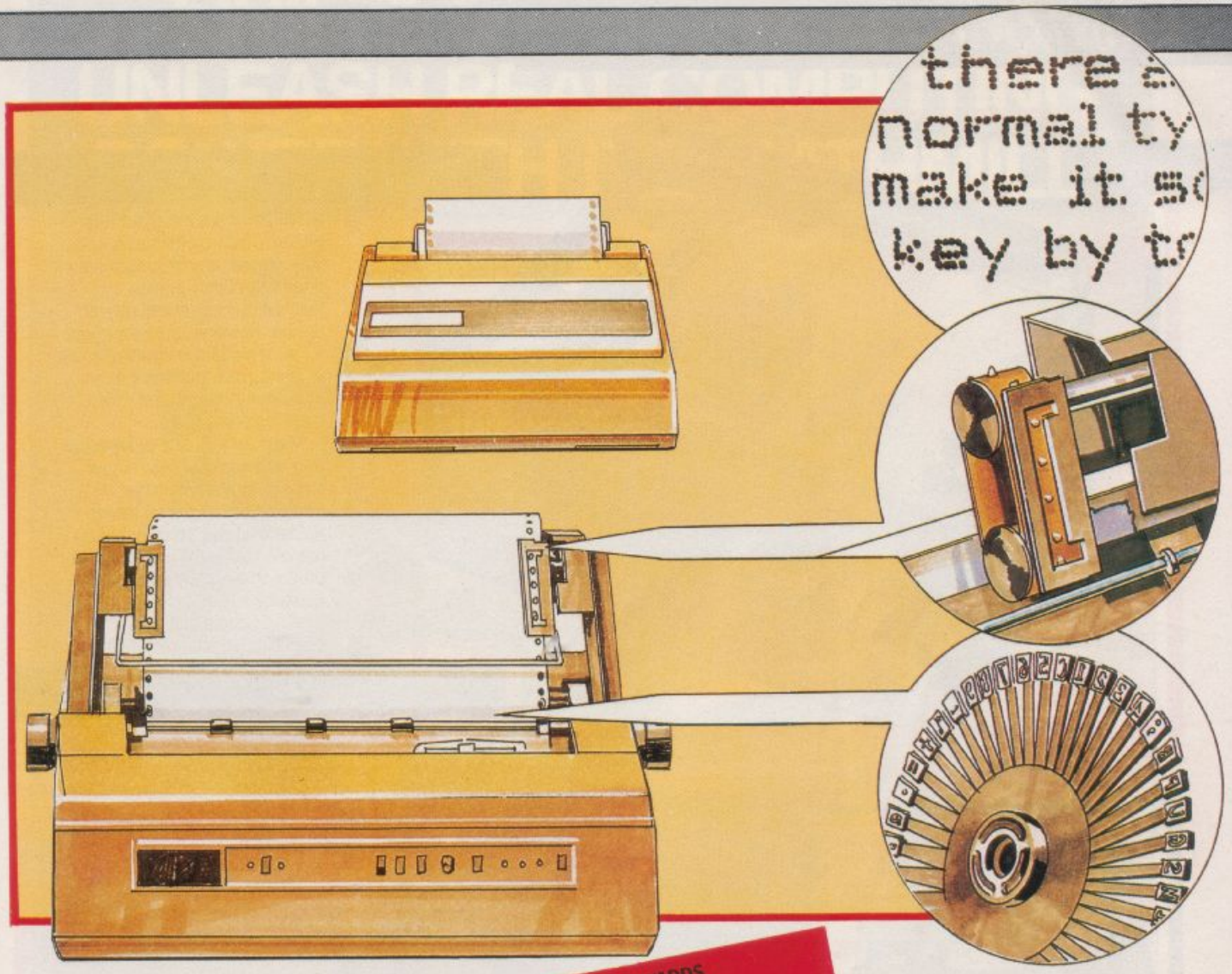
The authors explain their purpose in writing the book as 'telling you what the various parts of a computer system do, how they work and how they are made . . . If you make an effort to understand what goes on inside computers, you will find them easier to use.'

There can be no arguing with this logic, but again price becomes a factor — as this is an expensive book for its comparatively small size. However, despite its 48-page length and £4.95 price, this book is well-drawn and written in an informative style.

This hardcover book is published by Wayland Publishers and should be available in most larger book stores.



DON'T (Or How to Care For Your Computer) is perhaps the most practical choice of the books so far reviewed. It's littered with amusing illustrations and helpful photos which compliment Rodney Zaks' light-hearted prose quite nicely.

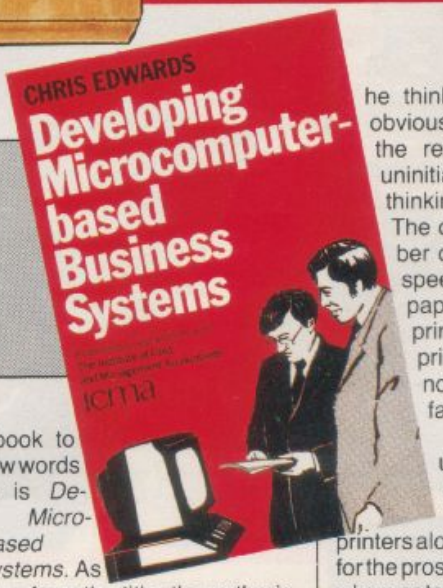


The printer gets a chapter all to itself in this book, and mainly deals with care of the device. Here's a quote from that chapter: 'In most computer systems, the printer is the device that has the largest number of mechanical parts. It is therefore the device most likely to fail. However, if a high-quality printer is used only intermittently (say less than two hours per day), and operated properly, the probability of failure is normally small (say, once per year).

'Because a printer has so many moving parts, it is particularly susceptible to rough or improper handling. In this chapter, we will explain how to position the printer correctly and how to set the controls. We will also describe several important environmental requirements'.

All of this is useful stuff, but bearing in mind the book was written three years ago, Zaks speaks largely to people using large data-processing systems in offices for a good chunk of the book. He also makes a few remarks about the state of the printing art which have now become dated.

Despite these drawbacks, this is a useful and informative book — and probably the one to say the most about printers of the collection we've looked at. It's published by Sybex Inc. and costs £4.95.



Another book to offer a few words on printers is *Developing Microcomputer-based Business Systems*. As you can guess from the title, the author's bias is toward printers in business systems but the essence of his advice applies just as well to printers in the home.

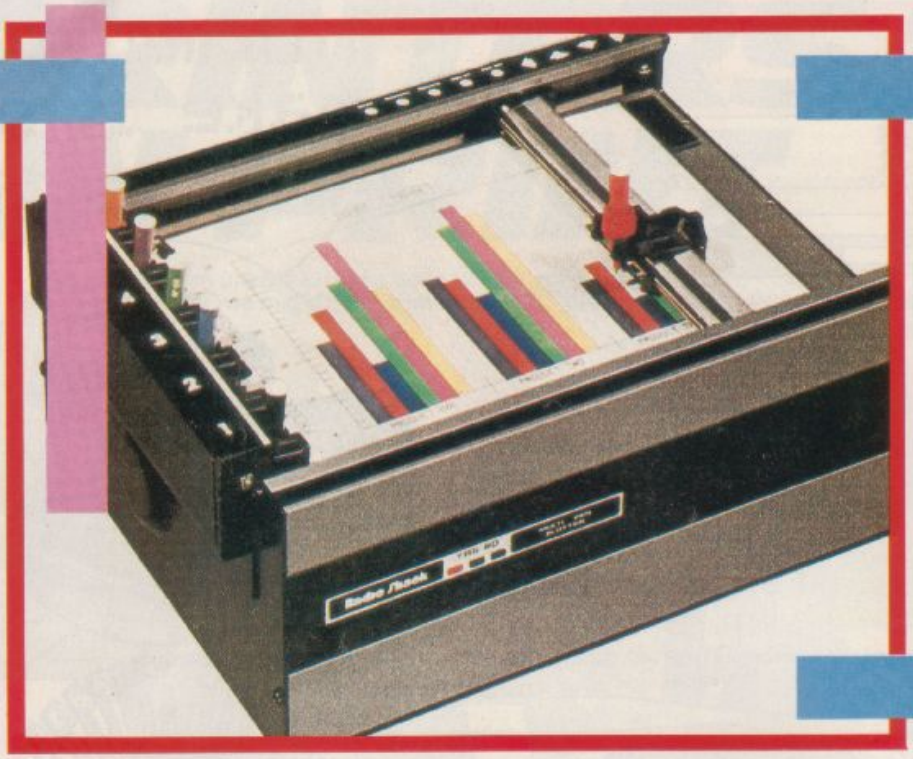
Here's a little of what Chris Edwards has to say: 'Approximately 100 different printers are presently marketed in the UK. A small number are housed with a keyboard, whereas the majority are independent units.

'Printers vary in at least ten respects.' At this point he then lists the ten ways in which he thinks printers differ. A few are obvious such as noise and price — but the rest will jolt the mind of the uninitiated printer purchaser into thinking a little bit about the subject. The other differences include number of characters per line, printing speed, printing mechanism, type of paper used, number of copies printed, the character set the printer supports, and whether or not it has a graphics printing facility.

Again this book takes an upmarket systems approach to printers, and wouldn't be worth buying for what it says about printers alone, but there is a good deal here for the prospective business printer-owner who wants to put the printer in context with the rest of the company's existing kit.

It is published by Prentice-Hall at £5.95.

Obviously, these are just a few of innumerable books which give some coverage to printers. Many books dedicated to particular micros will have more to say about using printers with your system particularly if you are thinking of 'own brand' printers such as the ZX printer or the ranges from Atari and Commodore.



At left you'll see a flat-bed colour plotter. These plotters used to be very expensive as they required a good deal of very precise mechanical control and careful design. However, the technology for such plotters is now beginning to standardise and they can be made more cheaply and with more features.

Meanwhile, colour outputs can also be made using dot-matrix technology like that in the Seikosha colour printer below. Rather than use the coloured ink jets involved in the colour printers produced by Tandy and Integrex, Seikosha has developed a colour printing system that uses a special multi-coloured ribbon.







Above are the Tandy, Sharp and Oric versions of the four-pen colour plotter for home micros.



Micropaedia Editor: Geof Wheelwright
Design: Nigel Wingrove

NEXT WEEK

Next week we begin a two-part special on Oric's Atmos and Oric-1 computers with a short history of the rise and fall and rise of Oric, a look inside the printed circuit board of the new Oric and the start of a two-part examination of Oric's Basic.

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Capable cable

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David Janda tests a cable that will make life easier for Oric owners

A cable has come to the rescue of Oric users. Called the Hybrid, this clever bit of kit gives the Oric and Atmos disk drive power, cures known bugs in the Oric's notorious ROM and improves its Basic.

At £100 it does what the Atmos sets out to do, and adds a little extra.

Made by Kent-based ITL, it contains miniaturised component mounting in a tiny, almost flat box at the micro's end of the cable. This is no bigger than the average connector, but contains the disk interface and Basic enhancements.

Small it certainly is, but it will make major improvements to the life of the Oric user.

The Hybrid comes with a manual, a master disk containing the Oric DOS, utility programs and demos. It can be bought with the Byte Drive 500 (Pro-tested Issue 41) and programs are available to transfer cassette software to disk, and to run Oric-1 programs on the Atmos and vice-versa.

Though tested here with the Byte Drive, the Hybrid is compatible with all 3in drives, as well as most 5.25in units. We found no problems with 40- and 80-track drives.

Features

The Hybrid is a small piece of ceramic substrate about 1½in sq. Components are layered on it: Integrated Circuits (ICs) without their casings on the top level. The hybrid is baked and a protective resin applied to it before it is housed in a connector casing.

Many chips can be fitted onto a hybrid, and the choice of ICs used is not limited and includes both RAM and ROM, operating systems and languages.

The Hybrid used for the Oric contains a dedicated Uncommitted Logic Array (ULA) which controls the Oric's memory map and allows the freeing of the 16K RAM where the Basic normally sits. This ULA takes care of the floppy disk controller and a ROM that contains a program to pull in the first part of the operating system from the disk.

The master disk supplied with the Hybrid contains the operating system, together with the Basic enhancements and patches. The OS is completly input/output (I/O) independent, and far better than the Oric's I/O, giving faster screen output.

Both random access and sequential storage are catered for by the OS, and sequential files can be appended, allowing additions to be made later. The files are accessed by letter ('R' for random, 'I' for input etc), and by channel number, of which there are three. More than three channels can be used with the high resolution area, but only two for random access files.

The features of the OS are accessed from Basic, though since the OS has been written to allow its 'high level' features to be accessed at low level, the machine code programmer is catered for.

Besides being able to save Basic programs, it is also possible to store machine code, memory dumps, random and sequential text files, ASCII, Basic and Command files.

The ability to set up a command file, called a DO file, is one of the OS's most important features. It allows screen input to be made into a sequential file, so the computer takes keyboard input from a file rather than from you.

The extensions to Basic offer useful commands. A 'print at' function has been implemented as VTAB and HTAB. The new WINDOW command allows you to specify windows in TEXT mode. Colours can be assigned to these windows, and one can take up the whole screen. This is necessary if you wish to have a fixed colour background (like the standard Oric), because once the OS is booted the PAPER command affects only one line, rather than the whole screen.

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The 'intelligent' part of the Hybrid, contains the disk interface and enhancements to Basic. Many ICs can be fitted including ROM and RAM chips and the unit is compatible with most disk drives.

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◄50 An ON ERROR command allows errors to be trapped, and the type of error can be discovered from the SYS codes. It is a particularly secure command, and with it it's possible to trap so tightly that a hard reset is needed.

The nasty (known) bugs in Oric Basic have been fixed, namely the problems with the IF . . THEN . . ELSE construct, TAB, PLAY, FILL and so on. On top of that, the implementation of the escape codes has been changed and it's now possible to use them within programs or strings. A nice effect of this is that using line feeds within program listings results in neat looking listings.

Other changes include fully working field separators (',' and ';'), allowing you to format text and numbers much more neatly using tabulated output. RESTORE now has a line and statement parameter, and TRON allows single-stepping through programs or parts of programs. INPUT will not produce the question mark if there is a string prompt, and CALL allows parameters to be passed.

The enhanced Basic is a welcome addition, and surprisingly, the operating system, together with buffers, enhancements and patches takes up only 9K of RAM.

In use

Once set up, the boot ROM in the Hybrid sets the disk spinning and the operating system and Basic enhancements are loaded. When you format a disk you specify a Basic program to be the boot program, and every time the system boots up, this program is loaded and run too.

This feature is very handy as it makes it possible to set up the Oric with function keys etc, as part of the start-up process.

File handling is simple, and there are three channels for data exchange to and from the drives. Only two of the three channels are available for random access and I would have liked to have seen three, to ease disk sorts. Also, the internal disk buffer is only 510 bytes long and while this is fine for most applications, I would have preferred it selectable.

The user interface is excellent. Typing DIR displays one of the most informative directories you could hope for. The disk type (40 or 80) is displayed together with the number of sectors free. Entries have a three-letter file type to their left and file-names can be up to 30 characters long.

Verdict

The Hybrid is well designed, useful, and improves the Oric out of all recognition. The piece of hardware, coupled with ITL's policy of continuous upgrading of the disk software, at no cost to the user (just take your disk to your dealer and you get the latest version of the master), makes it exceptional value for money. I got a great kick using the Oric with a disk drive. PCN

TABLE 1 — DOS COMMANDS

FORMAT	Initialises a blank disk for use. A formatted disk will
""(,D0,D1,D2,D3)	boot DOS.
DIR(,D0,D1,D2,D3)	Displays the contents of a disk. Sectors free, 40/80 track drive also displayed.
SAVE ""(,P)	Saves a Basic program to disk. 'P' specifies that program can only be RUN, for protection.
LOAD ""	Loads a Basic program from disk.
RUN ""	Loads and runs specified Basic program.
MSAVE "",A,E	Saves machine code file to a binary file.
MLOAD ""(,A,E)	Loads a binary file.
MRUN ""(,A,E)	Loads and runs a machine code program.
RENAME "old" TO "new"	All types of file to new if file name doesn't already exist.
ERASE ""	Deletes file from directory and frees sectors.
PROTECT ""	Locks a file and directory shows filename in inverse.
FREE ""	Releases a protected file.
VERIFY ""	Verifies any file on disk.
FIND ""	Finds a file on disk.

Brackets denotes an option, "" presence of a file.

TABLE 2 — TEXT FILE COMMANDS

OPEN "mode", #(No.), ""	Opens a specified sequential file for reading or writing to in "O", "I", or "A" mode.
OPEN "R", #(No.), "", L	Opens a specified random access file for reading from or writing to.
CLOSE #(No.)	Close a file and channel after use.
CLOSE	Closes all files after use.
INPUT #(No.)	Enables data to be read from specified channel number.
WRITE #(No.)	Enables the writing of information to specified channel number.
LINE INPUT#	Inputs an entire line into a string variable.
GET#	Will get any specified record in random access file.
PUT#	Put data into specified record in random access file.
CREATE ""	Converts a Basic file into a sequential text file.
DO ""	Creates keyboard input from a sequential text file, instead of from the user.
TYPE ""	Displays contents of text file without load or run.
EOF	Detects end of file in text file.

TABLE 3 — ADDITIONAL BASIC COMMANDS

VTAB(n)	Sets verticle tab to n.
HTAB(n)	Sets horizontal tab to n.
WINDOW l,w,t,b	Sets text window to line, width, top, bottom.
INVERSE n	Changes the foreground and background colours to opposite numbers.
NORMAL	Reverts back to normal colour conditions.
ON ERROR and ON ERROR RESUME	Avoids the halting of a program when an error occurs.
LWIDTH n	Sets the width of the printer.
SYS	Function which returns system variables.
SWAP v1, v2	Exchanges the values of two variables.
LINE INPUT	Inputs entire line up to 240 characters in a string.
CAPS	Set capitals.
PR:	Vectors all DOS and Basic output.
IN:	Vectors all DOS and Basic input.
DEF KEY$(n)=""	Defines function key with string which will be evaluated.
RESET	Clear all buffers.
USA	Sets Htz for US.
UKMD	Sets Htz for UK.
HOME	Homes cursor, doesn't clear screen.
PON	Printer on.
POFF	Printer off.
DRIVE	Sets drive.

Note: Tables are *not* complete.

