PERSONAL
EVERY THURSDAY
COMPUTER
NEWS
50p DEC 8-14 1983 Vol 1 No 40 THE COMPLETE COMPUTING WEEKLY

EXTRAS! EXTRAS! READ ALL ABOUT THEM!

THIS WEEK

BBC MUSIC TRIO
Three new ways to tickle the keys

SPECTRUM'S COUSIN?
We put the Timex micro on trial

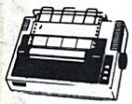
INTERGALACTIC INPUT . . .
. . . new games for the Dragon, Atari, Vic & Spectrum

THE 64 SIMPLIFIED
Word processing made easy.



Buying rules; interfacing tips

Printers: which type for you?



Different ways to store your data



Joysticks to control the action



Communications link-up

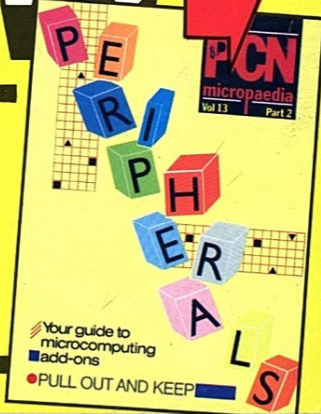
Our word on speech synthesisers

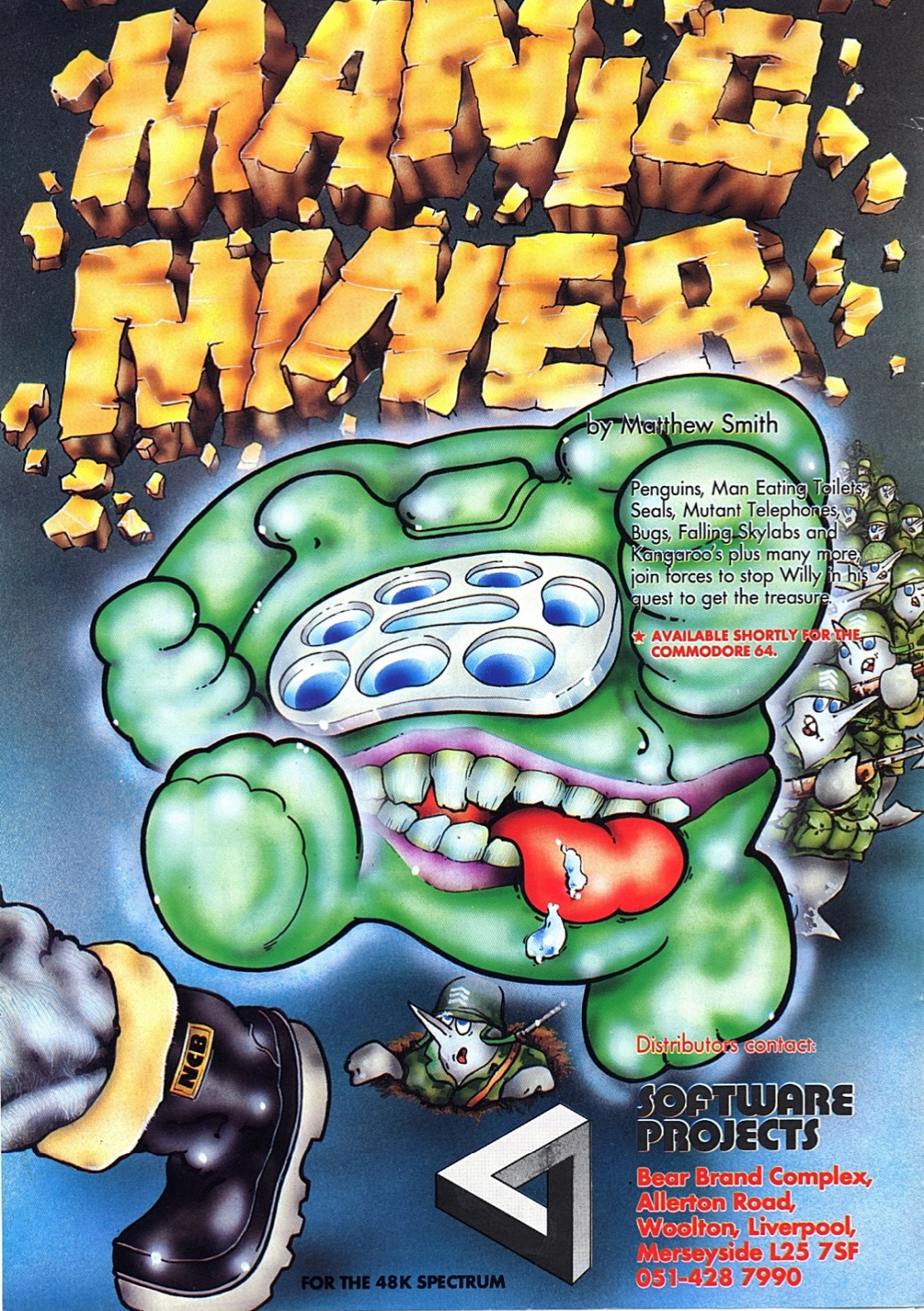


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We describe the kit, give you the specs and tell you what we think.
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December 8-December 14, 1983, Volume 1 No 40



Pull-out and keep
Micropaedia

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Shortage hits CBM cassette

By Piers Letcher

Serious shortages of Commodore's 1530 cassette unit could make it difficult to buy before Christmas.

This comes at a time when Commodore's advertising includes the comments: 'Peripherals? Yes, Commodore have everything you're likely to need, sir, right now.'

Commodore says the shortage is due to unprecedented demand for the 64, but that now these systems are made in Corby they are easy to buy in the UK.

However, visits to shops in London's West End revealed that no-one would sell a cassette unit on its own. Staff in Laskys, WH Smith and Dixons said that this was due to a national shortage.

Yet Commodore says there is no real shortage but simply a lag between delivery of computers and delivery of cassette units. And it criticises dealers for ordering fewer cassette units and disk drives than new computers.

The fact that Commodore claims to have shipped out 80,000 units last month, compared to 39,000 in October, shows just how well the machines are selling in the pre-Christmas rush.