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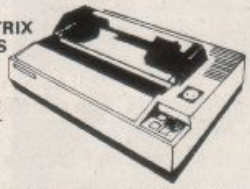
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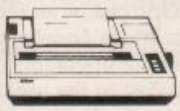
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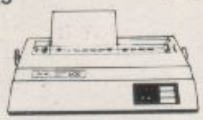


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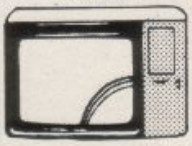
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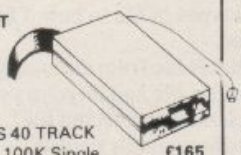
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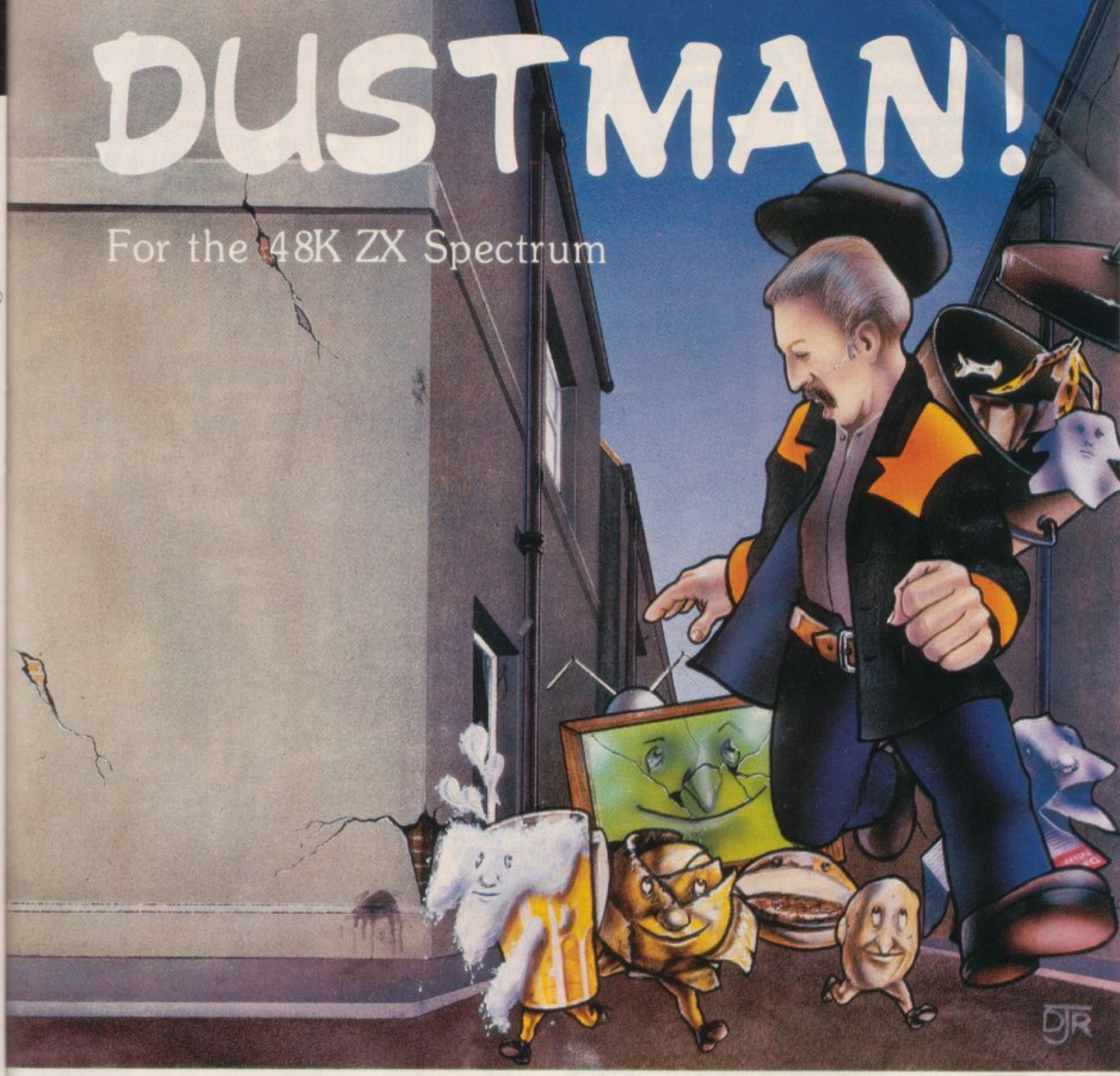
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WILLY'S REVENGE



For the prudish this might have been titled 'The Caterpillar Strikes Back.' The tables are turned in this energetic game, and Willy feasts on creatures from other games to make up for being cut up in the past.

All you have to do is whizz him around the screen, gobbling up the characters as you go. Bumping into other bits of his body — don't try any swift turns — or colliding with the screen edge loses a life. You get another chance, but by this time you've grown an inch or two.

There are eight lives in all; by the end you'll have grown to an unmanageable length. You start about four inches long, but finally you've 18 inches to manoeuvre.

The other characters vary in size too: the smaller they are, the higher the points. With some practice, I chomped quite a few of the 11 different meanies, but my score still fell way short of the high score chart.

The longer you survive on each life, the faster Willy moves, and the more points you'll gather.

Great fun, but you need a decent joystick to succeed.

SEA BATTLE



This relaxed and enjoyable game is a game for two, based on Battleships, with the computer acting only as referee. You play on a 12 x 12 grid. The three A4 pages of instructions were daunting but clear.

The aim is to sink the enemy's aircraft carrier or reach his side of the board with your carrier. The 18-strong fleet is well armed and contains destroyers, frigates, cruisers, minelayers, a minesweeper and an aircraft carrier.

Moves seemed slow initially, but this tactical game calls for planning and strategy.

Battles are decided by the micro which bases its decision of the outcome on a variety of factors. Attacks aren't always sudden 'eath affairs. Only one gun b: ry is deducted from the los ship, so unless you're down t last gun — in which case you'll sink — you live to fight again.

I was a little disappointed that a joystick option wasn't offered (using a menu like Beyond's Up Periscope) as this would have made for a far comfier game. Another choice might've been the chance to take on the computer.

But these were my only niggles: it's a well presented, enjoyable game, but be prepared for a few late nights playing it.

AND ALL BECAUSE



If you've envied the man who delivers the chocolates to the lady's boudoir, leaving only his calling card and a trail of wet footprints across her carpet, you'll like this.

And All Because, is B&H's answer to the advert. The instructions tell you to expect mazes, skiing, jumping ravines, hang-gliding and parachuting to name but a few.

Some of the graphics let it down. For stage one you drive around in a pre-war style racing car in an attempt to get out of the maze of chocolates. By stage two, giant choccies fall into your path. Fortunately, these jumbo strawberry cremes don't land on you — they're at least twice the size of Action Man.

Stage three is the cross-country steeplechase, which gave me the most problems, it was certainly far tougher

Perhaps I had the rag and bone man's horse as a jumper — he certainly ran as if the cart was still attached.

A fun game but I'll leave you to discover the rest. It raised many a chuckle — and quite a few snarls — in my household.

ACE-HIGH mkII



Meanwhile, back at the airfield you get the chance to earn fame and glory in a World War II dogfight. As a Spitfire pilot, you battle it out with the Heinkels and Messerschmitts in the skies.

It's not the easiest game to play, but shooting down the fighters and bombers beats space invaders any day.

While the instructions are printed, the famous dit-dit-dit-dah used by the BBC World Service during the war adds a touch of nostalgia.

Both joystick and cursor controls are on offer and surprisingly, it's possible to get more kills using the keyboard for firing. The object is to shoot down as many planes as possible before your kite cops it.

Your view is from the Spitfire's cockpit, and while lightning reactions don't appear to be needed, you must be swift to catch a fighter in your sights.

Should you knock out ten or more Jerries on your first sortie and use up your quota of 16 rounds, your Spitfire is refuelled and rearmed. Then it's tally-ho and chocks away for a crack at Ace-dom (25 kills).

I didn't quite reach those dizzy heights, but after many flying hours, I'd bagged 20 planes and picked up my wings.

ELECTION FEVER



Election Fever takes you into 1986. The Government has reduced the 600 plus MPs to 49 (hear, hear). The major parties are now Red, Blue and Yellow, and there are three separate stages to the game. First the leadership elections, followed by the campaign and finally election day.

You are the person with the real power — the agent to the party leader — controlling the party funds. Up to three players can join in and the computer will make up the threesome if necessary.

A profile is offered on three potential leaders and each player must choose who will represent their party. Current news is displayed throughout the game, giving an idea of whose popularity needs boosting.

In the election run-up you pay out for research, media time and grooming. The computer will decide how much each party spends on entertaining and bribery. As the election approaches, the opinion polls are also printed (they appear unrealistically accurate).

For election night, a map is printed on screen and as the results trickle in, it fills up. The program is listable so you can adapt the names, profiles and newsflashes as you wish.

Certainly more fun than the real thing.

Willy's Revenge (£7.95) Abacus Software UK, 21 Union Street, Ramsbottom, Nr Bury, Lancs. (0204) 383839

Sea Battle (£4.95) Oetistia, High Lee, Luddenden Foot, Halifax HX2 6LB

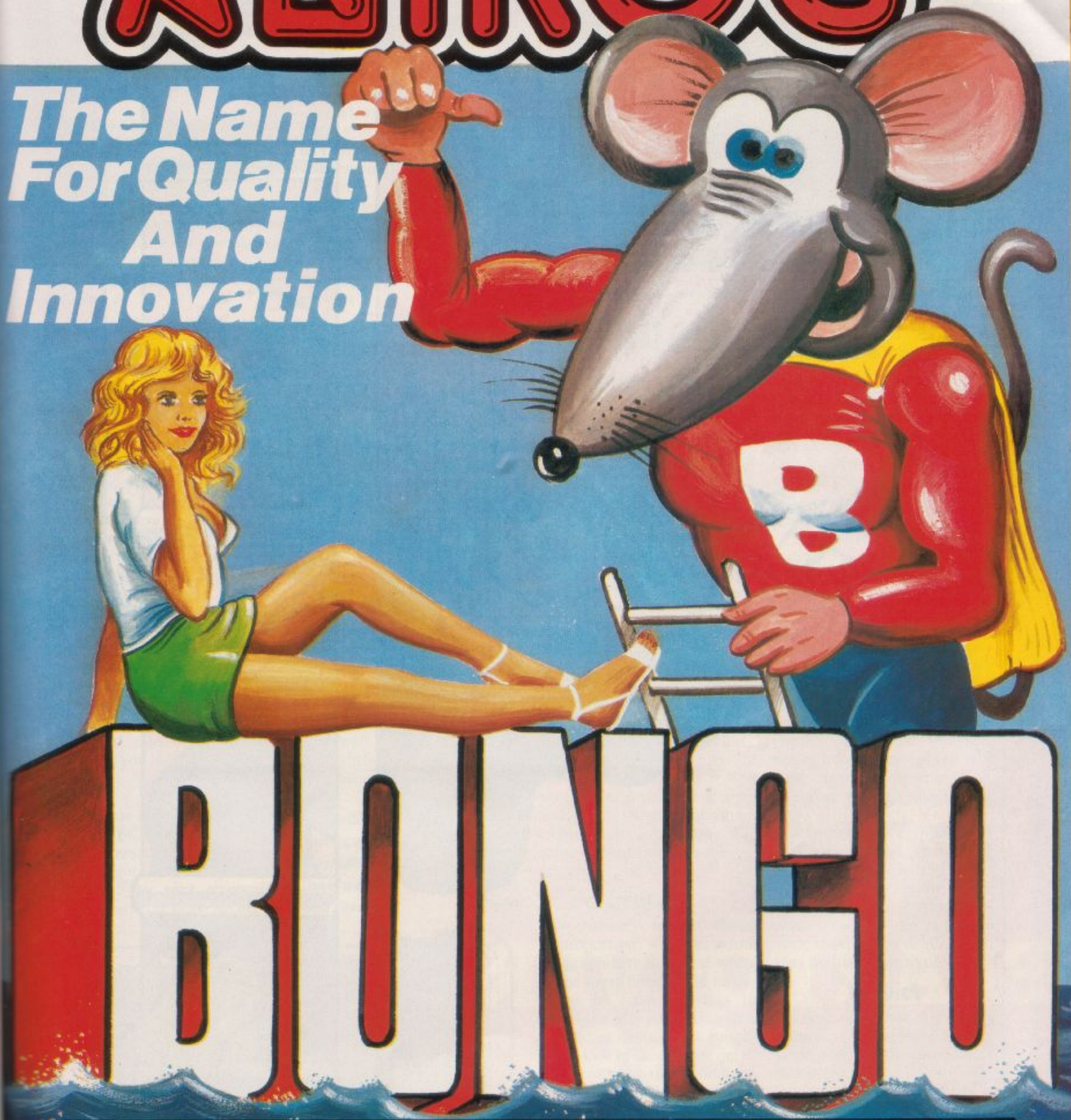
And all because (£6.95) B&H Software, 208 King Street, Cottingham, Hull (0482) 842373

Ace High Mk2 (£6.95) Tudor Williams, 15 Summerhill Road, Bilston, West Midlands WV14 8RD

Election Fever (£6.95) Whitsoft, Whittington House International, 42-45 New Broad Street, London EC2M 1QY (01) 628 0898

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BBC B

Snakes & fences

Name Snorter **System** BBC B **Price** £7.50 **Publisher** Beebugsoft **Format** Cassette **Language** Machine Code **Other versions** Electron (soon) **Outlets** Retail.

This original game requires you to destroy snakes in a number of mazes by an unusual method — you shunt sections of fence into them.

Objectives

There are five different mazes. A skill level of between one and ten must be selected, and you are given three lives.

Increasing numbers of snakes are introduced into each maze at regular intervals. To proceed to the next maze, it is necessary to destroy all the snakes. There is a fixed amount of energy available with which to do this — as you move around the maze, this energy decreases.

The aim is for you to position yourself (as the defender) behind sections of fencing and attack the snakes with it. Each time you shove a piece of a fence into a snake, you kill it.

On the other hand, if the head of one of the snakes touches you, a life is lost.

In play

The game makes excellent use of the BBC's graphics facilities. The mazes are well-defined and movement around them is achieved by very responsive reactions to the keys. An area is preserved in the centre of each maze in which the current score, the remaining energy, and the number of lives lost is displayed.

Annoyingly, despite the otherwise excellent graphics, the snakes are depicted as little more than a string of asterisks.

There are lengths of fencing scattered throughout each maze. These can be separated by the simple act of pushing the defender against one. Different bits can be joined together by shunting them into one another.

A combination of skill and strategy is required for success. It is not simply a matter of chasing the snakes around — in this way you merely use up all the available energy.

There is a slight problem during the loading process — if you do not answer the question regarding the use of sound effects soon enough, part of the program appears to get lost. No problems, however, during actual play.

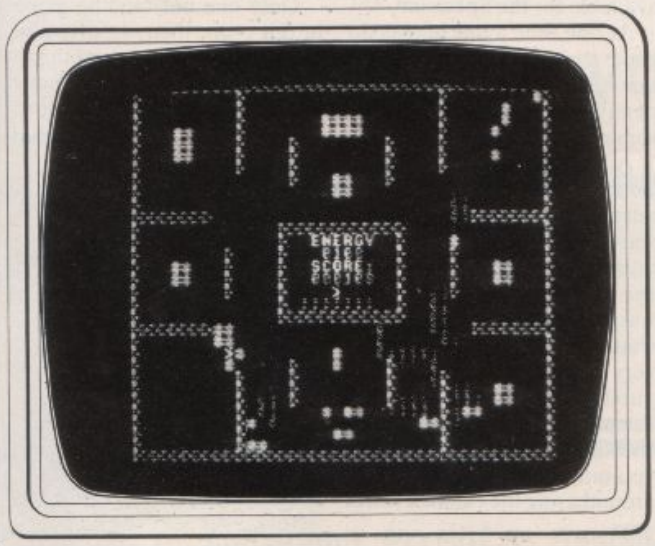
Verdict

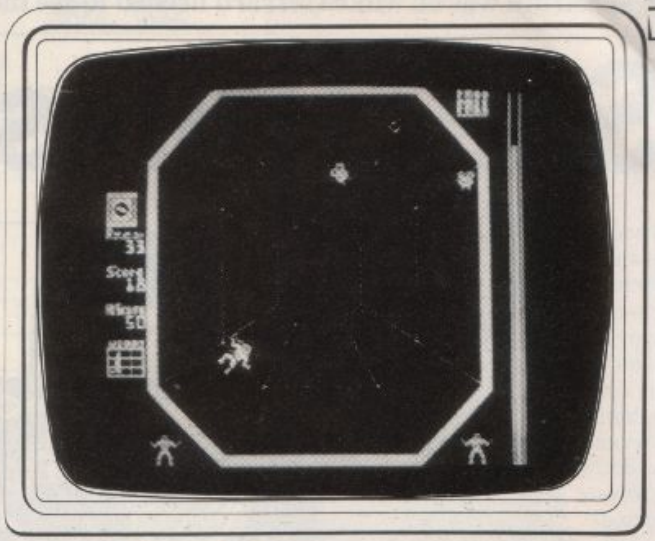
This really was enjoyable to play. Without the constraint of a limited amount of energy, it might have been just another chase and destroy game. As it is, a genuine element of strategy is required in order to play well. The sound effects were a little too much, but there is provision to turn them off.

Russell Jones

RATINGS (/5)

Lasting appeal	
Playability	
Use of machine	
Overall value	





Acrobatic astronaut

Name Free Fall **System** BBC **Price** £9.95 **Publisher** Acornsoft, 4a Market Hill, Cambridge CB2 3NJ **Format** Cassette **Other versions** Electron **Outlets** Retail.

If you can keep six balls in the air while simultaneously playing the piano, this is the game for you. There are just too many keys to operate in Free Fall. It is a pity, because the basic idea is a good one.

Objectives

A neatly-drawn little astronaut floats about inside Deep Space Station Coriolis, under attack from four different sorts of lobster-like creatures. You have to manipulate its arms and legs to kick and punch these creatures into oblivion. The game should feel like a mugger's night out.

In play

Unfortunately, to keep things in proportion, whoever wrote the graphics to this game wrote in the most flimsy little movements of arms and legs to represent kicks and punches. Instead of delivering a roundhouse kick to the delicate parts, the astronaut barely twitches a toe. Sometimes this seems to be effective, sometimes not. It's hardly the sort of thing to keep the crowds on the edges of their seats.