At the moment the only way to get hold of a cassette unit before Christmas seems to be to buy a Vic 20 or a Commodore 64.

■ Customers of Rumbelows who were promised a free cassette drive with their purchase of a new 64 have had to wait for the drive. But a spokesman for the retail chain said that it has just taken a shipment of units and should meet its commitments in the current week.



COLOUR SCHEME — Newly arrived from Japan is this four-colour printer-plotter for £129.95. Distributed by Micro Peripherals, the MCP-40 (nothing to do with pigs) works on any micro with a parallel interface. Producing up to 80 characters per line at 12 characters per second, it plots charts or graphs in four colours. Also out is its little brother, the MP-24, which sells for £86.25. This 24-column printer runs at 42 lines a minute, comes with ribbon, cable, and plug and also works on micros with parallel interfaces. More information from Micro Peripherals in Basingstoke on 0256 3232.

Tandy goes heavyweight in IBM chase

December 1 saw the US launch of Tandy's contender for the IBM PC market, but there's no date for a UK launch yet. In fact, Tandy UK is not yet committed to import it, so there's no certainty that it will ever appear here.

The Tandy TRS-80 Model 2000 is a PC lookalike with a difference. It uses the Intel 80186 chip, and is claimed to be three times as fast as the PC. The basic system has 128K memory plus two 720K disk drives. A hard disk version with a 10Mb drive is also available.

It costs slightly more than the PC in the US but includes a number of items that cost extra on the IBM. So both PC and XT comparable Tandy 2000 systems will actually cost less than the IBMs.

The 2000 is not fully compatible with the PC, but will run some of the IBM's software.

IBM itself will probably be using the 80186 in its Popcorn PC, due for launch in the spring, and there are a number of other IBM lookalikes in the same position. But Tandy says this won't affect the 2000; it has a fixed allocation of the chip and is confident that supplies can be maintained.

■ A new version of Tandy's TRS-80 colour computer has been released in the US.

The 16K machine now sports a full-travel typewriter style keyboard and includes among its upgrade options a 64K version of the machine, an extended version of Basic, a 'mouse' controller and the OS-9 operating system.

The cheapest version of the machine starts at $349 for a 16K machine with standard Basic, while the more expensive 64K edition comes with Extended Basic (although you can only use 32K of the memory when in the Extended Basic) and costs $599.

Not so Perfect Software

Perfect — or perhaps not so perfect — Software is in danger of losing its reputation with UK micro users.

Although Perfect Software Inc has thoughtfully re-written its manuals for the UK it has failed to re-write the software, with the result that some parts of its programs don't work.

With the Perfect range of programs — Writer, Speller, Calc and Filer — now given away free with a number of machines, many users could find themselves with software that doesn't work to its full spec and no prospect of being offered software that does.

One machine manufacturer, Torch Computers, is taking matters into its own hands by re-writing the program code.

The main failing with the software is with the database program, Perfect Filer. Minor irritations are that words like 'centre' appear on screen displays with the US spelling 'center' and that the standard date format in the program uses the American abbreviated form.

More seriously, the standard address format, called the Address Template by Perfect, uses two-character fields marked 'state' and a seven-character field marked 'zip code'. Neither can be properly used in the UK because there are no recognised two letter abbreviations for counties, and post codes in some London postal districts require an eight-character field.

Some users have also found that the printer drivers are not properly configured to work with printers popular in the UK.

Add-ons aplenty at Microfair

London's Alexandra Palace throbbed, warbled and squawked last weekend, making the point that the ninth ZX Microfair was into Spectrum sound add-ons in a big way. But the fair, although more polished than previous ones, still owed a lot more to rummage sales than it did to more overtly commercial exhibitions.

Software was king, with a good few bargains to be had — £9.95 for the officially £14.90 Valhalla can't be bad — but hardware add-ons were generally of the kind well known to Sinclair users, and many of these were still hauling themselves away from 'coming soon' status.

Fox Electronics, which has been advertising the Fuller FDS keyboard for almost as long as Fuller has, conceded to never having had any, and added bitterly: 'Nobody has — they've not been made yet.' On the other side of the hall, Fuller had several on display but not for sale, and was promising that mail orders would be cleared in two weeks.

Beckenham-based Transform was hedging its bets by displaying a Memotech 512, but was also showing a classy-looking (at just under £70 it ought to be) add-on Spectrum keyboard. But stocks of this won't be ready till next month.

East London Robotics seemed finally to have the Trickstick joystick up and running. It really does seem pretty revolutionary, but it's 'sold out until January.'

Interactive Instruments had one of its Shugart-based disk drives for the Spectrum attracting a certain amount of interest. Delivery in two weeks was being promised.

But the *PCN* User Friendliness Challenge Trophy goes to Campbell Systems for the following conversation: 'Hello, I seem to have lost my manual for Masterfile, you don't have a spare do you?' 'No, we don't sell them separately.' 'Does that mean I have to buy a new Masterfile just for the manual?' 'Yes, that's right.'

■ Word processing on the Spectrum seems to have come of age. Centronics interface merchants are offering complete packages — a real step forward for the budding Spectrum word-smith, as purchasing a package prevents disparate suppliers squabbling over whose component is at fault should problems arise.

Hilderbay is touting a range of printers to go with its two interfaces. The first is based on an adapted Olivetti Praxis 35 typewriter complete with interface and word processing software at £435. Although the price tag seems a bit over the top, you do have the advantage of classy 'letter quality' type and you get the Praxis keyboard as a replacement for the Spectrum's.

You don't, however, get to use the printer with another computer. This is where the more flexible System 2 comes in with its standard interface. A variety of software is available for both systems, including Tasword Two, as is a bumper crop of printers.

Tapesoft goes one better in price, offering the Silver Reed at £245, and interfaces for typewriter and computer at £49.90 and £39.90.

Oxford Computer Publishing is offering the Kempston Centronics interface, its range of software and the excellent Shinwa CP80 — £340 excluding software.

Cry baby blue

By Peter Worlock

If anyone had hoped that the unveiling of the PC Junior would finally end one of the most prolonged periods of speculation experienced by the micro industry they must be sorely disappointed. If anything, the guesswork has just begun.