As if to make up for this lack of graphic violence, in what is after all an extremely violent idea, the sound effects are deafening. And there is no way of dimming down the sound, short of putting a telephone directory over the speaker.

You have three rockets on the astronaut's suit which control movement, but firing them nearly ruptures the eardrums. The one really satisfying noise in this game comes when you drive the astronaut at full thrust into one of the walls of the space station. The result is a concussed astronaut and a loud, reverberating 'boing'.

That sound occurs frequently during play. The keys which activate the left and right rockets are both right next to the keys which cause the left and right arms to punch. So what inevitably happens is that, having manoeuvred the astronaut with care through the curved space of the station right to the point where you are about to cripple a lobsteroid, the right finger hits the wrong key and your man ends up comatose, bouncing off the space station wall.

Another point of difficulty is that some of the lobsteroids, waspoids, batoids and other oids appearing in the space station can paralyze your astronaut. You find this out when your controls go dead, which they do from time to time.

Verdict

I wasn't sure that this wasn't simply a marvellous way Acornsoft had dreamed up of disguising bugs in its program. A major plus point, though, is the very full instruction booklet that comes with Free Fall. In fact it's almost a great game.

Tony Harrington

RATING (/5)

Lasting Appeal	
Playability	
Use of Machine	
Overall value	

A Spectrum was all Mike Gerrard needed to see the solar system — and with no lifeline either.

Spectrums in space

There must be more space games for the Spectrum than there are stars in the sky, though you'd need stars in your eyes to get any pleasure out of some of the software on offer. In concentrating on so many variations of a single theme the inevitable result is a lot of dross, so do any of this recent batch of software stand out from the crowd?

Not **Starclash** from Micromega, which is a disappointment coming after their earlier 3-D attempts with **Haunted Hedges, Luna Crabs** and **Death Chase**. The cover gives the impression that this too is 3-D, showing a fighter zooming over the Earth's surface, but this is merely a shot of the title screen, the game itself being an invaders variation that I remember playing in the arcades at least three years ago.

In this, four separate waves of aliens come down the screen at you, different shapes moving in different ways, from a straightforward downward progression to green bow-ties that move up, down and around. You have three lives, and if you let a single ship reach the bottom of the screen then the entire wave starts afresh. After four waves there's a mothership, which has two reactor cores that flash alternately, and you must hit the live one to polish it off and start all over again. It's compatible with a Kempston joystick, but there are hundreds of better games around.

One of them is **Fireflash**, the best version of a missile command type of game that I've seen. The graphics of the base you're defending are very detailed, full of little buildings and towers, and you move your missiles along underground passages to the chosen launching pads. In addition to the nine skill levels, author Kevin Flynn has written into the program a routine enabling you to alter any of seven POKE values affecting the speed of certain aspects of the game.

The pre-set values and the range of possible alternatives are given on the cassette insert, and the game itself is fast-moving, colourful and reasonably noisy. An ability to understand what you're doing with six fingers simultaneously is an advantage.



From the same company comes **Munnery's Mergatroids**, which should be marginally easier as here you only need five fingers to enable you, as the instructions succinctly put it, to 'blast every alien you see!' This is an attempt at 3-D, with the waves of aliens moving towards your sights in the centre of the screen as you attempt to pass through seven zones of them.

The main problem is that the aliens are simple geometric shapes like diamonds and triangles, and because these are transparent it's impossible to pick out what you're firing at and what you're trying to avoid as they come thick and fast towards you, overlapping each other.

The fact that your own missiles are also transparent diamond shapes doesn't help matters, and the game was a case of over-kill, I thought.

Cosmos has you as 'the pilot of an advanced defender class starship. You protect convoys of sub-light speed cargo vessels from hostile attack and natural dangers.' The convoy is in the centre of an area of space made up of a 3 × 3 grid. You can only see one of these grids at a time through your viewscreen, but can scroll quickly enough around them.

You're watching out for the asteroid showers which float across as well as 18 alien ships that will try to destroy your convoy. Guiding your lasers by the sight in centre-screen, you must decide whether to stay close to the convoy, when you only see dangers at the last minute, or whether to roam around the grid in search of enemies and risk leaving your convoy open to obliteration.

I found control of this difficult as there's quite a delay between firing your lasers, which come in from the corners of the screen, and the shot exploding when they converge in your sights, by which time the target has zipped away. You have to keep firing continually, and try to predict the movements of your enemies, which is not easy.

The game is fast-moving but the graphics are ordinary and again it gets submerged beneath the mass of good material available for the Spectrum.

At one time a machine code game meant automatic interest, but now they're ten a penny, so you have to produce something different.

An attempt at that is promised by **Space Island**, a graphics adventure from Terminal Software, who have previously produced some good material for the Commodore machines. I wasn't impressed by this Spectrum effort, though, which is very similar to another they've published at the same time, **Vampire Village**. In both you're shown a map on the screen and you must move your character around using the cursor control keys.

In this space story, where you're attempting to find the cause of dangerous time distortions, your character is simply a cross while the map is filled with black dots, representing interesting features. As you arrive at a dot you're shown some text, which may perhaps tell you that there's a rifle or a boat there. Pressing the space key will get you a list of the 19 commands at your disposal, though unfortunately not for long enough to enable you to note them all down or even read them and consider which to use.

You enter the first letter of your chosen command in inverse video and the game responds (or not), the dot disappears and you go on your way to the next one. As you visit the various dots the game does start to build up like a conventional adventure, with problems to solve, but each time you die there's a lengthy wait while a new game is generated and the only time distortion I noticed was that after playing the game for ten minutes it seemed like two hours must have passed.

If you want a game where you spend half your time with a finger on the cursor key while you watch a cross move slowly over a simple map then this is definitely the one for you.

This only serves to raise the question again of how much of a games software industry the home computer market can support. All the signs are that a good thing is being spread much too thinly.

Only one outstanding game in this crop, then, so if you're looking round for something to buy make sure you makes your choice *before* you pays your money.

Mike Gerrard

Starclash (cassette £6.95, any machine), Micromega, 230 Lavender Hill, London SW11
Fireflash and **Munnery's Mergatroids** (£5.95 each), Abacus, 716 Llangyfelach Road, Treboeth, Swansea SA5 9EL.
Cosmos (£5.95), Abbex Electronics, 20 Ashley Court, Great Northway, Hendon, London NW4.
Space Island (£6.95, 48K), Terminal Software, 28 Church Lane, Prestwich, Manchester M25 5AJ.

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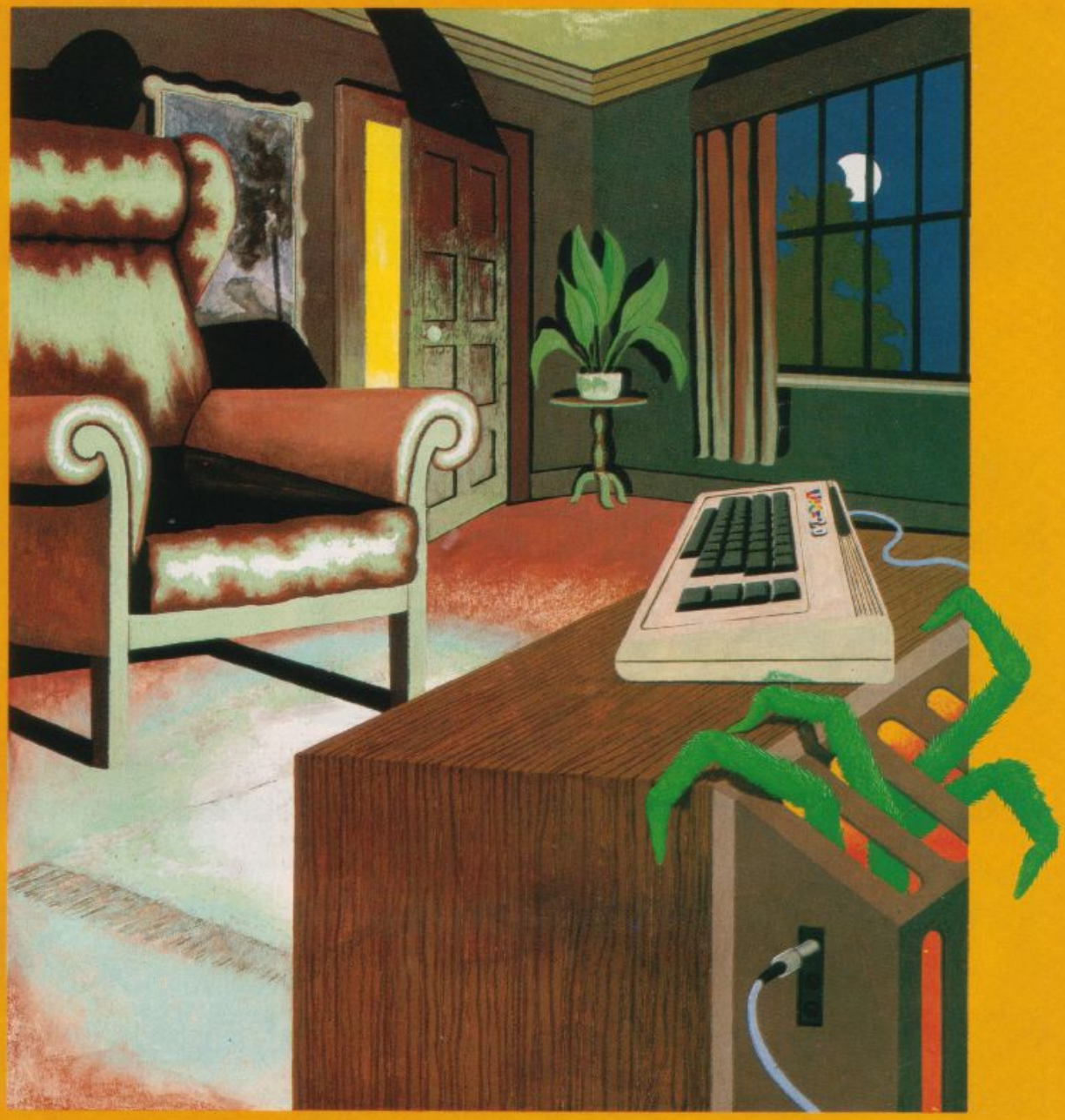
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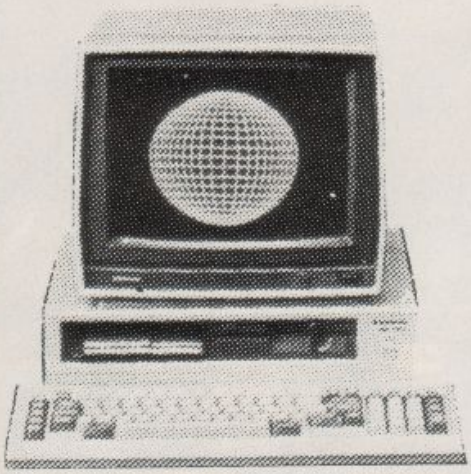
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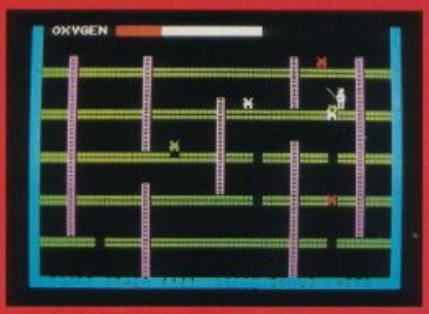
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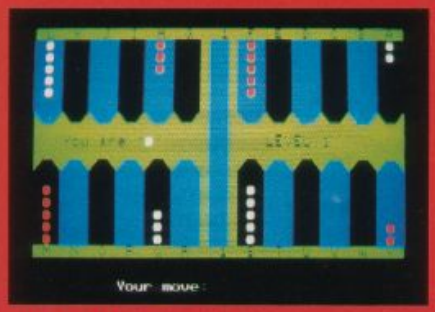
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Application: ***Game***
Author: ***Christopher Hillary***

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This simple game is surprisingly difficult and quite a challenge to complete. It makes good use of sound and colour and you won't have to spend a week typing it in as it's fairly short.

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36-40	Waits for the player to press a key.

```
10 REM U.F.O.
11 REM BY C.HILLARY
12 REM JANUARY 1984
20 POKE36879,26
21 POKE36878,15
22 PRINT"■          ■■          ■■■■■■■■■■ U.F.O. ■■■■■■■■■■          ■"
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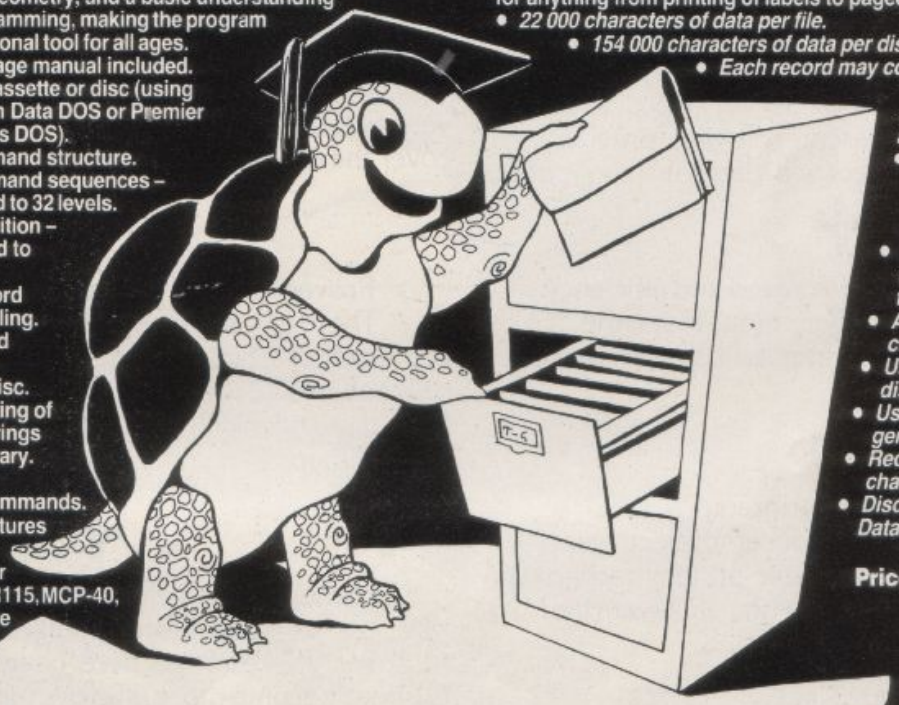
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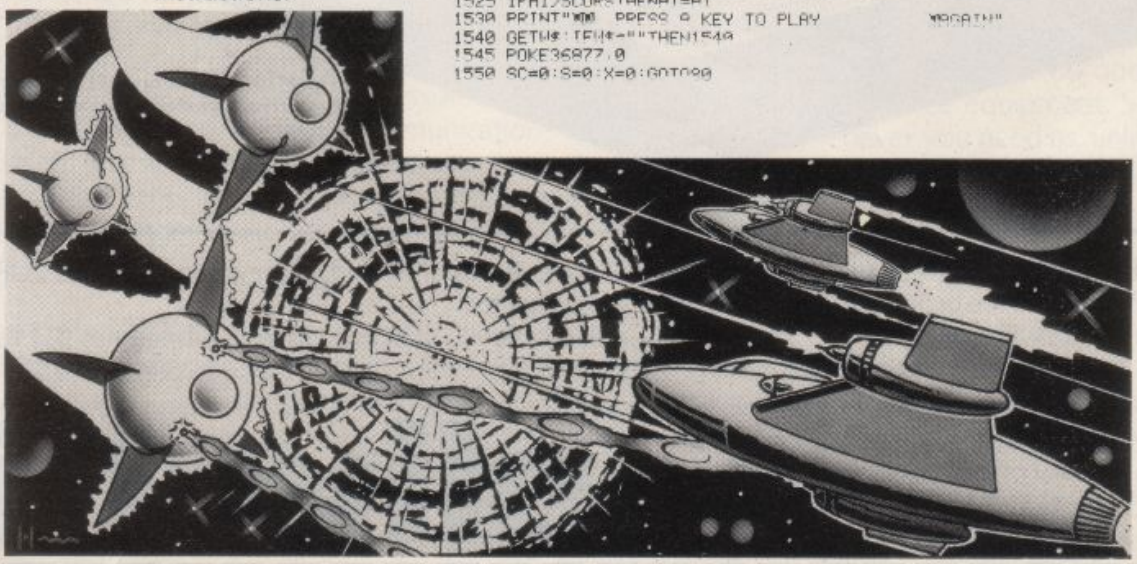
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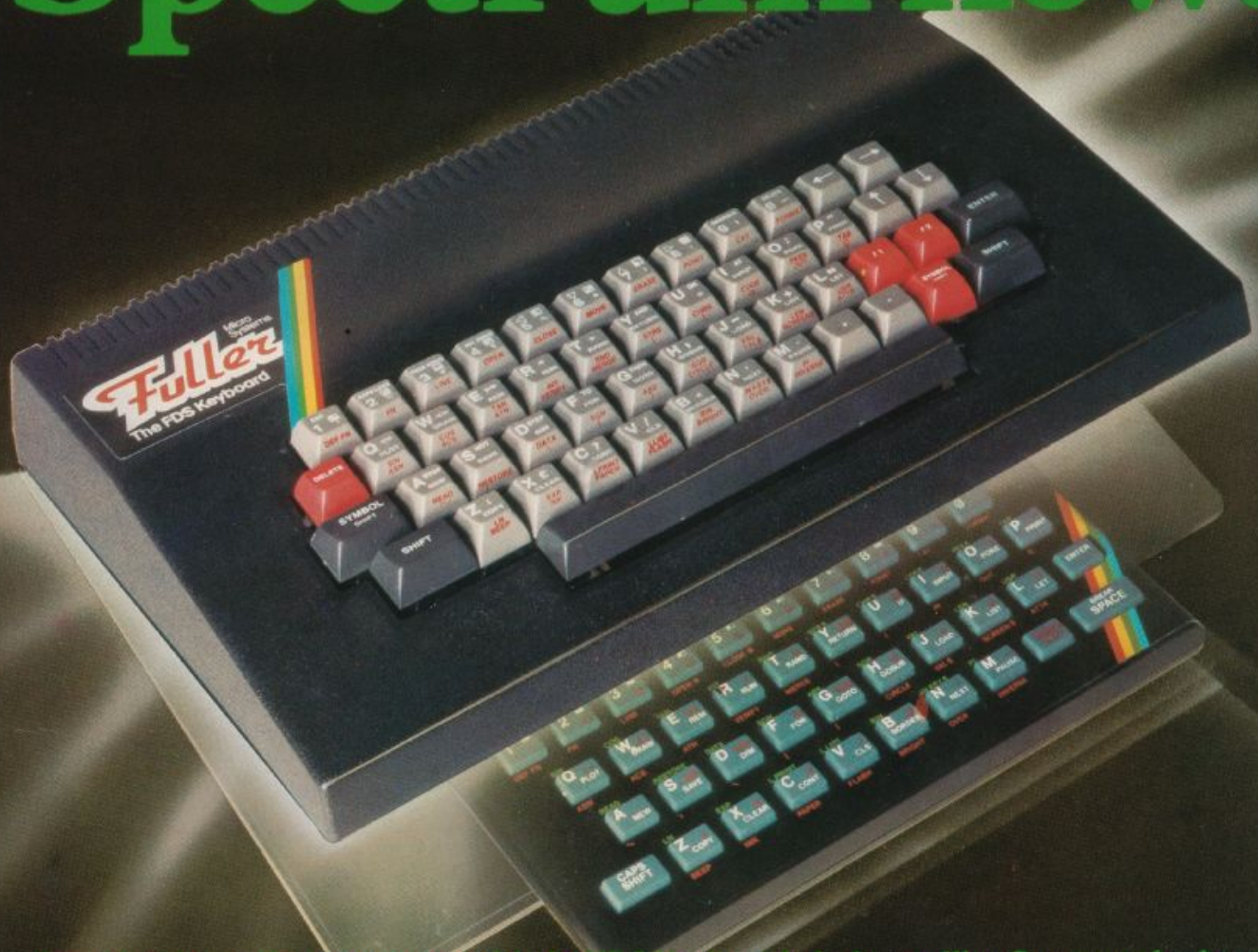


45-54	Makes a UFO fly through the instructions.
60-98	Clears the variables and picks out a base to go at the bottom of the screen.
99	Prints the highest score so far at the top right hand corner of the screen.
100-140	Puts 50 randomly coloured stars at random points on the screen.
160	Sets the loop for the UFO.
170-172	Sets the colour of the UFO (This turns white after 45 shots).
180-200	Puts the UFO onto the screen (variable T is the colour).
210	Checks to see if the UFO has collided with a star. If it has then go to line 600 where the UFO explodes.
220-255	Continue with the loop to move the UFO. Check to see if the loop has ended; if so go to 360 to land the UFO.
260-300	Fire the bullet from the UFO and print the number of times the player has fired, in the top left hand corner of the screen.
360-510	Makes the UFO land.
600-620	Makes the UFO crash.
1000-1080	Prints out messages and scores on landing.
1500-1550	Prints out the messages and scores on crashing, then run the programs again without instructions.

```
45 FORC=7944TO7965
47 POKEC-7680+38400,0:POKEC-1-7680+38400,0:POKEC+1-7680+38400,0
50 POKEC,81:POKEC-1,67:POKEC+1,67
52 POKE36876,225:FORD=1TO20:NEXT:POKE36876,0:FORD=1TO20:NEXT
54 POKEC,32:POKEC-1,32:POKEC+1,32:NEXTC
60 CLR
70 SC=0
80 G=INT(RND(1)*3)+1
81 IFG=1THEN85
82 IFG=2THEN87
83 IFG=3THEN89
85 PRINT"[graphics]"
86 GOTO98
87 PRINT"[graphics]"
88 GOTO98
89 PRINT"[graphics]"
98 C=0
99 PRINT"[graphics]HI";HI
100 POKE36879,8:POKE36878,15
120 FORA=1TO50:B=INT(RND(1)*330)+1
140 POKE38488+B,INT(RND(1)*7)+1:POKE7768+B,42:NEXTG
160 FORC=7725TO8187
170 IFC<44THENT=3
172 IFC>44THENT=1
180 POKEC-7680+38400,T:POKEC-1-7680+38400,T:POKEC+1-7680+38400,T
200 POKEC,81:POKEC-1,67:POKEC+1,67
210 IFPEEK(C+2)=42THEN600
220 POKE36876,225:FORD=1TO20:NEXT:POKE36876,0:FORD=1TO20:NEXT
225 POKEC,32:POKEC-1,32:POKEC+1,32
230 IFC=8187THEN360
240 GETE$:IFE$=""THENGOTO250
245 IFE$<>""THEN255
250 NEXTC
255 IFT=1THEN250
260 IFE$<>""THENPOKE36876,0:POKE36875,195
275 POKEC,81:POKEC-1,67:POKEC+1,67
280 FORF=22TO88STEP22:POKEC-7680+38400+F,7:POKEC+F,66:FORG=1TO50:NEXTG:POKEC+F,3
2
300 NEXTF:POKE36875,0:POKEC-1,32:C=C+1:PRINT"[graphics]TIMES FIRED";S:GOTO250
360 FORH=8187TO8152STEP22:POKEH,81:POKEH-1,67:POKEH+1,67
370 FORI=225TO195STEP-1:POKE36876,I:NEXTI:POKEH,32:POKEH-1,32:POKEH+1,32:NEXTH
375 POKEH-22,81:POKEH-23,67:POKEH+21,67
380 FORI=1TO5:POKE36876,225:FORK=1TO250:NEXT:POKE36876,0:FORK=1TO250:NEXT:NEXTI
400 POKE36871,3:POKE36872,3:POKE36873,3
410 FORL=8152TO7734STEP-22:POKEL-7680+38400,3:POKEL-7680-1+38400,3:POKEL-7680+1+
38400,3
420 POKEL,81:POKEL-1,67:POKEL+1,67:POKE36876,130:FORM=1TO30:NEXT:POKE36876,0
430 FORM=1TO30:NEXT:POKEL,32:POKEL-1,32:POKEL+1,32:NEXTL
435 O=130
440 FORN=7734TO7745
450 POKEN-7680+38400,3:POKEN-1-7680+38400,3:POKEN+1-7680+38400,3
460 POKEN,81:POKEN-1,67:POKEN+1,67
465 POKE36876,0
470 FORP=1TO40:NEXT:POKEN,32:POKEN-1,32:POKEN+1,32:O=O+1:NEXTN
480 POKE36876,0:FORP=1TO40:NEXT:O=O+1
500 IFO=254THEN1000
510 GOTO480
600 POKEC,81:POKEC-1,67:POKEC+1,67
605 POKE36876,0:POKE36877,220:FORI=15TO1STEP-1:POKEC-7680+38400,2:POKEC-1-7680+3
8400,2
610 POKEC+1-7680+38400,2:POKE36878,L:FORU=1TO50:NEXT:POKEC-7680+38400,1
620 POKEC-1-7680+38400,1:POKEC+1-7680+38400,1:FORU=1TO150:NEXT:NEXTL:GOTO1500
1000 POKE36879,25:PRINT"[graphics]      YOU DID IT"
1002 POKE36878,0
1005 IFX>=1THENSC=SC+50+INT(RND(1)*50)+1:GOTO1020
1008 X=X+1
1010 SC=50+INT(RND(1)*50)+1
1020 PRINT"[graphics]YOU SCORED";SC;"POINTS"
1030 IFSC>HITHENPRINT"[graphics] BEST SCORE SO FAR"
1040 IFSC<HITHENHI=HI
1050 IFSC>HITHENHI=SC
1060 PRINT"[graphics] PRESS A KEY TO PLAY           AGAIN"
1070 GETW$:IFW$=""THEN1070
1080 GOTO80
1500 POKE36878,8:POKE36879,25:PRINT"[graphics]    YOU CRASHED"
1510 IFX>=1THENSC=SC+S:PRINT"[graphics]YOU SCORED";SC;"POINTS"
1515 IFSC+S>HITHENPRINT"[graphics] BEST SCORE SO FAR"
1517 IFSC+S>HITHENHI=SC
1520 IFX=0THENPRINT"[graphics]YOU SCORED";S;"POINTS":HI=HI
1525 IFHI>SCORSTHENHI=HI
1530 PRINT"[graphics]  PRESS A KEY TO PLAY           AGAIN"
1540 GETW$:IFW$=""THEN1540
1545 POKE36877,0
1550 SC=0:S=0:X=0:GOTO80
```



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MORSE CODE

This program from P W Manhire, of Highams Park, London, produces a small machine code routine which is assembled in an 'out of the way' corner of the memory. The routine enables a BBC to produce Morse code directly from the keyboard. The routine can be enabled all the time, so anything you type will be emitted from the speaker in Morse code and whatever program you may be running. It is a good idea to turn the routine off before listing a long program as morse does not react as fast as the screen and it can take a while to catch up.

The program operates by redirecting the OSWRCH vector, the zero page memory locations containing the address of the routine that writes to the screen, to point to the morse code interpreter.

The dots and dashes are not the same pitch. This is because they are designed to sound at the fastest rate possible. Lines 430 to 450 define the sounds of Dot and Dash, a short pause (440) and a long pause (450). These values can be experimented with for the preferred sound. The data is the same as for the sound command and the volume is in internal format for negative numbers.

Title : *Morse Keyboard*
Machine : *BBC A/B*
Language : *6502 Machine code*
Application : *Education*
Author : *P W Manhire*

```
   50Base%=&D:Hbase%=&D00
   60REM FOR DISC Base%=&18:Hbase%=&18
   70*KEY0?&20E=&A4:?&20F=&E0:M
   80*KEY1?&20E=&B:?&20F=&D:M
   90REM CASSETTE  ?&20F=&D:M
  100FOR J%=0 TO 2 STEP 2
  110P%=Hbase%
  120[OPT J%
  130.S
  140LDA #(B MOD 256):STA &20E
  150LDA #(B DIV 256):STA &20F
  160RTS
  170.B:STA &72:PHA:TXA:PHA
  180TYA:PHA:PHP
  190LDA &72:CMP #65:BCC End
  200CMP #91:BCC Mors
  210BCC End:CMP #123:BCC Add
  220.End:JMP E:.Add:SEC:SBC #32
  230.Mors:SEC:SBC #65:TAX:LDA Hbase%+&C
0,X
  240STA &70
  250.Morse
  260LDY#0:STY &71
  270CLC:ROR &70:ROR &71:CLC
  280ROR &70:ROR &71:LDA &71:CMP #64
  290BEQ Dash:CMP #128:BEQ Dot:JMP E
  300.Dot:LDA #7:LDX #&A0:LDY #Base%
  310JSR &FFF1:JSR Sp:JMP Morse
  320.Dash:LDA #7:LDX #&A8:LDY #Base%
  330JSR &FFF1:JSR Sp:JMP Morse
  340.E
  350LDA #7:LDX #&B8:LDY #Base%
  360PLP:PLA:TAY:PLA:TAX:PLA:LDA &72
  370JMP &E0A4
  380.Sp:LDA #7:LDX #&B0:LDY #Base%
  390JSR &FFF1:RTS
  400]
  410NEXT
  420
  430DATA 1,0,&F7,&FF,80,0,1,0,1,0,&F7,&
FF,200,0,2,0
  440DATA 1,0,&FF,&FF,0,0,1,0
  450DATA 1,0,&FF,&FF,0,0,3,0
  460FOR J%=Hbase%+&A0 TO Hbase%+&BF:REA
D N
  470?J%=N:NEXT
  480DATA .-,-...,-.-.,-..,.,..-.,--.
  490DATA ....,..,.---,-.-,.-..,--,.
  500DATA ---,.--.,--.-,.-.,...,-,..-
  510DATA ...-,.--,-..-,-.--,--..
  520RESTORE 480
  530FOR J%=65 TO 90:READ A$:PRINTCHR$(J
%)+"   "+A$:NEXT
  540RESTORE 480:FOR J%=Hbase%+&C0 TO Hb
ase%+&C0+25
  550N%=0:NN%=0
  560READ A$:FOR I%=1 TO LEN(A$)
  570IF MID$(A$,I%,1)="."THEN N%=2
  580IF MID$(A$,I%,1)="-" THEN N%=1
  590NN%=NN%+N%*(4^(I%-1))
  600NEXT
  610?J%=NN%
  620NEXT
```

50	Set up the two data table pointers.
70-80	Set up functions key to define on or off.
110	P% defines the start of the code.
120	Select assembly.
140-150	Redirect the OSWRCH vector for point to the code beginning at B.
170-180	Routine starts here. Push the processor status and registers onto the stack. Temp store the accumulator at location &72.
190	Reclaim the accumulator, check whether the character is less than 65 (A),
200	Check if greater than Z, if so, return Else to morse.
210	Check for lower case, if so, subtract 32 to change to upper case.
220	.E jump to end. .Add subtracts 32 for case conversion.
230	Start of morse.
260	Put zero into location &71.
270	Shift the number right and discard the first bit.
280	Shift again and check the bit 7 for dash.
290	Check the dash until none left, in which case end.
300-310	Do dot sound.
320-330	Do dash.
340-370	End routine.
380-390	Subroutine .Sp stops sound.
430-450	Data for codes.

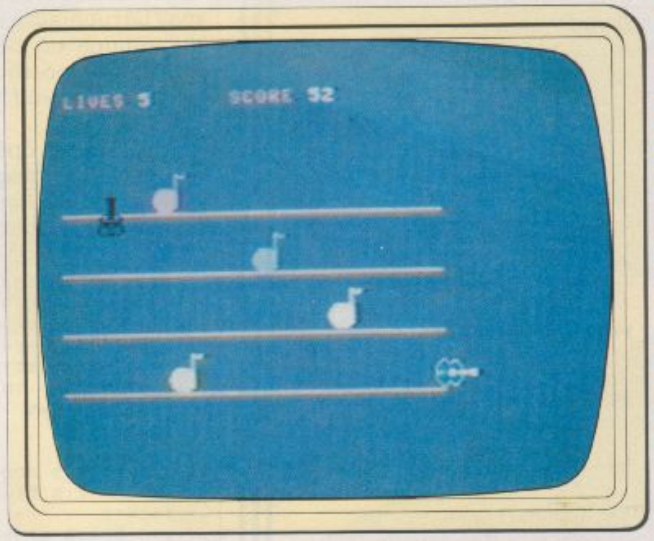


This program for the CBM 64 is from J Springall, of Clevedon in Avon, and takes you to a crazy world of music. You take the part of Gary the Guitar, the one in the top left hand corner of the screen, wearing the sunglasses.

Your aim is to try and reach your friend at the bottom right-hand corner of the screen. The drawback is that you have to get past the notes that are drifting along the staff (the lines drawn across the screen).

The only way past these notes is to jump over them, this is done by pressing the space bar or, if you're using a joystick, the fire button. Be careful how you go, since it is possible to bump into the notes on the line above, as well as those in front. You can move forwards or backwards while you are in the air, so you can avoid the notes while you are in mid leap. One other thing to be careful of is the different speeds of the notes. The further you get down the screen, the harder it is.

Title: ***Gary The Guitar***
Machine: ***Commodore 64***
Language: ***Commodore Basic***
Application: ***Game***
Author: ***J Springall***

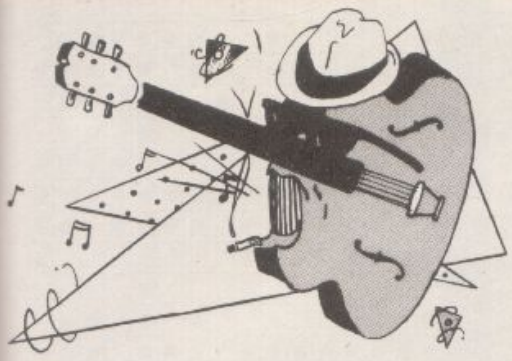


Program notes . . .

1	Set up variables and pointer to the sprite registers (V). The last poke sets the volume of all voices to maximum.
2	Clear the screen and set the foreground and background colours: GOSUB and print the intro.
5	Gosub and print the playing screen.
6	Discard the first 15 bits of data.
10	Toggle sprites on/off.
20	Set up the sprite pointers.
30-33	Read sprite data.
38-40	Put two of the sprites onto the screen.
50	Test the keyboard.
60-80	Check for keys to move Gary and move sprites as appropriate.
90-107	Jump and check position.
110-116	Move the other sprites on the screen.
120	Check for position and end if bumped.
300-330	Make the sound effects.

```
1 V=53248:F=20:K=1:O=230:S=103:Z=130:H=30:L=60:POKE54296,15
2 PRINT"■" :POKE53281,11:POKE53280,11:GOSUB3000
5 GOSUB 500
6 FORN=0TO15:READQ:NEXT
10 POKEV+21,252
20 POKE2042,13:POKE2043,192:POKE2044,191:POKE2045,191:POKE2046,191:POKE2047,191
30 FORN=0TO62:READQ:POKE832+N,Q:NEXT
31 FORN=0TO62:READQ:POKE12288+N,Q:NEXT
32 RESTORE:FORN=1TO142:READQ:NEXT:FORN=0TO62:READQ:POKE12224+N,Q:NEXT
33 RESTORE
38 POKEV+41,0:POKEV+42,1:POKEV+43,4:POKEV+44,1
39 POKEV+6,250:POKEV+7,202
40 POKEV+4,F:POKEV+5,9+1
50 GETA$
60 IFA$="■"THENF=F+6:IFF>230THENF=20:J=J+33:IFS+1>235THENGOTO700
70 IFA$="■"ANDF>20THENF=F-6
80 IFA$=" "AND P=0 THEN P=1
90 IFP=1THENJ=J-3:K=K+1:IFK=20THENP=2
100 IFP=2 THENJ=J+3:K=K+1:IFK=40THENP=0:K=0
105 IFP=2 OPP=1ANDK<5THEN POKE54277,190:POKE54278,248:POKE54273,17
106 IFP=2OPP=1ANDK<5THEN POKE54272,37:POKE54276,17:FORT=1TO100:NEXT:POKE54276,0
107 IFP=2 OPP=1ANDK<5 THEN POKE54278,0:POKE54277,0
110 POKEV+8,O:POKEV+9,103:O=O-3:IFO<3THENO=230
112 POKEV+10,Z:POKEV+11,166:Z=Z-8:IFZ<3THENZ=230
114 POKEV+12,H:POKEV+13,199:H=H-8:IFH<3THENH=230
116 POKEV+14,L:POKEV+15,136:L=L-3:IFL<3THENL=230
120 I!=PEEK(53278):IFII=2ORII=132ORII=36ORII=68THEN2000
300 POKE54277,9:POKE54276,17:FORT=1TO10:NEXT:READA:READB
310 IFB=-1THENPOKE54273,0:POKE54272,0:END
320 LJ=LJ+1:POKE54273,A:POKE54272,B:POKE54276,0
```





77 335-340 Update and print the score onto the screen.

500-560 Print the playing screen.

700-750 Well done, option for another game etc.

1000-1220 Sprite data.

2000-2036 Lose a life, make crash sound and continue.

3000-3100 Opening intro display, press S to start the game.