Had IBM come up with the goods, raised the curtain on any kind of serious contender in one of the most intensely competitive areas of industry, we could have all rested easy, secure in the knowledge that once more the Big Blue had identified its market and neatly stitched it up.

In this case, it hasn't. Not by a long way. To be sure, the Junior has some finesse: a true 16-bit processor, a superb graphics specification, memory expandable to 128K. But it also has a keyboard that would hardly be out of place on a ZX81 and a couple of pure gimmicks that IBM ought to be ashamed of. (Who wants a keyboard that can be used 20ft from the main unit and can't be used near another Junior unless you pay for the optional cord?).

One thing it will feature is a waiting list. In what must rank as one of the greatest attempted spoiling operations, IBM obviously figured that if it couldn't get the Junior to market by Christmas it would show it around in the hope that buyers would not buy anyone else's machines in the interim. (Elan appears to have the same trick in mind here).

It is this time delay that gives the analysts, pundits and readers of the tea-leaves the opportunity to continue their fevered forcasting. And anyone who doubts the serious intent of such apparently idle speculation overlooks the fact that the mere prospect of an October launch for the Junior was sufficient to slice more than $340 million off the collective value of Apple, Commodore, Tandy and Coleco.

IBM itself says that it sees no home computers or business computers — only personal computers. This begs the question of what IBM sees in Junior and who it expects to buy it. The 'personal computer' hype (which seems to be the refuge of companies making micros too flimsy for business and too expensive for the home user) has prompted a savage response from Commodore in the US. It is currently running an advertising campaign under the headline 'If personal computers are for everybody, how) come they're priced for nobody?

IBM appears to be looking hard at schools and universities, which may be a market. Less certain is its idea of business PC users buying Juniors to allow them to take their work home. There is limited compatability with many PC applications requiring more than Junior's maximum RAM.

It's doubtful too whether many will find the keyboard conducive to any serious work.

All in all, an increasingly cost-conscious home market, the Junior looks outrageously over-priced even in the high-earning US.

Foremost in IBM's corporate mind seems to have been the need to avoid Junior carving too great a slice out of the PC's market. It may transpire that Big Blue has hurled itself neatly between two stools.

But what does it all mean to you? In the short term, obviously very little. IBM has no plans to launch the Junior in the UK and grey imports will find a limited market at a price of around £900 for the cheapest configuration. But in the long term, effects may be more profound and far reaching.

For example, following the rampant success of the PC at the business end of things it has become increasingly difficult to buy a machine that isn't just a same-as-only-better-than-IBM clone.

Will Junior bring a repeat? It's only two months since Oric was fawning with the promise of a Junior-compatible micro. Apple also seems likely to make its New Year offering, the Mackintosh, PCDOS compatible. Indeed there are some who claim that PCDOS could become the major operating system on home computers.

But pulling off that kind of coup would require a quantum jump in technology. A far likelier move is towards CP/M. Not only would this extend the tried and trodden path on which home users get the cast-off benefits of business users, but it would also be fuelled by moves towards CP/M by Commodore with the 64, Coleco's Adam and the struggles of the Lynx and the Newbrain in that direction.

If IBM and Apple do force an up-market turn in home computing it is ironic that they may well fail to take the most benefit from it.

Lurking somewhere off stage is Uncle Clive, ZX84 tucked under arm. So far the pending machine at Sinclair Research has been discussed in terms of a straight business-type micro. But if the market changes, a 16-bit machine with mass storage built-in at Sinclair's usual price level could prove to be a killer.

And then of course there is Commodore which can be expected to lob a surprise package into the ring. Precisely what it might be is hard to predict, but it will probably be disgracefully lacking in some respect, will provoke outrage and scorn in many and could outsell everything else in sight.

The end result — the notorious bottom line — is some way off. But it may be as well to wish everone in the industry a Merry Christmas, because for many of them it may turn out to be anything but a Happy New Year.

ITV to decide

ITV's projected rival to the BBC micro looks set to get a green light at the beginning of next week.

The Independent Television Companies Association is to discuss the matter at its meeting on Monday and if, as seems probable, this meeting gives the project the go-ahead, the Independent Broadcasting Authority has the final say on Tuesday.

The IBA has to be consulted because of the ethical considerations involved. Any ITV micro will be produced as part of a computer literacy project on the lines of the BBC series.

Programmes produced for the independent companies will therefore be linked to one specific micro, and this would be interpreted as the independents recommending one machine over others — some of the 'others', of course, will be advertisers.

Michael Feldman, producer of Thames Television's Database programme, has been quoted as being against the indpendent companies favouring any one micro. But Thames itself points out that Mr Feldman is not a spokesman for the company, and is in any event not necessarily opposed to the project.

Mr Feldman is currently in the US and is therefore not available for comment.

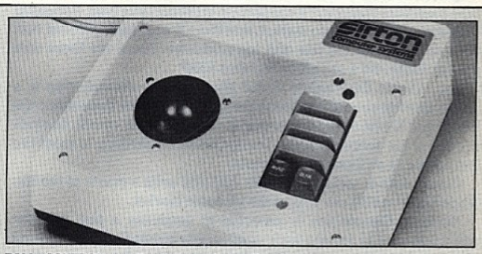
The case of the defence is further strengthened by the nature of the project. Ivor Stalliday, secretary of the ITCA, says that the IBA has given an indication that if favours extending ITV activities in micro-computing, and that the companies themselves agree.

This is a point of policy that needs not be directly connected with the ITV micro, but if the programmes dealt with a number of different micros, their scope would be severly limited. And as the independents also seem interested in the idea of telesoftware in conjunction with Oracle, one modem-bearing micro would make life a lot easier.

Changing hats to company secretary of Oracle, Mr Stalliday confirmed that, even without the ITV micro, Oracle was interested in becoming more involved in micros. There are no hard and fast plans for a Micronet 800-style service yet, but this is something that is liable to be discussed over the coming months.

All this activity confirms Mr Stalliday's view that 'the case for having one computer is a very strong one.' In which case, what will it look like? The independents have not yet produced a detailed specification, but a number of companies have been approached with informal guidelines. The ITCA will at present go no further than this, and prime suspect Transam Computer isn't talking either.