```
322 IFLJ=0THENRESTORE:LJ=0
330 DATA 17,37,19,63,21,154,22,227,25,177,28,214,32,94,34,175
335 D=D+1
340 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■";D
490 GOTO40
500 PRINT"□"
502 PRINT"■■■■"
505 FOR X=0TO3
510 PRINT"■■■■■■■■■■■■■■■■■■■
```

DATABASICS

This week PCN Databasics lists a selection of add-ons for your micro. PCN keeps you up to date in three-week cycles, listing peripherals, then software, followed by micros.

Printers are best categorised by print-head type. The two most common methods of transferring type to paper are the **Dot matrix** and **Daisywheel** techniques.

A dot matrix printer uses a row of pins which are programmed to strike the paper through a ribbon and form the character as a pattern of dots.

The daisywheel acts more like a conventional typewriter, the character set being pre-formed on a wheel with each character on a separate spoke. As the interchangeable wheel rotates it is struck by a hammer to form the character impression.

Dot matrix printers tend to be faster than daisywheel but offer lower print quality.

In selecting a printer make sure the **interface** on your computer is compatible with those available as standard or at extra cost on the printer.

The ● sign means the interface is included in the price; O means you have a choice of interfaces included in the price; + means the interface will cost extra.

Max Baud rate indicates the approximate characters-per-second rate as they are fed into the printer.

The **buffer** stores characters sent by the computer. The printer can take characters in chunks, at a rate quicker than they are able to be printed, sometimes allowing the computer to be freed for further use.

Lines per inch indicates the maximum number of lines printed in a vertical inch. **Characters per inch** can be varied on some printers as the typesizes themselves can be adjusted.

Maximum print speed as indicated by the manufacturer tends to be a little optimistic. **Maximum print positions** tells you the optimum number of characters that can be printed in one line by the smallest character size on the printer. **Maximum paper width** is the widest paper the printer can take.

Size represents the space the printer takes up on a desk top. **The weight** of the printer is given in kilogrammes.

Maximum copies indicates the number of carbon copies that can realistically be produced at one time.

Underlining puts a line under characters while **bold type** thickens the characters to make them stand out. **True descenders** indicates that the print method allows for fully formed tails on letters such as p,g or q.

Proportional spacing puts the same space between characters whether they are a long 'm' or a short 'i'. **Block graphics** builds up pictures using rectangular blocks, while **High Resolution Graphics** uses smaller dots.

Bidirectional means the printer can save time by printing left to right and then doing the next line backwards right to left. Similarly, **Logic Seeking** enables the machine to save more time by printing the short lines without sweeping over the whole width of the page.

Feed methods comprise **fanfold** which uses continuous stationery sheets folded road-map style drawn into the printer by a tractor mechanism. The tractor cog fits into holes in the fanfold paper and takes the paper past the printer mechanism. **Roll** is a roll of paper that feeds into the printer, usually using **friction feed** where the paper is gripped between two rollers, typewriter-style. **Cut sheet** indicates the printer uses single sheets like a typewriter.

Distributor: to find which company distributes a particular add-on, use the code listed in this column to refer to the distributor table.

The table is at the end of the listings, and gives the distributor's name and telephone number.

PERIPHERALS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)						Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
PRINTERS																																
Adler TRD 170	£833	Daisywheel		●		●			9600	256	6,8	10,12,15	17	198	15.5	56×37	13	6	●	●	●	●			●	●	●	●	●	●	●	T2
Anadex DP 9000A	£1,397	M 7×9, 9×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	106	9.5	40.9×57	13.6	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9001A	£1,397	M 7×9, 11×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	132	9.5	40.9×57	13.6	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9500A	£1,397	M 7×9, 9×9, 13×9		●	●	●			9600	2700	6,8	10,12,13.3	200	176	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9501A	£1,397	M 7×9, 11×9		●	●	●			9600	2700	6,8	10,12.5,15,16.7	200	220	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex DP 9620A	£1,489	M 7×9,9×9,13×9		●		●			9600	1500	6,8	10,12,15,16.4	200	216	15.5	40.9×70.3	16	6	●	●	●			●	●	●	●			●		I1
Anadex WP 6000	£2,616	M up to 18×20		●		●			19200	4500	6,8,12,16	10,12,16.7	285	220	15.5	46.7×74.9	25	6	●	●	●	●		●	●	●	●		●	●	●	I1
ASP 3500	£977	M 9×7, 9×9		○		○			9600	80	6,8	10,12,16.5	180	217	14	61.5×40.5	19	6	●	●	●		●	●	●	●	●					M1
Brother EP22	£170	M 7 × 5				●			300	N/A	6,4,3	10	17	75	8¼	31.5 × 23.7	2.4												●		●	J1
Brother HR15	£512	Daisywheel		●	●	●			9600	3000	6,4,3	15,12,10	13	165	13	46.4 × 33	8.9	4	●	●	●	●			●	●	●			●	●	●	J1
Brother HRI	£747	Daisywheel		○		○	○		9600	2000	4,5,6	10,12,15	35	198	16.5	38.1×71.2	16	8			●				●	●			●		●	J1
Canon AP400	£1,140	Daisywheel	●			●		1	19200	4000	4,6,8	10,12,15	25	197	15.5	50.8×48.2	18.5	6	●	●	●	●	●		●	●	●	●	●	●	●	D1
Centronics 159/4	£962	M 9×7				●			9600	768	6	5,8.18,10,16.36	150	80	10	38×35.6	10	5							●	●	●			●	●	B1
Centronics 150/4	£682	M 9×7				●		1	9600	768	6,8	10,12,16.36	150	132	9.5	38.1×35.5	9.1	3	●		●	●				●	●	●		●	●	R1
Centronics 152/4	£788	M 9×7				●		1	9600	708	6,8	10,12,16.5	150	217	9.5	38.1×35.5	9.1	3	●		●	●			●	●	●	●		●	●	R1
Centronics 154	£869	M 11×8		●		●			9600	2000	6,9,12,18	5,10,16.5	120	132	15	52.6×37.1	13	5	●		●			●	●	●	●			●		C1
Centronics 159/2	£881	M 9×7		●					N/A	768	6	5,8.18,1.,16.36	150	132	10	38.1×35.6	10	5														
Centronics 351	£1,891	M 7×9		●	+	●			19200	2000	6,8	5,8,9,10,12,16.5	300	193	15	45.7×56.8	16	6	●	●	●			●	●	●	●			●		C1

Centronics 159/2	£881	M 9×7		●				N/A	768	6	5,8.18,1.0,16.36	150	132	10	38.1×35.6	10	5						●	●	●		●	●	●	B1
Centronics 351	£1,891	M 7×9		●	+	●		19200	2000	6,8	5,6,8.25,10,12,16.5	200	192	15	45.7×55.9	18	6	●	●	●		●		●	●	●	●	●	●	●	B1
Centronics 352	£1,966	M 7×8		●	+	●		19200	2000	6,8	5,6,7.5,8.25,13.2,15,16.5	200	218	14.5	55.9×45.7	18.1	6	●				●	●	●	●		●	●	●	C1
Centronics 353	£2,420	M 7×8			+	●		19200	4000	3,4,6,8,12	10,12,13.2,15,16.5	200	218	15	55.9×45.7	18.1	6	●		●		●	●	●	●		●	●	●	C1
Centronics 739/2	£710	M 11×9		●				2200	132	6	5,8.3,10,16.7	100	132	9	36.8×27.9	5.4	5	●			●		●			●	●	●		●	C1
Centronics 739/4	£786	M 11×9				●		9600	512	6	5,8.3,10,16.7	100	132	9	36.8×40.6	7.2	5	●			●		●			●	●	●		●	C1
Commodore 4022P	£454	M 6×7	●					N/A	N/A	2	5,10	40	80	10	36.8×33	9.9	3					●	●	●	●	●	●		●		C2
Commodore 8023	£1,029	M 5×8	●					N/A	N/A	2	5,10	150	250	15	51.4×36.8	11.6	3		●			●	●	●	●	●	●	●	●		C2
Data Products DP55	£1,687	Daisywheel				●		2	9600	1000	6,8	10,12,15	55	198	15	44.4×60.4	24	6	●	●	●	●		●	●	●	●	●	●		●	S1
Data Products M100	£1,790	M 9×9		+		+	1		N/A	N/A	6,8	5,8,10,16.5	140	218	16	67.5×59.4	27	6	●	●	●	●	●	●	●	●	●			●		S1
Data Products M200	£1,979	M 7×7		+		+	1		N/A	N/A	6,8	5,10.8,16.7	340	340	16	67.5×59.4	27	6	●	●	●	●	●	●	●	●	●			●		S1
Data South DS180	£1,604	M 9×7	+	●	+	●		1	9600	2000	6,8	5,6,8.25,10,12,16.5	180	217	15.5	60.9×40.6	16	6	●	●	●		●	●	●	●	●			●		D2
Diablo SP1/P11	£2,127	Daisywheel				●			9600	256	6,8	10,15	40	198	16	56.9×46.3	27.2	6	●	●	●	●			●	●			●		●	M2
Diablo 630	£2,127	Daisywheel				●			9600	768	6,8,12	10,12,15	40	198	16.5	56.9×46.3	27	6	●	●	●	●			●	●	●			●	●	M2
DMP 100	£249	M 5×7		●		●			1200	2000	6,8	10.5	50	80	9.5	40.6×20.9	3.9	1	●	●	●		●	●		●	●			●	●	T1
DMP 200	£499	M 9×23		●		●			1200	2000	6,8	10	120	120	9.5	41.9×34.3	7.5	3	●	●	●	●	●	●	●	●	●	●		●	●	T1
DMP 400	£699	M 7×9, 9×9		●		●			1200	2000	6,8	10,12,16.7	140	220	15	61.9×40.4	19	5	●	●	●	●	●	●	●	●		●	●			T1
DMP 500	£1,099	M 23×9		●					9600	2000	6,8	10,12,16.7	220	220	15	58.4×33	12.7	5	●	●	●	●	●	●	●	●		●	●			T1
DMP 2100	£1,399	M		●		●			1200	2000	6,8,12	10,12,16.6	160	232	15	55.2×38.1	20	8	●	●	●	●	●	●	●	●			●			T1
DRE 8820	£895	M 9×7		○		○			9600	500	6,8	10,12.5,15,16.7	150	266	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8830	£1,300	M 9×7		○		○			9600	500	6,8	10,12,13.3,15,17	180	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8840	£1,370	M 9×7		○		○			9600	500	6,8	10,12,13.3,15,17	240	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRE 8925	£1,660	M 12×8, 12×20		○		○			9600	500	6,8	10,12,15,16.7	120	226	15.5	64.7×47.6	23	5	●		●				●	●	●	●		●	●	G1
DRH 80	£621	M 7×9		○		○			9600	256	6,8	10,12.5,15,17.5	80	140	8	41.5×30	7.5	4	●	●	●		●		●	●	●	●	●	●	●	T1
DRH 136	£776	M 7×9		○		○			9600	2000	6,8	10,12,15,16.5	120	224	15.5	48.6×30.3	10.5	3	●	●	●		●	●	●	●	●	●		●	●	T1
DRS 250	£1,431	M 7×9		○		○			19200	512	6,8	10,12,15	250	198	6	61×45	25	5	●	●	●		●	●	●	●	●			●		T1
DWP 410	£995	Daisywheel		●					9600	2000	6,8	10,12	25	160	16	60.3×19.6	16	5	●	●	●	●			●	●	●		●	●	●	T1
Epson RX-80 FT	£366	M	●	●	●	●	●		19200	256	6,8,10.3	10,12,17,5,6,8.5	100	80	10	38.9×30.3	5.1	3	●	●	●		●	●	●	●	●	●	●	●	●	E1
Epson RX80	£320	M	●	●	●	●		●	19200	256	6,8,10.3	10,12,17,56,8.5	100	80	10	38.9×30.3	5.1	5	●	●	●		●	●	●	●	●			●		E1
Epson FX-80	£503	M	●	●	●	●		●	19200	300	6	10,12,17,5,6,8.5	160	80	10	42×34.7	7.5	3	●	●	●	●	●	●	●	●	●	●	●	●	●	E1
Epson MX-100 III	£546	M	●	●	●	●		●	19200	256	6,8	10	100	136	15½	59.2×39.3	10	3	●	●	●		●	●	●	●	●	●	●	●	●	E1
Epson FX-100	£654	M	●	●	●	●		●	19200	300	6	10,12,17,5,6,8.5	80	132	16	61.5×35.4	10.5	3	●	●	●	●	●	●	●	●	●	●	●	●	●	E1
Epson MX80	£401	M 9×9		●	+	+		1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	5.5	3	●	●	●		●	●	●	●	●			●		E1
Epson MX80 FTT/3	£447	M 9×9		●	+	+		1	19200	256	6,8	5,8.25,10,16.5	80	132	10	40.6×38.1	7.7	3	●	●	●		●	●	●	●	●			●		E1
Epson MX82	£546	M 9×9		●	+	+		1	19200	256	8	17.2	80	159	10	40.6×38.1	7.7	3	●	●	●	●	●	●	●	●	●	●	●	●	●	E1
Epson MX100FT/3	£574	M		●	+	+		1	19200	256	8	16.5	100	233	15.5	59.7×40	10	3	●	●	●		●	●	●	●	●	●	●	●	●	E1
Facit 4510	£672	M 9×7		○	○	○			9600	712	6,8	6,12,16,17.5	100	132	11.5	42.5×34.8	9	5	●	●	●	●		●	●	●	●	●		●	●	A2
Facit 4525	£1,150	M 9×9		○	○	○			9600	512	6,8	5,8.5,10,17	280	132	11.5	46.5×35.6	13.5	5	●	●	●				●	●	●			●		A2
Facit 4542	£2,300	M 9×14		●	+	+			9600	800	6,8	10,12,15	250	232	18	64×45.7	40	5	●	●	●	●	●	●	●	●	●			●		A2
Fujitsu 830	£2,179	Daisywheel		+	●	●			1200	256	3,6,8	10,12,15	80	204	15	59.7×44.9	18	6	●	●	●	●		●	●	●	●		●	●	●	Z1
General Electric 2030	£961	M 9×7				+	1		1200	640	2,4,6,8,12	10,13,16.5	60	218	15.5	54.6×47.6	9.9	2	●						●	●	●	●		●	●	Z1
General Electric 2120	£1,751	M 9×7				+	1		1200	640	2,4,6,8,12	10,13,16.5	150	218	15.5	54.6×47.6	9.9	2	●						●	●	●	●		●	●	Z1
General Printer GP300	£2,287	M 9×9, 18×25				●		2	19200	380	6,8	10,12,15	300	120	13.5	52×44.5	20	5	●	●	●	●	●	●	●	●		●		●	I2
General Printer GP300L	£2,490	M 9×9, 18×25				●		2	19200	380	6,8	10,12,15	300	132	13.5	63.5×51.5	24	5	●	●	●	●	●	●	●	●		●		●	I2
Hermes 612C	£2,242	M 36× 18		●	+	●			9600	2000	6,8	10,12,15	200	198	15	426×620×180	22	6	●	●	●	●	●		●	●	●		●	●	●	M7
Integrex	£914	M 7×5, 9×6	+	●		+			N/A	37	6,8	10	125	80	10	38.7×32.5	9.6	1						●	●			●		●		D3
ITT Swift 3342	£1,719	M 9×7			○	○			1200	640	2,3,4,6,8,12	10,13,16.5	150	240	15.5	56×47	10.4	6	●		●				●	●	●	●		●	●	I3
ITT Swallow	£914	M 9×7		○	○	○			1200	640	2,4,6,8,12	10,13,16.5	60	240	15.5	56×47	10	6	●		●				●	●	●	●			●	I3
Juki 6100	£459	Daisywheel	+	●	+	+			2400	2000	6,8	10,12,15	18	165	13	454×520×151	14	4	●	●	●	●		●	●	●	○		●	○	●	M7
Lear Siegler	£1,667	M 9×9		○	○	○			19200	2000	6,8	10,12	180	218	16	68.6×50.2	22.7	5	●		●	●	●		●	●	●			●		I4
Logabax LX213	£1,840	M 9×9		+		●			9600	4000	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●				●	●	●			●		T3
Logabax LX217	£2,242	M 9×9		+		●			9600	400	6,8	10,12,16.5	180	218	15	57.1×43.2	17	5	●	●	●				●	●	●		●	●		T3
Micro Peripherals 99G	£517	M 9×7, 11×9		●		●			9600	2048	6,8	10,12,16.5	100	136	9.5	41.1×27.3	6.7	2	●	●	●			●	●	●	●	●	●	●	●	T3
Micro Peripherals 150G	£918	M 9×7, 11×9		●		●			9600	8192	6,8	10,12,16.5	150	226	15	58.4×39.9	11.2	2	●	●	●		●	●	●	●	●			●		T3
MT120 I	£600	M 9×7	+	●	+	+			9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4		●	●		●	●	●	●	●	●	●	●	●	M3
MT120 L	£765	M 9×7	+	●	+	+			9600	132	6,8	10,12.5,16.6,20	160	132	10	34.3×24.1	7.5	4		●	●		●	●	●	●	●	●	●	●	●	M3
MT1802 I	£1,845	M 7×9	+	○	+	○			9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5			●				●	●	●			●		M3

PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+)						Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method					Distributer
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
MT1802 L	£2,205	M 7×9	+	○	+	○			9600	218	6,8	10,16.6	200	218	16	55.9×76.2	8.6	5			●				●	●	●			●		M3
MT440 I	£1,966	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.6	400	220	16	66×45.7	36	5			●				●	●	●			●		M3
MT440 L	£2,185	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.6	400	220	16	66×45.7	36	5			●				●	●	●			●		M3
MT420 I	£882	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●	●			●		M3
MT420 L	£954	M 9×7		●	+	+			9600	220	3,4,6,8,12	10,12.5,16.7	200	220	16	66×45.7	36	5		●	●	●		●	●	●	●			●		M3
MT140 I	£1,593	M 9×7	+	●	+	+			9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●	●		●	●	●	M3
MT140 L	£1,869	M 9×7	+	●	+	+			9600	218	6,8	10,12.5,16.6,20	160	218	16	48.3×24.1	7.5	4		●	●		●	●	●	●	●		●	●	●	M3
MT80	£327	M7 × 8		●	(+)	(+)			960	2048	6,8	5,8,10,17	80	142	10	37.7×29.5	5.3	4	●	●	●		●	●	●	●	●	●	●	●	●	M3
Newbury Labs 1550	£747	M 9×7		○		○			9600	2000	6,8	5,6,8.5,10,12,17	120	230	15.5	55.9×30.5	11	3	●	●	●	●	●	●	●	●	●	●	●		●	N1
Newbury Labs 8510A	£552	M 9×7		○		○			9600	3000	6,8	5,6,8.5,10,12,17	120	132	10	55.9×28.6	8.5	3	●	●	●	●	●	●	●	●	●	●	●		●	N1
Newbury Labs NL40	£1,478	Daisywheel		○	○	○			2400	2000	6,8	10,12	40	163	15.5	55.9×43.2	14	2	●	●	●	●			●	●	●	●	●	●	●	N1
OKI Microline 80	£242	M 5×7		●		+			9600	256	6,8	5,10,16.5	80	132	9.5	34.2×24.5	6.5	4					●				●	●		●	●	X1
OKI Microline 82A	£378	M 9×7		●	●	+			1200	132	6,8	5,8.3,10,16.5	120	132	9.5	36.1×32.8	8.9	4	●		●		●		●	●	●	●		●	●	X1
OKI Microline 83A	£608	M 9×7		●	●	+			1200	132	6,8	5,8.3,10,16.5	120	132	15	51×32.8	14	3	●		●		●		●	●	●	●		●	●	X1
OKI Microline 84	£948.75	M		○	○	●			4800	132	6,8	5,8.3,10,12,17	200	231	15	51×32.8	14	3	●	●	●	●		●	●	●	●		●	●	●	X1
Olivetti DM5050	£575	M 7×9		●	+	+		4	9600	1000	6	10,12.5,16.5	100	132	9	11.6×30	7.5	2	●	●	●			●	●	●	●	●		●	●	B2
Olivetti DM5100	£1,033	M 7×9	○	○	○	○			9600	256	6	10,12,16.5	140	220	14.75	59.2×40.1	17	4	●	●	●		●		●	●	●			●		B2
Olivetti DM5200	£1,351	M 7×9	●	+	+	+			9600	256	6	10,12,16.5	200	220	19.75	59.2×40.1	17	4	●	●	●		●		●	●	●			●		B2
Olivetti DY-211	£862	Daisywheel	+	●	+	●			9600	1000	6	10,12,15	29	198	17	54.1×32.8	16.3	4	●	●	●	●			●	●	●	●	●	●	●	B2
Olivetti DY-311	£1,322	Daisywheel	+	○		○			9600	1000	6	10,12,15	39	225	17.25	60×50	17	4	●	●	●	●			●	●	●	●	●		●	B2
Olivetti JP101	£420	Dry Ink Jet		●	+	+			9600	1000	6,8	10,12,18	50	147	9	39×26.8	5.2	1	●				●	●	●	●	●	●			●	B2
Olivetti TH240	£661	Thermal 5×7			+	●			9600	1000	6	10	240	80	8.75	40.1×34	7.5	1	●	●				●		●		●			●	B2
Olympia ESW102RO	£917.70	Daisywheel	○		○	○			19200	4000	6	10,12,15	24	212	17	52.8×37	13	6	●	●	●	●			●	●	●		●	●	●	I5
Olympia ESW3000RO	£1,306	Daisywheel	○	○		○			19200	4000	3,4,6	10,12,15	50	225	17	60.4×40.8	19.5	6	●	●	●	●			●	●	●		●	●	●	I5
PR-1010	£380	M9×9		●					N/A	N/A	6, 8	5, 6, 10,12,	96	158	10	403×286	7	3	●	●	●		●		●	●	●	●	●	●	●	R4
Phillips Mullard GP300	£2,287	M		+		●			19200	512	3,4,6,8,12	10,12,15	300	180	14.4	64.5×52.3	24	6	●	●	●	●	●		●	●	●	●	●	●	●	R2
Printek 920	£1,949	M		+		●			9600	1792	6,8,12,16	10,12,13.3,16.7	340	227	16	59×42.5	20	4	●	●	●		●	●	●	●	●			●		T3
Qume Sprint 9/35	£1,892	Daisywheel				+	1		9600	500	6,8	10,12,15	35	198	15	61.3×49.9	19	3	●	●	●	●	●		●	●	●	●	●		●	Q1
Qume Sprint 9/45	£1,966	Daisywheel				+	1		9600	500	3,6,8	10,12,15	45	198	15	61.7×42.5	20.4	3	●	●	●	●	●	●	●	●	●	●	●		●	Q1
Qume Sprint 9/55	£2,403	Daisywheel				+	1		9600	500	3,6,8	10,12,15	55	198	15	61.7×42.5	20.4	3	●	●	●	●	●		●	●	●	●	●		●	Q1
Rair Decwriter IV AA	£1,200	M 7×9			+	●			300	256	2,3,4,6,8,12	5,6,6,6,8.25,10,13.2,16.5	30	127	15	57.1×39.4	11.3	3				●					●	●			●	R1
Rair 630	£1,940	Daisywheel			+	●			9600	768	6,8	10,16.5	40	196	15	59.9×46.4	27.2	2	●		●	●			●	●	●	●	●	●	●	R1