Transam, along with prism Microproducts, is involved in an 8-bit, disk-based system to be launched in January. Bob Denton of Prism refused to discuss the micro but said it would be a Prism, not a Transam, and that it would not be the ITV micro. Stories connecting the machine with ITV were 'all absolutely wrong' he said.



BALL CONTROL — Predicting that track-balls are going to be the graphics manual inteface of the future, Sirton Computer Systems (01-640 6931) has moved into the field with its Track-Ball Graphics Cursor. You can program the device in either Basic or machine code, and it has eight function keys to simplify certain commands. The unit costs £325.

Sord plans A4 PC clone

An IBM-compatible lap-held micro could be the next move in Japan's campaign to established itself among personal computer users.

Sord plans to release a machine answering to this discription in spring next year. The only other detail that it is divulging at the moment is that the machine will include hard-wired software on board, along the lines of the Tandy Model 100.

Its price could well fall into the range that is attracting many other Japanese suppliers — the gap between the highest-priced home micros and the lower end of the serious business machines, roughly between £400 and £1,000.

Sord has recently added the M685 to the top of its range of micros. This is a 32-bit system designed to move on the patch of the minicomputer suppliers.

VIEW FROM AMERICA



Junk mail and mega micro kitsch

By Chris Rowley

This is the season of Christmas junk mail. Literally 50 or so toy 'n gadget catalogues have just invaded my mail box. All are full colour and fat. All bristle with microcomputers on the front page, it's a sea of keyboards. There are Adams, the new Ataris, Commodore 64s, video games galore but the really hot toy of the season is an example of one of the oldest known applications programs from Coleco.

Yes, its the Cabbage Patch Dolls, in such acute shortage that they appeared twice this week in national TV news. The nation gawped as tearful mothers queued for hours and then clutched the essential piece of Christmas equipment with relief, happily paying two or three times the official price. Coleco's embattled stock surged 1⅝ points as a result.

This week is Comdex week in Las Vegas and, as is now customary, a host of new micros were placed before the public eye. Leading the charge were new IBM compatible portables. From Japan came the Panasonic Senior Partner, a 128K RAM, one 320K floppy unit, slightly smaller than a Kaypro, with built in thermal printer, bundled software, monitor etc, retail price $2,500.

Kaypro itself announced an IBM board for Kaypro IV, which with board will now be $2,200 (that's twin 800K on disk, 64K RAM and 9in screen). Fateful words from Kaypro: 'It appears that MSDOS will take over from CP/M as the dominant operating system.'

Texas announced the portable model of the Professional. It will have 64K, two disk drives, black and white monitor and costs $2,400. ITT announced an IBM-compatible named the Xtra. It comes in various configurations, similar to those of the IBM PC, for prices beginning at $3,000.

The Pied Piper Professional model looks hard to beat at £2,000 with twin disk drives, bundled Perfect Software and serial, parallel and modem ports.

Questions of the moment . . . One, can Atari make it as anything more than a software company? It has nothing in the portable field. Nothing in laser disks for the coin-op market. And there is a spreading feeling that the new XL line is too late and too expensive. There are those who predict doom and a sell off by Warners ASAP . . .

Two, what is Commodore up to? Wild rumours abound, even to a suggestion from a software house that Commodore will discontinue the Vic 20 and the 64 after announcing the 128 later this month. Analysts scoffed at the notion that Jack Tramiel would do anything to upset the two million or so Commodore people.

Commodore is said to be selling 200,000 units a month of the two models and has 50 per cent of the US home market.

However, Commodore is expected to announce a new machine sometime soon, a development most eagerly awaited by IBM amongst others. Indeed some see the rather lack-lustre PC Junior as just another ploy in IBM's game plan for dominating the micro market.

And if Commodore does produce a new 128K machine, say for $500 or so, then PC Jnr will look even more sickly and Jack Tramiel will have 90 per cent of the home computer market in a year or so.

In this context one should note that IBM increased its share of Intel to 16.3 per cent last week and Big Blue is undoubtedly flirting with 80186 and the 80286 chips for new generations of the PC.

All of which prompts another question. Where is AT&T? Following the break up of the Bell phone system AT&T is no the longer largest company in the world, but undoubtedly it has the heft to be a formidable component of the microcomputer market. The 3B2 microcomputer series announced earlier this year by AT&T will use a 32-bit chip developed by Bell Labs. The word from within the new lean and mean AT&T is that the new micros will be unveiled in the New Year.

Some nominations for Kitsch Product of the year. From General Foods we have Pacman sugar coated breakfast cereal in truly horrible colours. Or how about 'Eat Only Diskettes' in milk chocolate from the Sweetware Company of Vermont.

Cyborg still in the pipeline

By Piers Letcher

If you are tempted by Cyborg's long-running and extensive advertising campaign for its amazing disk drive, it would be worth thinking twice before parting with any money.

Its claims for the drive are astonishing, and it may be for this reason that the drive is still unavailable. Cyborg says that it will be end of January before the first drives are ready, and these will be for the Spectrum and ZX81. This delay now matches its 'Expect eight weeks for delivery' rider.

PCN was offered a demonstration in Paris later this month of the ZX81 drive but was told that it would be impossible to see one in this country before late January 1984.

Owners of most machines are going to have to wait even longer. Cyborg says that drives will be available at the rate of two machine-types per month for the 21 machines it intends to cover. This means that the Apple and Dragon drives will not be ready before next March, and the Texas drive won't be around until May. If you had ordered this in September you faced a wait of at least six months longer than the advertised eight weeks.

The drive may be extraordinary enough to be worth a wait. According to the advertisement, for £230 you get a drive capable of storing 720K (formatted). With this you also get a System Nucleus disk, containing all of the disk filing commands that you would expect, although you will have to pay extra for the leads. The price for these is expected to be F600 (about £50). The interface is contained in the lead.

There are also plans to produce a 3in drive capable of storing an incredible 1.2Mb.

Clock control



If clock watching is an essential part of any office job, Intelligence UK may have made a significant contribution to office automation.

The company has an enhancement to its Micro Find information retrieval package to use the built-in clock of the Epson QX10. It calls the enhancement a 'time dependency' feature—the ticking of the clock can be used to initiate procedures at set times or on set days.

On a daily basis, it suggests, you might use this to serve as a diary. At longer intervals it could be used to generate reminders to laggardly payers.

It adds £100 to the £295 price of Micro Find. Its implementation is intended to give the maximum number of features with the minimum of difficulty for the user.

The next machine to be made 'time dependent' in this way could be ACT's Apricot.

Intelligent UK (01-543 3711) says it prefers to implement the feature on machines that have a built-in clock, which limits the field a little.

Dillons lyrical accounts

Owners of MSDOS, CP/M86 and Unix micros may be interested to note that a suite of ledgers are now available from the new Irish company Dillon Technology. The Lyric programs are destined for small to medium sized companies.

Written in Microfocus' Level 2 Cobol under Xenix, each program retails at a rather stiff price (not much change from £1,000). This gives you a full currency conversion system; multi-user operation; full report tailoring and integration.

Dillon plans to release stock control, order entry and various vertical marketing packages in the near future. Dillon's push into the 16-bit hard disk market is supported by the Industrial Development Authority in Ireland. Contact 0628-75751 for more details.

DR takes the IBM path

PC compatibility, windows and support for multiple tasks are among the features of Digital Research's latest release of Concurrent CP/M.

Version 3.1 also carries networking software, support for Intel's 8087 maths co-processor, shared code, and GSX graphics. Its first public engagement was at Comdex last week; DR will start delivering the system in December. The price of an individual copy will be £235.

Like Microsoft, DR has implemented windows as an extension to its operating software. Applications will also have to be extended to make use of the feature, but DR's windows overall look less demanding than Microsoft's (Issue 39).

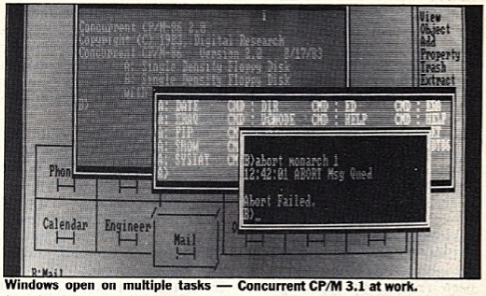
Windows are an eye-catching feature but DR's European vice president Paul Bailey commented: 'I think the ability to run IBM applications is probably the most important feature of the release.' The company is not claiming total compatibility; it has audited what it sees as the top 20 applications, checking their relationship with the BDOS and BIOS of the PC, and reproducing the conditions in Concurrent CP/M. This approach, Mr Bailey says, 'opens up 90 per cent of existing IBM PC applications'.

It also aligns DR directly with PCDOS rather than MSDOS, but it isn't yet supporting the hierarchical file system of PCDOS 2.0. 'When it becomes necessary, we will offer it,' said Mr Bailey.

This capability puts the size of Concurrent CP/M up to 94K, so a 256K system is a minimum requirement. But the type of applications that DR has in mind for its windows, not to mention networking and multi-user configurations, would hardly be accommodated in less.

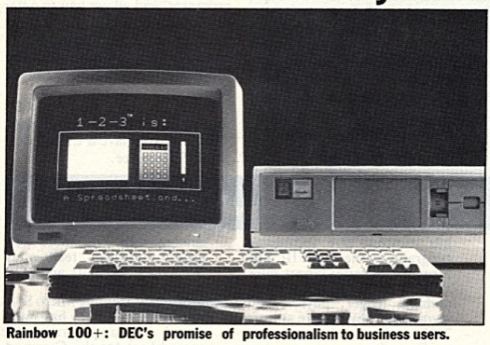
DR's windows are activated by a function key. The software drives a colour or a monochrome monitor and accepts input from either a mouse or from the keyboard. It doesn't include icons, on the understanding that anybody using a computer will probably be able to use English commands, but as with Microsoft's offering it combines simple segmentation of the screen with self-positioning and sizing of the windows.

The networking is performed by DR Soft/Net, which allows for micros to be linked through local area networks like Ethernet.



Windows open on multiple tasks — Concurrent CP/M 3.1 at work.

New Rainbow in the sky



Rainbow 100+: DEC's promise of professionalism to business users.

Digital Equipment (DEC) has launched its Rainbow 100+, with the plus being a hard disk, twice the user memory, and a new customer services package.

But you may need a crock of gold to pay for this Rainbow — the total package costs £4,200.

The Rainbow 100+ has the same Z80A/8088 combination in the engine room as the plain 100, but the main memory is 128K expandable to 896K and the basic configuration includes a 10Mb hard disk. There are also dual floppies giving 800K. It runs MSDOS 2.05 and CP/M-86/80 — you can switch from one operating system to the other with one key stroke.

DEC refers to its personal computers as Professional, which is hardly unusual, but in this case there is plenty to back up the name. Its customer services package includes 12 months' on-site warranty covered by the purchase price with four-hour on-site response at an extra cost. There are also 'customer orientation' and training seminars and telephone support from the company's customer information centre.

DEC intends to begin volume shipments of the new system this month, and after the hold-ups that dogged the launch of the original Rainbow you can expect it to work hard to meet this deadline.

It operates a recommended software scheme to ensure packages are available to users of the Rainbow 100+, ranging from programming languages through data management to business applications.

Oric snowed under at Xmas

Oric micros will be in short supply this Christmas as Oric Products International struggles to meet a backlog of demand.

Although a warehouse fire in mid-October (Issue 34) destroyed a relatively small proportion of Oric's stock, it widened the huge gap between demand and supply. A spokesman for Oric said last week that orders are double the machines Oric can produce, and it can't increase the rate of production without more components. 'We're critically short of components at the moment,' he said.

Foreign distributors — particularly the French — are also anxious to see more Orics. Oric has been consistently exporting about half its production runs (much of it to France, where the machine was voted Micro of the Year by French technical journalists).

The October 13 fire at Kenure Plastics in Feltham, Middlesex, which destroyed about 7,000 Orics, compounded the component supply problems but didn't hold up production for long. 'We were back in production two days later,' said the Oric spokesman.

■ The official Oric disk drives, due to be launched at the Which Computer show on January 17, will cost around £200. Oric intends to build up stocks for release to retail outlets shortly after this date.