Rair 820	£1,529	M 9×7			+	●			9600	1280	6,8	10,16.5	150	132	15	66×53.4	18.2	6	●		●				●	●	●	●		●	●	R1
Rair Centronics 150/4	£722	M 9×7		+		●			9600	N/A	6	10	150	132	10	38.1×35.6	9	2		●					●	●	●	●	●	●	●	R1
Rair/Texas Instruments 743	£1,437	Thermal				●			300	N/A	6	10	30	80	8.5	39.1×40.6	6.1	1	●										●		●	R1
Ricoh RP1300 Flowriter	£1,144	Daisywheel	○	○		○			9600	200	8	10,12,15	37	163	15	59.3×33.2	14	7	●	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600 Flowriter	£1,782	Daisywheel	○	○		○			9600	2000	8	10,12,15	60	163	15	62.5×35.5	22	7	●	●	●	●	●	●	●	●	●	●	●	●	●	A1
Ricoh RP1600S	£1,667	Daisywheel	+	+		●			9600	4000	6,8	10,12,15	65	204	13.5	63.5×36.2	27	7	●	●	●	●		●	●	●	●	●			●	M4
Sanders S700	£2,875	M		●		●			9600	2000	6,8	6,10,12,15,17,18	450	234	14.5	47×56.9	23.6	5	●	●	●	●	●	●	●	●	●		●		●	A2
Santec S-700	£3,082	M 96 × 28	(+)	●	(+)	●			9600	2,000	12,8,6,4	20,16,15,12,10,6	500	256	14.8	57×47	23.6	5	●	●	●	●	●	●	●	●	●		●	●	●	R6
Seikosha GP100A	£247	M 5×7	+	●	+	+			9600	256	6	6,12	50	80	10	42.7×23.8	4.5	3		●				●			●			●		D4
Shinwa-CTI CP80	£333.50	M 9×13		●		+			9600	132	6	11	80	142	10	295×377×125	5.3	4	●	●	●		●	●	●	●	●		●	●	●	M7
Smith Corona TP1	£557	Daisywheel		○		○			19200	N/A	3,4.5,6	10,12	120	126	13	49.5×31.5	8.4	5	●	●	●							●	●	●		●	D1
Sord SLP160	£724	M		●					9600	136	6,8,9	10,12	120	136	15	51×36	13	5	●	●	●		●	●	●	●	●			●	●	S12
Sord SWP20	£1,444	Daisywheel		●		+			9600	2000	6,8	10,12,15	16	132	15	66×44.7	22	5	●	●	●	●			●	●	●	●		●		S2
Star DP-8480	£251	M		●		+			2400	132	6,12	10,12,16.7	100	132	10.5	39.4×32.4	8.5	2	●		●		●		●	●	●	●		●	●	S3
Star DP-510	£333,50	M9×9		●	+	+			9600	2,300	6,8	10,12,17	100	132	10	315×392×136	7	3	●	●	●	●	●	●	●	●	●	●	●	●	●	M7
Star DP-515	£460	M9×9		●	+	+			9600	2,300	6,8	10,12,17	100	233	15	515×542×136	10	3	●	●	●	●	●	●	●	●	●	●	●	●	●	M7

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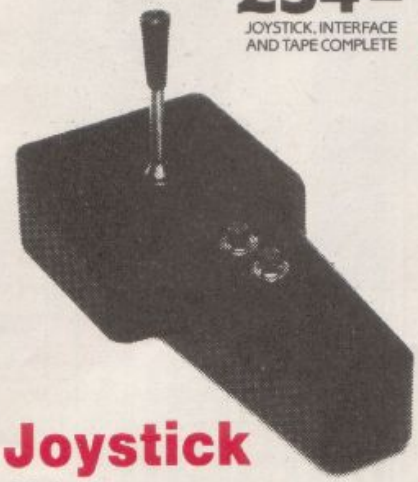
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PRINTERS

Make & Model	Price inc VAT	Printhead type (M = matrix)	INTERFACES ● inc in price, ○ = options at extra cost (+) I-EEE	Centronics	20ma	RS232	Others ●	Others (+)	Max baud rate	Buffer Memory Size (in characters)	Lines per inch	Characters per inch	Max print Speed (CPS)	Max print positions	Max paper width in inches	Size (base area in cms)	Weight (in kilos)	Max Copies	Underlining	Bold Type	True Descenders	Proportional Spacing	Block Graphics	High Resolution Graphics	Bi Directional	Logic Seeking	Feed Method: Fan Fold	Roll	Cut Sheet	Tractor	Frictional	Distributor
Star DP-515	£460	M9×9		●	+	+			9600	2,300	6,8	10,12,17	100	233	16	71.7×61	53	6			●		●		●	●	●			●		S4
Systime Systerm	£1,909	M				●			9600	256	6,8	10	120	132	16	71.7×61	53	6			●		●		●	●	●			●		S4
Systime Sysprint-S	£1,599	M				●			9600	256	6,8	10	120	132	8.5	40×29.5	5.6	1			●			●	●	●		●	●		●	T1
Tandy TRS 80 DW2	£1,299	Daisywheel		●					9600	2000	6	10,12	43	163	16.5	62.4×20.4	27	4	●	●	●	●				●	●		●	●	●	T1
Texas Instruments 745	£1,470	Thermal				●			300	256	6	10,17	30	80	8.5	39.1×40.6	13.5	1										●				R1
Texas Instruments 781	£1,259	Thermal 7×5			●	●			9600	256	6	10,17	120	80	8.5	40.6×15.24	8.5	1							●	●		●			●	D5
Texas Instruments 810	£1,369	M 9×7		+	+	●			9600	256	6,8	5,8,10,16.5	150	132	15.5	65.4×50.8	25	9							●	●	●			●		D5
TRD 170S	£834	Daisywheel		○		○			19200	256	6	10,12,15	17	132	15.5	64×45.7	40	5							●	●	●			●		D5
Toshiba T1350	£1,495	M		○		○			9600	256	6	10,12	192	192	15	55×38	19.9	3	●	●	●	●	●	●	●	●	●	●	●	●	●	T4
Walters WM2000	£477	M 9×9	+	●	+	+			19200	750	6,8,12	5,6.6,8.3,10,13.3,16.6	128	132	10	43.9×33.5	12	4	●	●	●		●	●	●	●	●			●		W1
Walters WM4000	£713	M 9×9	+	●	+	+			19200	1500	6,8,12	5,6.6,8.3,10,13.3,16.6	150	220	15	63×39	13	5	●	●	●		●	●	●	●	●			●		W1
ZX Printer	£40	Electrical						1	N/A	N/A	9	32	50	32	4	14×4.6	N/A	1			●		●	●				●			●	S5

MONITORS

These have been split into **colour** and **monochrome.**

Screen size is a diagonal measurement in inches. Nearly all monochrome monitors accept a **composite video** signal from the computer and most computers are equipped with composite video output. Colour monitors feature a wider range of **signal** systems than mono and it is important to match the output of your computer to the input of the monitor.

An **audio channel** will enable sound to be output from a speaker inside the monitor. **Mono tint** refers to the colour of the text on a mono monitor. Some monitors come with an **anti-glare filter** to relieve operator discomfort.

Band width refers to the frequency range of signals to which the monitor can respond in MegaHertz. **Dot resolution** indicates the number of dots which can be displayed across the screen: the more dots, the sharper the picture.

Dimensions indicates the area the unit occupies on the desktop.

COLOUR MONITORS

Make & Model	Price inc VAT	Screen size (in inches)	Signal: Modulated PAL	Unmodulated PAL	TTL RGB	75 Ohm linear	32 bit 4 bit TTL	Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
Crofton C1401	£300	14			●					10	600	37×42	10	C4
HM 2713	£3,120	13			●					25	720	54×40	36	B1
HM 2719B	£2,553	19			●					25	960	50×49	46	B1
HM 2719C	£3,042	19			●					25	960	50×49	46	B1
HM 3619	£3,548	19			●					45	1280	50×44	48	B1
Kaga Vision II	£327.75	12			●				●	15	510	32×30.3	12.5	D6
Lion Cub 1431-TTL	£286	14			●					7	585	65×57.5	11.5	S6
Lion Cub 1436	£316	14					●			7	585	65×57.5	11.5	S6
Lion Cub 1445	£633	14				●	●			15	895	65×57.5	11.5	S6
Lion Cub 1449	£604	14				●				15	895	65×57.5	11.5	S6
Lion Cub 1451-TTL	£430	14			●					10	653	65×57.5	11.5	S6
Lion Cub 1455	£483	14				●	●			10	653	65×57.5	11.5	S6
Lion Cub 1459	£459	14				●				10	653	65×57.5	11.5	S6
Lion Cub 2031-TTL	£344	20			●					7	585	65×57.5	11.5	S6
Lion Cub 2051-TTL	£646	20			●					10	940	65×57.5	11.5	S6

Make & Model	Price inc VAT	Screen size (in inches)	Signal: Modulated PAL	Unmodulated PAL	TTL RGB	75 Ohm linear	32 bit 4 bit TTL	Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
Luxor Digital	£574	14			●			●	●	25	800	N/A	15.7	P1
Luxor Linear II	£643	14			●			●	●	25	800	N/A	15.7	P1
Microtech 14	£402	14		●	●	●		●		18	585	33.7 × 40.8	12.6	M6
TM 22	£329	6				●		●		5.5	N/A	22×34.5	4.1	J3
VM 14 PSN	£378	14				●		●		5.5	300	47×40	13.6	J3
Wolf Cub 1435-TTL	£358	14				●	●			7	653	65×57.5	11.5	S6
Wolf Cub 1456	£454	14					●			10	653	65×57.5	11.5	S6

MONOCHROME MONITORS

Make & Model	Price inc. VAT	Screen size	Composite video	Audio channel	Mono tint	Anti-glare filter	Band width (MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
AVT DM 210G	£138	12	●		Green	●	12	750	30.8×29.6	9.5	L1
EG 100	£77	12	●		Green		8	700	37.5×29	8	L1
EG 101	£91	12	●		Green		12	700	37.5×29	8	L1
LEDM 091D	£99	9	●		B&W	●	12	750	22×24	5.4	L1
LEDM 0910	£121	9	●		Green	●	12	750	22×24	5.4	L1
Luxor 10	£212	10	●		Orange	●	22	625	N/A	8	P1
M9	£131	9	●		Green		15-22	650	22.4×25.7	5.7	P1
M12	£144	12	●		Green		15-22	800	29.3×30	9.3	P1
Novex	£114	12	●		Green		12	750	N/A	N/A	P1
N12 1003	£112	12	●		Green		24	800	23×26.5	7	P1
Prince	£126	12	●		Green		24	800	33×50	7	C4
PM 102	£126	9	●		Green	●	24	800	22×28	7	C4
Zenith ZVM121	£99	12	●	●	Green	●	15	N/A	29×29	6.5	P2
U300	£149	12	●		Green	●	18	N/A	34·8×36·8×29·2	7·7	R4

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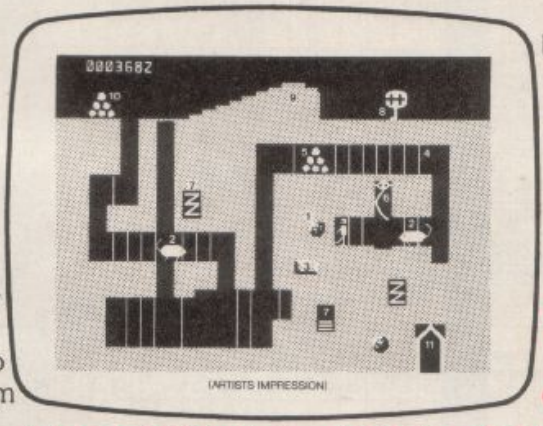
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All the time the Gremlin (8) is busy digging it's way through your waste earth pile (9) to reach the entrance to your mine. Once it does you have no escape!! – so you must stop it getting there by returning to the surface to replenish the main mound (9) with the smaller pile of earth which appears on the surface as you dig (10). The deeper you dig the more points you score – but the further you have to go to replenish that mound! Once all nuggets have been collected, a cave opens (11) allowing you to pass through to the next stage – if you can reach it! This gives you more rats – but less snakes to destroy them with!!



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DISK DRIVES

This section is divided into categories covering 5¼in and 8in floppy disks.

Disk data **capacity** is measured in kilobytes (K): one kilobyte = 1,024 characters. A **no of disks** column is included because some disk units contain two disk drives.

Manufacturers can vary the number of disk data **tracks** and these are divided into sectors. This **sectoring** system allows the information to be stored and retrieved by reference to a timing mark on the disk so the computer can keep track of its rotation. The system can be hard, where reference is kept by a hole in the disk, or soft, where the disk position is monitored by magnetic signals.

Some drives have one read/write head for each side of the disk so the buyer has a choice between **single or double-sided** drives. **BS** means that the drives are both single and double-sided.

As disk technology advanced it became possible to cram more data onto the floppy so drives will feature either **single or double** (data) **density. BD** means that the drives are both single and double density.

The interface acts as an interpreter so the computer and disk can exchange information. Each device must have the same interpreter before a useful cable connection can be made. The **connect to** column allows you to match the disk interfaces to those included in the disk drives or available at extra cost.

5¼" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
Apple II	£399	143K	1	35	16	SS.SD				●						P2
Atari	£299	90K	1	40	Soft	SS.SD									●	A4
BASF 6106	£195	500K	1	48	Both	SS.BD					●					B6
BASF 6108	£240	500K	1	48	Both	DS.BD					●					B6
BASF 6118	£279	1Mb	1	96	Both	DS.BD					●					B6
Canon X8300	£600	640K	2	80	Soft	DS.DD									●	C5
CD 40	£679	400K	2	40	Both	SS.BD									●	C6
CD 50A	£424	500K	2	40	Both	SS.BD					●					C6
CD 50E	£569	1Mb	2	80	Both	SS.BD					●					C6
CD 50F	£712	2Mb	2	80	Both	DS.BD					●					C6
CD 80	£765	800K	2	80	Both	SS.BD									●	C6
CD 80D	£949	1.6Mb	2	80	Both	DS.BD									●	C6
Commodore 2031	£454	171K	1	35	Soft	SS.DD	●									C2
Commodore 4040	£799	343K	2	35	Soft	SS.DD	●									C2
Commodore 8280	£862	1.6Mb	2	154	Soft	DS.DD	●									C2
Commodore 8050	£1,029	1Mb	2	77	Soft	SS.DD	●									C2
Commodore 8250	£1,489	2Mb	2	154	Soft	DS.DD	●									C2
Control Data 9409T	£420	1Mb	1	80	Both	DS.BD					●					C7
Control Data ZL141B	£175	250K	1	40	Both	SS.DD			●							M5
Control Data ZL142	£360	500K	2	40	Both	SS.DD			●							M5
Control Data ZL241B	£240	500K	1	40	Both	DS.DD			●							M5
Control Data ZL291	£380	1Mb	1	80	Both	DS.DD			●							M5
Control Data ZL292	£640	2Mb	2	80	Both	DS.DD			●							M5
CS 40	£482	200K	1	40	Both	SS.BD									●	C6
CS 50A	£229	250K	1	40	Both	SS.BD					●					C6
CS 50E	£305	500K	1	80	Both	SS.BD					●					C6
CS 50F	£397	1Mb	1	80	Both	DS.BD					●					C6
CS 80	£523	400K	1	80	Both	SS.BD									●	C6
CS 80D	£627	800K	1	80	Both	DS.BD									●	C6
Cumana CS 100	£245	100k	1	40	Both	SS.DD			●		●	●	●		●	C6
Cumana DS 250	£286	185K	1	40	Both	SS.DD					●	●	●		●	C6
Cumana AS100	£252	200K	1	35	Soft	SS.BD				●						C6
Cumana DA8035	£684	655K	2	80	Both	SS.BD				●						C6
Dragon Disk Drive	£275	184K	1	40	Soft	SS.DD					●					G3
EG 401AT	£370	102K	2	40	Soft	SS.BD					●					L1
Gemini 825	£403	400K	1	80	Soft	SS.DD						●				G2
Gemini 825	£518	800K	1	160	Soft	DS.DD						●				G2
Gemini 825	£661	800K	2	80	Soft	SS.DD						●				G2
Gemini 825	£776	1.6Mb	2	160	Soft	DS.DD						●				G2
Lowe EG 400AT	£426	200K	2	40	Soft	SS.BD					●					L1
Lowe EG 400T	£253	102K	1	40	Soft	SS.BD					●					L1
M 4853	£311	1Mb	1	80	Soft	DS.DD					●					A3
M 4854	£368	1.6Mb	1	77	Soft	DS.DD					●					A3
Megastore MIOS	£1,034	1.2Mb	2	80	Soft	DS.DD				●					●	V1
Multi Floppy Drive	£592	8Mb	5	770	Soft	SS.DD	●									H1
RM MDS-1	£1,950	144K	1	40	Soft	DS.SD		●							●	R3
RM MDS-2	£2,147	288K	2	40	Soft	DS.SD		●							●	R3
Scorpio 8	£863	8Mb	5	770	Soft	SS.DD	●									H1
Sharp MZ80 FB	£856	560K	2	70	Soft	DS.DD									●	S7
Tandy Colour	£449	175K	1	40	Soft	SS.DD									●	T1
Tandy 26-1160	£299	75K	4	40	Soft	SS.SD					●					T1
Tandy 26-3023	£299	156K	4	35	Soft	SS.DD					●					T1
Tandy Model 1	£389	90K	1	35	Soft	SS.SD									●	T1
Tandy Model 111	£369	175K	2	40	Soft	SS.DD									●	T1
TM 101-4	£282	1Mb	1	160	Soft	SS.DD	●									H1
TM 102-2	£393	2Mb	1	160	Soft	SS.DD	●									H1
TM 848-1	£389	800K	1	77	Soft	SS.DD	●									H1
TM 50-1	£147	250K	1	40	Soft	SS.DD	●									H1
TM 100-2	£221	500K	1	80	Soft	DS.DD	●									H1
TM 100-4/4M	£247	1Mb	1	160	Soft	DS.DD	●									H1
Torch Disc Pack	£839.50	800K	2	80	Soft	DS.SD			●							T5
Tracker 1	£373	1Mb	2	80	Soft	SS.DD					●					D7
Tracker 2	£497	2Mb	2	80	Soft	DS.DD					●					D7

8" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of discs	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus -	Gemini	20ma	Others	Distributor
ACP 700 (AC)	£293	1Mb	1	77	Soft	DS.DD									●	E2
ACP 750 (DC)	£316	1Mb	1	77	Soft	DS.DD									●	E2
ACP 1500 (DC)	£403	2Mb	1	77	Soft	DS.DD									●	E2
Caldisk 142M	£465	500K	1	77	Both	SS.BD									●	E2
Caldisk 143M	£522	1.2Mb	1	77	Both	DS.BD					●					F1
Caldisk 143M-1	£465	500K	1	77	Both	SS.BD					●					F3
Commodore 8280	£2,760	987K	2	77	Soft	DS.DD	●									C2
Canon X 8330	£1,200	2Mb	2	153	Soft	DS.DD									●	C5
Control Data 9404B	£684	800K	1	77	Both	SS.BD					●					M5
Control Data 9406-4	£1,144	1.6Mb	1	77	Both	DS.BD					●					M5
Eicon FD8/1D/DD	£1,438	1Mb	1	77	Soft	SS.DD				●						E3
Eicon FD8/1D/SD	£1,397	500K	1	77	Soft	BS.SD				●						E3
Eicon FD8/2D/FBR	£1,740	1Mb	2	77	Soft	DS.SD									●	E3
Eicon FD8/2D/DD	£2,013	2Mb	2	77	Soft	SS.DD				●						E3
Eicon FD8/2D/SD	£1,972	1Mb	2	77	Soft	SS.SD				●						E3
Eicon FD8/1D/FBR	£1,240	500K	1	77	Soft	DS.SD									●	E3
F 311	£1,725	1.2Mb	2	76	Soft	DS.SD									●	B5

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to: I-EEE	RS232	BBC	Apple II	St. Shugart	Nasbus	Gemini	20ma	Others	Distributor
8" DISK DRIVES																
F 320	£2,300	2.4Mb	2	76	Soft	DS.DD									●	B5
M 2894	£499	1.6Mb	1	77	Soft	DS.DD					●					A3
M 2896	£493	1.6Mb	1	77	Soft	DS.DD					●					A3
Megastor 11 DD	£1,133	2Mb	2	77	Soft	DS.DD				●						V1
Megastor 11SD	£1,018	1Mb	2	77	Soft	DS.SD				●					●	V1
Megastor 111	£1,121	2Mb	2	77	Soft	DS.DD				●					●	V1
R.M. FDS-2	£3,789	1Mb	2	77	Soft	DS.SD		●							●	R3
Tandy Model 11	£999	486K	1	77	Soft	DS.SD									●	T1
Tandy Model 16	£949	1.2Mb	1	77	Soft	DS.DD									●	T1
Tandy Model 16	£1,549	2.5Mb	2	77	Soft	DS.DD									●	T1

MODEMS

A modem interfaces a computer and the telephone system so computers can communicate over long distances. It converts data to electrical pulses or sounds that can be sent down the line. A modem can be connected to the line directly or acoustically. A **D** in the **connection** column represents direct link, while **A** indicates acoustic. The acoustic coupler is like a female telephone handset: with a speaker in the coupler opposing the phone's mouthpiece and a microphone opposing the earpiece. A **B** in this column indicates that both methods of attachment are available. **Baud** rate shows the speed with which the data is transmitted.

The modem must be connected to the computer through an interface. The **interface** column lists the main interfaces featured on each modem. **Asynchronous** means that data may be transferred at intervals as available or as needed. **Synchronous** data is transmitted at regular intervals. **Simplex** transfers data in one direction, while **Half duplex** can transmit/receive in either direction, but not simultaneously. **Full duplex** transmits and receives information in both directions at once. Some modems can **originate** a call or start a two-way conversation. **Answer** means they can respond to a call from another computer.

Make and Model	Price inc. VAT	Connection	Data Rates (baud)	Interface	Others	Capabilities: Asynchronous	Synchronous	Simplex	Half Duplex	Full Duplex	Originate	Answer	Distributor
AD 1223	£287.50	D	1200	RS232		●			●		●	●	A6
AJ 311	£320	B	300	RS232		●			●	●	●	●	A5
AJ 1234	£684	A	1200	RS232		●	●			●	●		A5
AM 211	£387	B	300	RS232		●			●	●	●		A5
Bermac 1200/1 Model A	£414	D	1800	RS232		●			●		●		B3
Bermac 1200/1 Model B	£460	D	1800	RS232		●			●		●	●	B3
Commodore 64 Modem	£99.95	D	1200	C-64 cartridge port		●			●	●	●	●	C2
CCITT CAT	£228	A	300	RS232/V24			●			●	●	●	●	D8
CDSV22	£719	D	1200	RS232/V24			●	●			●	●	●	D8
DSL2123	£329	D	300/1200	RS232/V24			●			●	●	●	●	D8
Prism VTX 5000	£99.95	D	1200	Sinclair Spectrum			●			●	●	●		P3