Osborne waits

The machine that could save Osborne may be too little too late.

The Osborne IBM-compatible Executive II portable computer announced and shown in the US earlier this year still isn't on sale there and probably won't be until the company sorts out its financial problems. But an Osborne UK spokesman said this week that the machine may be released here 'in the near future' — and the managing director of the company's UK operations is currently in the US, possibly to look at the Executive II.

The much touted IBM 'comportable' has been developed to come standard with:

■ a 7-in amber screen with full 24 line by 80 character screen
■ 128K of bank-switched RAM for the main Z80 processor and an additional 128K dedicated to the 8088 second processor
■ the CP/M Plus operating system
■ an adaptable character set and software-configured keyboard to allow use of foreign alphabets
■ a second processor, the Intel 8088, which gives the machine some measure of IBM compatability — including IBM graphics
■ RS232C and IEEE interfaces.

Before 'the troubles' that currently plague Osborne's US operation, the Executive was due to sell for $3,195 there. That price would put the machine in the same category as the best-selling IBM-compatible Compaq portable (which, unlike the Executive II, has an IBM-type keyboard) and would also represent something of a departure for Osborne — which came to prominence on the back of its low prices for the Osborne-1.

Release of the Executive II would seem to make the Executive I — essentially a non-IBM compatible 128K Executive II — obsolete. But the Osborne UK spokesman said that if the machine is released in this country, it will not discontinue the Executive I and that the two machines would be considered complementary.

This seems an optimistic view to take, particularly when you consider what the Executive I did to sales of the Osborne 1.

Gavilian upgrades

Gavilan has announced enhancements to its 'mobile' computer even before the original product has been mass-marketed in the US. The original Gavilan was designed as an up-market portable system with an attached (and equally portable) letter-quality printer. It, and its upgrade, are based on the 8088 processor. Both have 1.2 Mb of RAM and a 320K 3.5in floppy.

The Gavilan will be the 'Rolls Royce' of portable computers when it is released here in the first quarter of 1984. The conventional weight of the present crop of 'luggables' has been reduced by replacing the heavy CRT screen with an LCD display. A further kilo or so has been trimmed by shrinking the conventional dual 5.25in drives to a single 3.5in microfloppy. When the kilos come off the pounds must go on — the Gavilan will retail here for around £3,500 with a further £795 for the printer.

The Gavilan weighs a mere nine pounds (14 pounds with printer).

As well as running MSDOS, the system comes with its own user environment running a trio of Gavilan's own applications programs — a word processor, a spreadsheet program and a communications package. The new Gavilan has had its screen increased from the meagre eight lines to 16. This product will cost the same.



Gavilan — different versions on the way, but no sign of the original.

Gavilan has also announced a second version of the product — this will offer only MSDOS and the original eight line screen but it should sell in the UK for around £2,500.



WINTER STORE— Mass storage for the IBM PC needs hard disks and if you can't make do with an XT a free-standing disk system could be the answer. Alloy Computer Products' PC-Stor holds 43Mb on a 5¼in Winchester with a 21.6Mb back-up tape cartridge in the same unit. File transfer between the disk and the tape is handled by Alloy's own tape interchange program, which can tolerate ambiguous file names; the data transfer rate is 0.7Mb per minute. The price of the PC-Stor is £3,441. Alloy is on Cirencester (0285) 68709 for further details.

Caxton ideas

A text-oriented spreadsheet/database? Well, that's the nearest we can get to a description of Brainstorm, a new product from Caxton.

Brainstorm is billed as an 'ideas processor' and allows you to enter 'thoughts' which the program then structures for you. You can set up headings, keywords *etc* and the program structures a tree based on these.

On the face of it you can use it in an almost infinite variety of ways. That is, if you have a CP/M micro and £295 to spare.

SOFTWARE

PCN rounds up the latest add-ons.

Games

Commodore: Soccer on the Commodore 64 is given a new twist by a game from Bubble Bus (0732 355962) called Kick-off. This is a version of table football, for one or two players. Bubble Bus has also launched Widows' Revenge, an updated Exterminator in which the spiders fire back. Both cost £6.99.

Spectrum: Hewson Consultants (0491 36307) has released a new version of its flight simulator called Nightflite II for the 16K Spectrum. It is also launching a version of the original Nightflite for the BBC Micro. Shards Software's Jericho Road (01-514 4871), for the 48K Spectrum, is an adventure that aims to be educational — it is text with limited graphics. The price is £5.75. Ocean Software (061-832 9143) has produced a game that could introduce a character to oust the likes of Cuthbert — Mr Wimpy, The Hamburger Game, puts a representation of a hamburger through its paces in a series of culinary jobs. It costs £5.90 and runs on the 48K model.

BBC: Empire, the Dragon strategy game from Shards (01-514 4871), is now available to users of the BBC B, price £6.95.



Bytes and buns: Ocean Software's new Spectrum game.

Business

Nascom: Henry's of Edgeware Road (01-402 6822) has produced a small scale word processor called Diskpen III. It runs on micros that use the Gemini GM812 card; this covers not only Nascom but also Gemini Galaxy, Quantum, and other systems. Designed to be easy to use in jobs that don't require a full-blown system, it costs £50.

Apple: For the IIe Pete and Pam (01-677 7631) has the modestly titled Incredible Jack, which gives you calc analysis, form letter generation, mailing list, filing and word processing functions all in one. It costs £129.50. Jarman Systems (044282 6841) has launched five accounting programs for the Apple III. The Jarman Plus series covers sales and purchase accounting, nominal ledger, payroll and invoicing. They require at least 256K and a hard disk in the configuration.

IBM PC: Costplan is the name of a cost analysis package for production and financial managers. It comes from Deloitte Haskins and Sells (01-236 3011) and runs on a 128K system with twin 320K floppies and a 132 column printer. The price is £1,000. Microcomputer Products International (01-591 6511) has launched Decision Analyst, a general purpose problem solving package that runs in 96K on the IBM PC and requires an 80 column printer and a 24 by 80 screen. It is also available on CP/M86 and MSDOS systems.

IBM XT: Sky Software (0527 36299) has PC users moving towards multi-user XT systems in mind with its range of packages called Blue Sky. They include the Skymaster accounting suites, Skymail mailing package, Skycost costing program, and Skybuild contractor's accounting system. Sky uses PC-Net under PCDOS.

Epson: Graphstat has been released for the QX-10 Epson, a combined statistics and graphics package developed by Holdene. It comes in three parts dealing with ever more advanced statistical techniques; they cost £195, £110, and £110. Epson is on 0895 52131.

Commodore: Marketing Micro Software (0473 462721) has introduced PS, a programmable spreadsheet for the Commodore 64 at £69.95. It comes originally from the US software producer CSA, of Practicalc fame.

Hinet: Designed for Hinet systems but capable of running on any CP/M system that has at least 64K of RAM is Selven Systems' (0376 519413) Presense suite of information management functions. It can be used independently or with Selven's accounting and payroll suites. It costs £500.

Utilities

Commodore: Dynatech (0481 20155) has released Home Filewriter for the Commodore 64. Costing £39.95 it is a program generator best used in database applications around the house — Dynatech suggests inventories, collections, address lists, tax records and the like. Superbase 64 from Precision Software (01-330 7166) is an information control system for the 64 with links to Easyscript and Easyspell. It costs £99.95 and will make its first public appearance at the Christmas fair, Wembley, later this month.

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PCN Charts

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

GAMES

Top Thirty

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

*Denotes available on other machines

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

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

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

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PCN Charts

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

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

HARDWARE

Top Twenty up to £1,000

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

Top Ten over £1,000

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

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

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ON 16K AND 48K SPECTRUM WITH THE GRAPHICS SUBROUGINE from FOWLER SOFTWARE

The program enables someone with no knowledge of machine code to animate his drawings. Small and large objects can be moved smoothly, ie one pixel at a time.

In order to show what is possible using this program, demonstration program includes a 9 × 3 characters figure walking across the screen.

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

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

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

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

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

Mr/Mrs/Miss.....

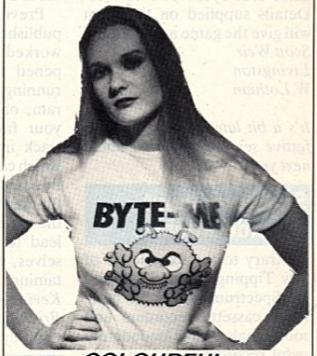
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Don't carry a LOAD on your shoulders, unburden yourself on *PCN*'s letters page.

A merry micro Christmas

I have had a microwave, which I have decided to send to Random Access.

Why not have, this Christmas, personalised computer games? You get personalised ties, cigarette lighters, golf clubs etc, so why not your own, unique computer game in cassette, with say 'John Smith's Defender' on the insert?

The company would advertise forms asking the person's name in which the game is to be sent, their age, colour of hair/eyes, computer make and RAM.

Two or three days before Christmas day, the computer brother, father or sister would receive a small package with the words 'Don't open till Xmas morning, John' on the front.

The game would be arcade style, like Space Invaders. John will be directly involved in the game, shooting down the letters of his name on defender and blowing up his attacking age. Now and again, a bonus ship will appear, if he hits it, he finds out the sender of his unique personalised game.

PCN £10 Star Letter



The program will have things like 'John, your highest score today is xxxxx' and 'another game blue eyes?' or whatever. Details supplied on the form will give the game authenticity.

Scott Weir
Livingston
W Lothian

It's a bit late to set up for this festive season, but what about next year? — Ed.

Spectrum input considerations

Contrary to the experience of Roy Tipping (Issue 37) I find the Spectrum not at all fussy about cassette recorders and poor signals. I have loaded truly awful recordings and virtually anything with an earphone/speaker socket works. Oh well, I suppose nothing is clear cut in computing.

Could not Mr Clements' problems (Issue 32) merely have been a faulty Spectrum, a possibility he illogically dismisses just because it's an Issue 3 machine? I got through two faulty machines before I found one that would run machine code programs reliably — there appear to be sub-standard RAM chips about.

A lot of nonsense has been printed about the Issue 2 — Issue 3 incompatibility, and apart from cases of legitimate use of the earphone socket (which Sinclair seems to have overlooked), Sinclair is quite right in blaming sloppy programming, where people use IN to read the keyboard without ignoring the value of bit 6 of the result.

In fact Sinclair has done us a favour by changing the default value since now programs will have to be written to ignore the value at the earphone socket.

Previously I found programs published in magazines that worked fine unless you happened to have left the tape running after loading the program, or had the urge to play your favourite Led Zeppelin track into your Spectrum, in which case the spurious input at the earphone socket caused all the keyboard reads to return the wrong result. This could lead to games playing themselves, which was quite entertaining.

Kevin Gordon
Broadfield
Crawley

News for the educationalists

Education Otherwise is a self-help organisation, run by parents for parents who have taken their children out of state school in order to educate them at home.

To help our members to use to the full their home computers in educating their children, we have decided to publish a newsletter devoted to educational computing. We would, therefore, invite *PCN* readers who have written educational programs to contribute a copy for publication in our newsletter.

J E Rupik
17 Westmorland Street
Balby, Doncaster

Perhaps all you educational program authors would send PCN a copy too! — Ed.

What computers are meant for

I am concerned about the emphasis placed on games programs in *PCN* and many other computer magazines.

Computers are by their very name machines designed for computing. If people wish to play games then there are many video machines on the market. I would like to see more emphasis placed on programs designed for educational purposes.

Computers should be used for much more useful things than just playing games. Of course, a less prominent emphasis could be placed on them without making games the centre of the computer universe.

I write fairly elaborate programs connected with such areas as algebra, trigonometry, physics, etc, even though I only possess a 16K ZX81, and I find that this machine, despite its size, can be used in a wide variety of ways.

Therefore, if the ZX81 can be used to such effect, including some interesting graphics for plotting curves and graphs of functions, then other more expensive and larger computers can be used to even greater effect.

Maybe people should start thinking about using their home computers for the purposes that computers were first designed for — after all there's a reason why Basic includes such functions as Sin, Cos, LN, etc.

I don't want to turn the computer public into a vast army of eggheads but perhaps less emphasis would be placed on games.

J R Smith
Alum Rock, Birmingham

But why buy a games machine? Why not a computer that can be used for games as well as many other things? — Ed.