Prism 1000	£69.95	D	1200	RS232			●			●	●	●		P3
Prism 2000	£84.94	D	1200	RS232			●			●	●	●		P3
Sendata 700 Series A	£253	A	300	RS232, 20ma		1	●				●	●	●	B4
Sendata 700 Series B	£224	A	300	RS232, 20ma		1	●				●	●		B4
Sendata 700 Series C	£309	A	600-1200	RS232, 20ma		1	●			●		●	●	B4
Sendata 700 Series E	£149	A	300-1200	RS232, 20ma		1	●		●			●		B4
Racal 126 LS1	£782	D	2400	V24				●			●	●	●	R2
Racal MPS 3021	£295	D	300	V24			●				●	●	●	R2
Racal MPS 1222	£678	D	1200	V24			●	●			●	●	●	R2

PLOTTERS

Plotters use a pen to put graphics or characters on paper under the command of a computer. They are usually one of two types—flatbed or drum. A **flatbed** holds the paper flat while the pen draws on it in two dimensions. A **drum** plotter turns the paper vertically on a cylinder while the pen moves horizontally. Most plotters can change pens during operation so a variety of colours and line thicknesses are available. **Max pens** indicates the number of pens in operation or on standby. Dimensions of the paper to be used are listed under **paper size. Maximum plotting speed** measures the distance in millimetres per sec covered by the pen. **Interfaces** are included in the basic price or come at extra cost.

Make and Model	Price inc VAT	Type	Max Pens	Paper Size	Maximum Plotting Speed in secs.	Interface (+ at extra cost)	Distribution
Calcomp 81	£3,392	Flat	8	A3	30cm	RS232 or IEEE	C3
Commodore 1520	£170	Drum	4	4½"	52mm	Commodore Serial	C2
HP 7470A	£1,317	Drum	2	A4	38.1cm	RS232 (IEEE+)	H2
MT Pixy 3	£688.85	Flat	3	A4	200mm	Parallel (RS232 +)	M3
PD4	£585	Flat	1	A4	700mm	(IEEE+)	J2
RY-21	£747.50	Flat	1	A4	200mm	Centronics, (RS232+)	R5
RY-10MZ	£1,865	Flat	8	A3	400mm	Centronics, (RS232, IEEE+)	R5
Strobe 100	£662	Drum	1	A4	7.6cm	(RS232, Parallel+)	D6
TRS-80 Pen Plotter	£1,399	Flat	6	A4	6.8cm	RS232	T1
Watanabe WX 4635	£2,301	Flat	1	A3	250mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4637	£2,862	Flat	2	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe 4638	£2,635	Flat	1	A3	400mm	(Centronics, RS232, IEEE+)	E4
Watanabe WX 4671	£1,129	Flat	1	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4675	£1,638	Flat	6	A3	50mm	Parallel (RS232, IEEE+)	E4
Watanabe 4731	£1,761	Drum	4	A3	200mm	(Centronics, RS232, IEEE+)	E4

DISTRIBUTORS

A1 Appropriate Technology, 01-625 5575 **A2** Advent Data Products, Melksham 706289 **A3** Altex Microcomputers Ltd, Reading 791579 **A4** Atari International (UK), Slough 33344 **A5** Anderson Jacobson Ltd, SLough 25172 **A6** Alpha Datasystems, 058 27 66136
B1 Bytech, Reading 61031 **B2** British Olivetti, 01-785 6666 **B3** Barron McCann, Biggleswade 316286 **B4** Bencom Sendata (UK), 01-940 1386 **B5** Baydel Ltd, Leatherhead 378811 B6 BASF, 01-388 4200
C1 Centronics, 01-581 1011 **C2** Commodore Business Machines, Slough 79292 **C2** Caicomp Ltd, Bracknell 50211 **C4** Crofton Electronics, 01-8911923 **C5** Canon (UK) Ltd, 01-680 7700 **C6** Cumana, Guildford 503121 **C7** CBL, Reading 792097
D1 Discom, Evesham 3591 **D2** Datatrade Ltd, Northampton 22289 **D3** DNCS Ltd, 061-643 0016 **D4** DRG, Weston-super-Mare 415398 **D5** Data Systems Division, Bedford 223889 **D6** Data Efficiency, Hemel Hempstead 63561 **D7** Data Track Technology, New Milton 619650 **D8** Dacom Systems, Milton Keynes 676797
E1 Epson (UK), 01-900 0466 **E2** Elecomatic, 041-881 5825 **E3** Eicon, Barhill 81825 **E4** Environmental Equipments Northern Ltd, Nantwich 625115
F1 Fastcol, Reading 791557
G1 Geveke Electronics, Woking 26331 **G2** Gemini Micros, Amersham 28321 **G3** G. C. McMichael, 02816 2797
H1 HAL Computers Ltd, Farnborough 517175 **H2** Haywood Electronic Asoc. Ltd 01-428 0111
I1 Informex Ltd, 01-318 4213 **I2** Intac Data Systems, Rotherham 547170 **I3** ITT Business Systems, Brighton 507111 **I4** ITT Consumer Products, Basildon 3040 **I5** Inteligent Interfaces, Stratford-upon-Avon 296879
J1 Jones & Brother, 061-330 6531 **J2** J J Lloyd Instruments, Locksheath 4221 **J3** JVC, 01-450 2621
L1 Lowe Electronics, Matlock 4995
M1 Mitsui & Co Ltd, 01-600 1777 **M2** Modata, Tunbridge Wells 41555 **M3** Mannesmann Tally Ltd, Reading 788711 **M4** Micropute, Macclesfield 615384 **M5** Microware, 01-272 6237 **M6** Microtech Leeds, Leeds 679964 **M7** Micro Peripherals Ltd, Basingstoke 3232
N1 Newbury Data Recording, Newbury 48864
P1 Phoenix Technology, 01-737 3333 **P2** Pete & Pam Computers, Rossendale 227011 **P3** Prism Microproducts 01-253 2277
Q1 Qume (UK) Ltd, Reading 584646
R1 Rair Ltd, 01-836 6921 **R2** Riva Terminals, Woking 71001 **R3** Research Machines Ltd, Oxford 249866 **R4** Roland (UK) Ltd., 01-568 4578 **R5** Rikadenki Mitsui Electronics, 01-397 5111 **R6** Real Time Printers Ltd., 0276 681444
S1 Sintron Electronics, Reading 875464 **S2** Sord, 01-930 4214 **S3** Stotron, Coventry 613521 **S4** Systime, Leeds 702211
S5 Sinclair Research, Camberley 685311 **S6** Silicon Express, Leicester 374917 **S7** Sharp Electronics, 061-205 2333
T1 Tandy Company, Walsall 648181 **T2** Triump Adler, 01-250 1717 **T3** Trend Communications, 06285 24977 **T4** Toshiba Office International, Sunbury-on-Thames 85666 **T5** Torch Computers, 06284 75303
V1 Vlasak, High Wycombe 448633
W1 Walters Microsystems Int Ltd, High Wycombe 445175
X1 X-Data Ltd., Slough 723331
Z1 Zygal Dynamics, Bicester 3361 **Z2** Zenith Data Systems, 0452 29451

PCN Billboard

Atari disk drive and/or memory upgrade wanted for Atari 400, cash waiting. Tel: Dave 021-478 1208 (Birmingham).

ZX81 + 16K RAM, typewriter keyboard, hi-resolution module, joystick and software, including Forth. Excellent condition. Offers please. Tel: Dave on 021-443 1914.

Atari 400, recorder. Star Raiders, Asteroids, Super-Breakout, Chess, Joysticks, Paddles, Manuals, Books. Cost £300. Will accept £120. Tel: 093 287 2808 (Chertsey).

ITT 2020 and BBC B, bargain at £250. Tel: 09141 75371.

Atari 800 for sale, 9 months old, Basic etc. Program recorder and 60 games including, Zaxxon, Necromancer, Fort Apocalypse, Pooyan, more, £300. Ronnie £300. Tel: 01-203 4545.

Spectrum 48K plus software, exchange for Dragon or Vic 20 plus Vic cassette recorder, write: 34 Cavern Road, Torquay, Devon TQ1 1NS.

BBC (B) software; Arcade games: Defender, Scramble, D Kong, Checkman, Galaxyians and many more. Eight for £10 or £1.80 each. For details, tel: Mike, King's Lynn (0553) 65156.

Dragon 32 + cassette, recorder Compusense edit + cartridge, joysticks, software. 12 months of *Dragon User*, books etc, £200 ono. Wirral, Merseyside. 051-652 8914.

Spectrum software for sale: ZX Trek, Timegate, Champions, Football Manager, Black Crystal, 3D Graphics. All £3. 11 Trafalgar Way, Billericay, Essex, CM12 0UT S. A. Rouse.

Vic software for sale. Only £2 Stamp, Digger Dan or super Simon. Tel Jim after 4 pm 041-336 4913.

Dragon 32software, joysticks, new keyboard, mags accept £180. Chess computer, 00 guage railway system 1000's of stamps inc GB commem's. £220 the lot. Tel Bob 01-672 6383.

Sell Dragon 32 includes software, magazines, joysticks, *Dragon User*. sell for around £190 very good condition. All leads included. Tel (0742) 617919. After 5 pm (Pervaze).

Massive Spectrum software sale: All originals at low prices up to 50% off. Large sae for catalogue B. Croxford. Ford, Farmhouse Litton, Nr Bath.

ZX81 32K keyboard, repeat, inverse video printer, manual, leads several books, two games, £100 Tel Ashford (Middx) 57704.

48K Spectrum with ZX printer. Both in excellent condition and both under guarantee. Plus software. Bargain, £150. Tel Anthony 0223-870981.

BBC B wanted. Must be in good condition and preferably in London area. Software not essential. Tel 01-571 1954 afternoon.

Wanted Tandy cartridges to hire, loan or swap, Wildcatting, Colorcube, Shooting-gallery, Checkers, Roman-Checkers, Backgammon, handyman, Football, popcorn. Tel Staines 58707 after 6 pm.

Microline 82A dot-matrix printer, 80 columns, 120 cps dual interfaces. Lightly used in excellent condition — offers over £200. Harding, 12 Belmont, Lansdown Road, Bath.

Spectrum microdrive order form. Offers. Also issue on *48K Spectrum* plus some software £100 ono. Plus Pacman cartridge (Atari 400) £12. Tel 01-586 9366.

Atari two cassettes plus instuctions Learn Forth by Elcomp. £10 Tel 051-724 5563 evening.

Olivetti ET351 text editor for sale, including twin disc drive, plus quantity of discs etc. £1500 Tel 01-363 0356.

Atari VCS with 12 cartridges including Enduro, Donkey Kong, Star Raiders. Plus nine others. £165. Will not split. Tel Maidenhead 32875.

Sharp PC-1500 pocket computer and case, boxed with manuals, assembly language details etc. £100. Tel 01-802 8487.

Vic 20 plus cassette unit, 3k super expander, programmers reference guide, magazines and software, £100 Tel Folkestone 0303 77135.

ITT 2020 48K, QUME Sprint, 45 cps printer plus card, paddles. colour card, manuals w/p software and various games. etc. excellent condition. £625 ono. Tel 0376 23002.

For sale, ZX printer in excellent condition. Three months old. Boxed, complete with manual. £25. Tony, Tel Edenbridge (Kent) 864506. Buyer collects.

Atari VCS + 13 cartridges set of paddles 2 joysticks cost £300+ new sell £200 or swop for CBM 64 . Tel Marlow 75248 after 6 pm. Andre.

Seikosha GP2SOX graphics printer plus BBC connecting cable and screen dump program only £195 ono. Tel Rhoose 710663 after 6.30 pm.

ZX81 computer 16k RAM. Serviced by Sinclair 12 months guarantee. 133 programs on paper, 3 cassettes, 30 magazines including *Sinclair User* £75. Tel 051-677 8585.

Database Video game cartridges: Boxing, Four in a Row, Maze, Air Sea Battle, Bat and Ball, Shooting Gallery, Space Wars and Horses. £4 each. Tel 01-689 8420.

Zenith ZVM-121 green screen monitor, £65. Also Newbrain software technical manual. £25. Tel 01-302 9512 eves. only.

Spectrum back-up copier 16K/48K, easy to use even for beginners. £4, P. J. Monk, 2 Knights Close, Pembury, Tunbridge Wells, Kent, TN2 4EL.

Spectrum software for sale. Black Crystal £4, Microl Spreadsheet £4, Arcadia £2, Molor Maul £2, Tel Rugby 833116.

Will swap Atari software for Atari books etc. Send for list. Also swap Jumbo Jet ROM for other ROM. K. Brookes, 2 East St, Blackhall, Cleveland.

Lynx 48K manual, leads, disassembler, some games, Sinclair's red book. Good as new £150. Tel 061-973 2651 after 6 pm.

Wanted Serious or business software for Spectrum 48K. Write Peter Gill, Chemin de la Caroline 20, 1213 Petit-Lancy, Geneva, Switzerland. Tel Geneva 22/ 920255.

Swap Colour Genie software. More than 60 programs. Peter Heezen, Dorpsdyk 199 3161CC Rhoon The Netherlands.

96K Lynx. One month old, guaranteed, plus Pac-Man, Monstermine tapes including all leads, two manuals. Excellent condition. £230 Tel 061-881 4018 after 5 pm.

Colecovision with Turbo, Zaxxon and Donkey Kong. Sell for £150 or swap for CBM1541 disc drive. Tel Burton 701042.

Amber 2400 printer hardly used, spare paper and ribbon. Cost £100 sell for £65 ono (inc p&p). Tel Abingdon (0235) 31218 after 6.30 pm.

Sell Oric Hobbit £8, Zorgons Revenge £5, Ocean Hunchback £5, Ian Sinclair's The Oric-1 £4.50. Stafford (0785) 211445 Ian after 4 pm.

16K Spectrum DCP interface + leads, meteors, six Spectrum books, Microdrive order form, in good condition. All £150 ono 0234 216491 after 5 pm.

Oric software unused. Dinky Kong, Hopper, Ultra, Light Cycle, Xenon-1 and book. 60 programs for Oric-1 (PCN library), £5 each lot £28. Pontefract 620585.

Tandy CGP 115 plotter/printer. Excellent condition with two extra paper-rolls. £115 ono. Also Dragon Centronics printer cable £10. Tel N'pton (0604) 28379.

Dragon 32. Totally unused, new, tape recorder, joysticks, software worth £41 + books worth £23 + light pen. All only £200 ono. Tel Northampton (0604) 28319. Evenings only please.

Vic 20 plus cassette deck with Sargon chess, star battle and some cassette software plus programming book. Best offer over £100 secures. Farnham 725209.

International soccer (Commodore) plus defender (Atarisoft) wanted. Good prices paid or swap for other CBM 64 software. After 6.30 pm ask for Ian. 0622 61917.

48K Atari 400 recorder. £180 of games (Defender, Miner, Donkey Kong, etc), magazines joysticks, basic. In boxes, 11 months guarantee. Offers? Tel 01-734 5602 (office hours) or 01-550 0806 after 6 pm.

Commodore 64 £185 or would like to swap Electron or Atari 600XL with cassette unit of Atari 800XL. Tel Southampton (0703) 437369.

Swap Spectrum software. Over 100 titles to choose from. Send your list for mine. Eddie Early 65 Anner Road, Dublin 8 Ireland.

Spectrum 48K for sale + CCR 800 tape recorder + carry case + Kempeston interface + 2 joysticks + micro drive order form. £150 ono. Tel 722 8745 David.

Sell Galactic Chase £11. Preppie £15. Star Trek 3.5 £7. 3D Caves of Death £10 All original. Tel Canvey Island 696601 (after 7 pm).

For sale. Zeta deluxe joystick for Vic-20, Atari 400/800 or VCS. One month old. Boxed. Excellent condition. Three year guarantee. Tel (0375) 678180 £7 ono.

Lynx 48K. Immaculate condition — hardly used. Includes user magazines plus programs. Guaranteed. £135 Tel 0532 742450 after 6 pm.

Atari 400. Cassette unit, six cartridges, four cassettes, and three books, £200 or exchange for BBC. Tel James 0342 713610.

Wanted Up to £90 offered for 48K Spectrum in excellent working order (complete with manual etc). Tel Preston 724992 except Saturdays. Robert.

Commodore Pet 32K 3032, dual disk drive 3040, printer 3022 for sale. Also manuals, business games disks. Good condition. £400 Tel 0602 231265.

MZ80K 48K with built-in monitor plus recorder. Includes five languages, over 100 games. Calc, several manuals/ books. £280 ono. Tel Huddersfield (0484) 606499.

Lynx 488K £125. Boxed, manual reads introductory + own games cassettes perfect for machine code and Basic learning Tel 074-788 206.

Atari VCS with Pac-Man, Combat, joysticks paddles, good condition £50 ono. Also Defender £13 Air-sea-battle £10 Nightrider £10. Tel (0705) 476357 Tony.

Atari software, disks, cassettes and cartridges. Home filing manager, Bandits, Astro Chase, Preppie, Pac-man. Tel 0606 76576 evenings or weekends. Howard.

Wanted Dragon users for pen-pals in the Southampton to Salisbury area for info exchange. Ashley R. Adamson 'St Elmo' Slab Lane, West Wellow, Romsey, Hants SO5 0BY.

Jupiter Ace 32K. Excellent condition still boxed, complete with manual plus adventure game. £100. Tel 01-958 7414 after 6 pm..

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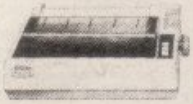


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The last laugh is on Laskys

You've probably seen the Lasky's advertising. 'Why did you spend Np on this magazine when you could have got free advice and a demonstration?' says one cheeky little two-page spread.

We dinosaurs in the micro press were a bit sceptical about this at first, but the latest ad banishes all our doubts. This promises a Commodore 64 for £199, and a Commodore 'Vic 64' for £79.90. What can we say? We frankly admit that Laskys know more than we do — we'd never heard of that last one . . .

Ultimately not

More and more attention should be paid to the question of data corruption in transit.

Motorola Information Systems marketing manager Ray Wright unleashed a particularly souped-up time-division multiplexer on the world, with the words: 'We think it's the ultimate. That's why we call it Ultramux.'

Revolution in Leeds now

Red and black was a significant colour scheme in the days of the Spanish Civil War. Little wonder then, that Oric's new fighting Atmos is dressed up so smartly.

All of this could be an unhappy coincidence for Curry's, whose latest Micro-C shop in Leeds is similarly decorated in the red/black trim, right down to the last details of furniture and ceiling.

Poisonous humour

Hungry Horace is on the way down in the *PCN* Charts and you don't have to look far for the reason — yes, in issue 49 we printed its publishers as Poison.

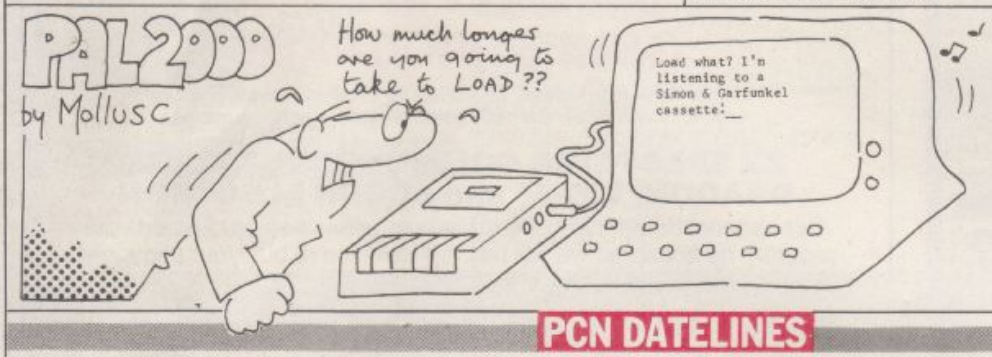
Asbjorn Tobiassen from Kristiansand wins the *PCN* Gobbledegook prize of £5 for being the first of several readers to spot it. This may be of little consolation to Psion/Melbourne House but we hope they see the joke.

Hungry Horace	Poison/Melbourne

SYNTAX ERRORS

The program Minescape in issue 50 had a few untrapped errors in it. Line 1020 should be numbered 1045 and 1040 should read:

```
1040 UNTIL B=3 OR L=0
```



NEXT WEEK

Full throttle — *PCN gives a road-test to Yamaha's musical MSX micro.*

Mac-Winners! — *Two Apple Macintosh systems are on the line in our latest competition.*

Atmospheric Fair — *Pull-out this guide to the new Oric micro.*

Game — *We run games software for the Dragon, Commodore 64, and Spectrum.*

Action... — *. . . in a fast-moving listing for the Spectrum.*

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
Computer Trade Show	March 13-15	Wembley Conference Centre, Middlesex	Reed Exhibitions, 01-643 8040
Scottish Computer Conference	March 13-15	Holiday Inn, Glasgow	Quadrilect, 01-242 8697
Microcomputer Applications Workshop	March 26, 27	Computer Laboratory, Liverpool University	Ms C Bryson 051 709 6022
Microcomputer Networks Workshop	March 27, 28	Computer Laboratory, Liverpool University	Ms C Bryson 051 709 6002
Electron & BBC Micro User Show	March 29-April 1	New Horticultural Hall, Westminster, London	Susie Lipman 061-456 8383
Computer Aided Design	April 3-5	Met. Exhibition Hall	Reed Exhibitions, 01-643 8040
Artificial Intelligence Seminar	April 7-8	City University, London	Warm Boot Ltd, 01-368 7561
Sir Frederick Osborn School Computer Fair	April 8	Sir Frederick Osborn School, Welwyn Garden City	Alan Henderson, Welwyn Garden 23367/8
COMPEC WALES	April 10-12	Cardiff University	Reed Exhibitions, 01-643 8040
Computers for Builders Exhibition	April 12	Cavendish Conference Centre, 82 New Cavendish Street, London W1	A4 Publications Ltd., 088-385 2051

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Personal Computer Show	March 14-17	Sydney, Australia	ECL Ltd, 01-486 1951
International Business Equipment & Computer Show	March 13-17	Singapore	International Business Centre Co. Ltd., 8F Hosoi Building, 15-7, 5-chome Honmachi, Higashi-ku, Osaka, Japan
Videotex '84	April 16-18	Hyatt Regency, Chicago	Sally Summers, 0101 212 279 8890

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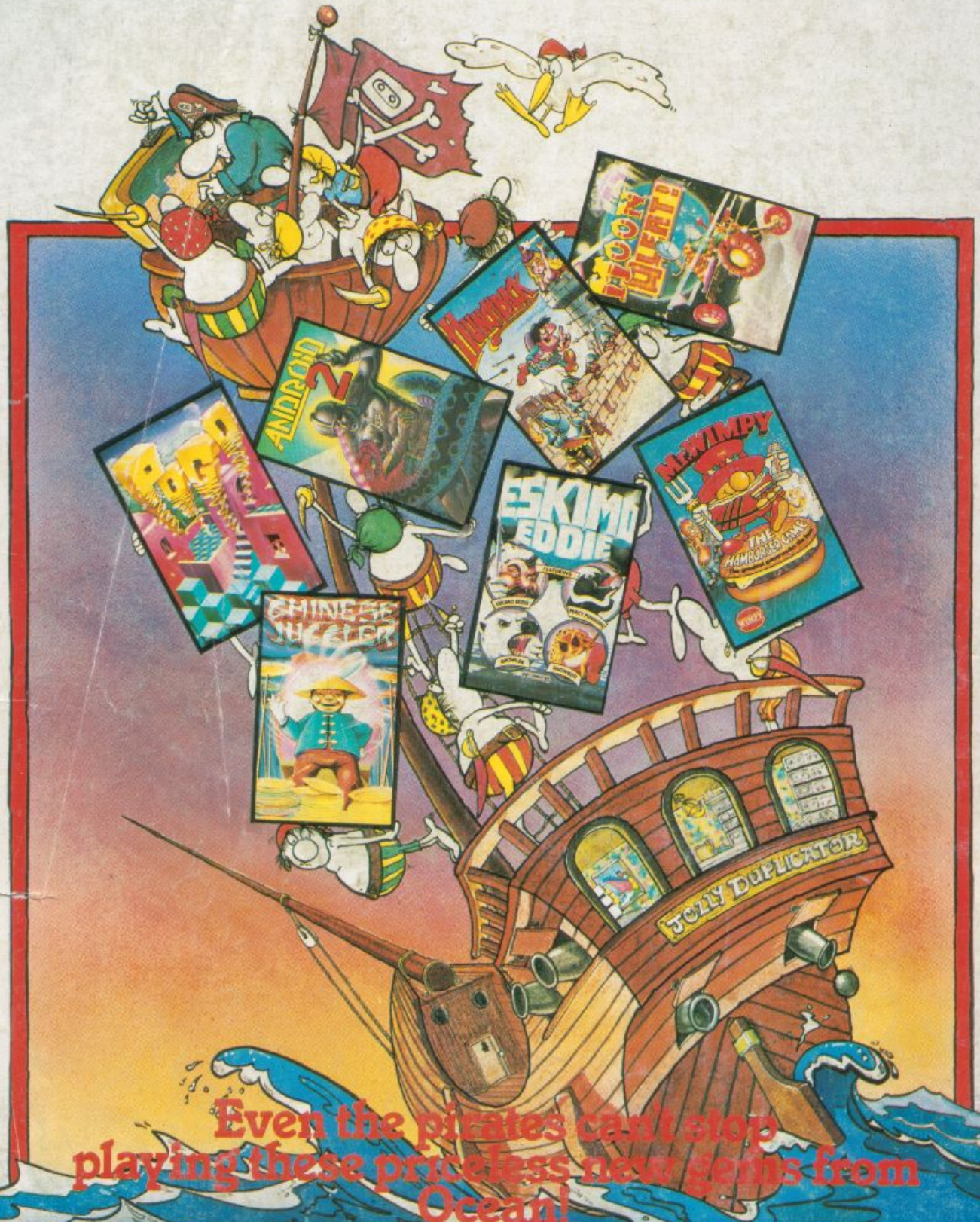
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