A user's lament

I am writing to ask if anybody would like a computer pen friend. They must have a 48K Spectrum, they must be about 12 to 13 years of age and also like programming, as well as playing games. Please, if there is somebody out there who wants to exchange ideas with me, write to me.

J Chinnocjk
23 Crossway, Littleworth, Stafford, Staffs.

Write idea for micros

This was seen on a wall in a USA computer establishment:

I don't like this computer,
I wish that they would sell it.
It seldom does just what I want,
but only what I tell it!

Isn't it nice to know that programmers in other countries feel like throwing their micros out windows too.

Christopher Neary
Gravesend
Kent

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A change of address

Q I have an Oric, which as you know, has a 6502 processor. I am attempting programs in machine code, but first I'd like to know how to calculate displacements in the jump instructions. I'd also like to know the differences between the following addressing modes.
1 Immediate 2 Zero page 3 Zero page,X 4 Absolute 5 Absolute,X 6 Absolute,Y 7 Indirect,X 8 Indirect,Y
A Lovelock,
Orpington,
Kent.

A The best way of writing machine code is to use an assembler as this calculates all the branches and jumps for you. If you do not have access to an assembler program and have to rely on PEEKS and POKES then the jump addresses are calculated as follows:

For ordinary absolute jumps, such as the instruction JMP or JSR, the address to jump to is the memory location where the instruction you want to jump to is contained *eg*

```
1000 JMP 1005
1002 LDA#0
1004 RTS
1005 STA 0
```

This will jump directly from the JMP 1005 to the STA at location 1005.

Calculating branch offsets is a more complex matter, since these are relative jumps and only allow you to jump 127 locations backwards or 128 forwards. The simplest method of calculating these branches, for short ones anyway, is to call the location after the branch instruction 255 (FF hex) and then count the bytes forward (255 0 1 2 etc) or backward (255 254 253 etc) until the location you want to jump to is reached. This is then the offset amount, for example:

```
1000 LDX#0
1002 INX
1003 CPX#10
1005 BEQ 251 ; branch back to the INX instruction
; if CPX sets the zero flag
```

Note that you cannot branch more than the amounts given above (127 back and 128 forwards). If you want to understand this in more detail, you will need to use two's complement arithmetic and there is not really enough space here to explain this.

With regards to the addressing modes, Immediate addressing means that the data following the instruction is operated on directly *eg* LDA #0 loads the accumulator with zero; note that in assemblers the # sign means immediate.

Absolute addressing means that the addresses referred to by the instruction are 16 bit ones, so LDA &1234 loads the accumulator with the contents of location &1234 (the & sign denotes a hexadecimal number).

Absolute,X addressing, takes the absolute address given after the instruction and adds the contents of the X register to it to obtain the final address used for the operation *eg*

```
LDX #10
LDA 16332,X
```

loads the accumulator with the contents of location 16342 *ie* it adds 10 to 16332 to get the address.

Absolute Y addressing is the same as Absolute X except that the Y register contains the offset.

Zero page addressing is used to save space in machine code programs. It does this by confining to 8 bits the addresses referred to, which puts them in the zero page (the first 255 bytes of your memory; 0–&FF hex). For example LDA &FA ; will load the accumulator with the contents of location &FA.

Zero page X addressing is similar to absolute X except the address after the instruction is confined to one byte and therefore to the first 255 bytes of memory. There is also a zero page Y addressing mode which only applies to the LDX and STX commands. Examples of zero page X are LDA 100,X and CMP 100,X.

The addressing mode Indirect X is best demonstrated by an example:

```
LDX#10
LDA(70,X)
```

The second instruction [LDA(70,X)] loads the accumulator from the address contained in 80 and 81 (70+ the contents of X), the low 8 bits of the address are in 80 and the high 8 bits in 81.

Indirect Y is similar to the above but *eg*

```
LDY#10
LDA(70),Y
```

The Y register is added to the 16-bit number in 70 and 71 to produce the final address (70 contains the low byte, 71 the high byte).

There are also a few other addressing modes that you may come across on the 6502. Accumulator addressing applies to operations carried out purely in the accumulator: for instance ASL, the arithmetic shift left is in accumulator mode.

Implied addressing applies to instructions like DEX, (decrement the X register which operate on registers and flags.

Relative addressing applies to the branch instructions (BEQ branch if equal to zero).

Indirect is only used for the JMP command and uses two locations on the zero page to obtain the address *eg* JMP (70) uses the address in 70 and 71 (70 is the low 8 bits, 71 the high 8 bits) to get the location to jump to.

After all this, the best thing is to try all of these modes to see how they work in practice.

Suffering the Spectrum sprawl

Q I have, and am getting, several peripherals for my ZX Spectrum, but I have a limited amount of desk space and the Spectrum, TV and tape recorder take up practically all the room there is.

I am therefore considering putting my peripherals on a shelf above my desk and connecting the Spectrum to them by a 1.5-2m length of ribbon cable.

Would this work, and if not, can you suggest an alternative I could try?
D Snowdon,
South Woodford,
London.

A In theory there shouldn't be any problem with this, although the length of cable you have in mind may well give you trouble in practice. When you're running through ribbon cables of this length, you'll run into the problem of resistance, which increases with the length of cable involved, and with interference between the signals in the different parts of the cable.

It's pretty much guesswork, but we reckon you'd be all right with two feet of cable, one metre might still work, but that two would be pushing it. Are you absolutely sure that you want to stick your peripherals eight or nine feet off the floor anyway?

Do you have room for your stepladder by the desk?

In short, we wouldn't recommend that you use a cable that length.

There's a chance that it would work, but it's likely that you'd need the micro equivalent of an electricity substation to boost the signals and it's unlikely that anyone makes one.

As an alternative, you might be able to rig something up using an extension keyboard for the Spectrum. I don't know what peripherals you have, but depending on the keyboard you choose you should be able to put sound units etc inside the extension keyboard, which would cure some of the problems.

Otherwise, lower the shelf or get yourself a desk that's big enough.

Oric's ROM offers little for FRE

Q I have discovered on the Oric that if you type HIMEM 1280, then test for free memory using PRINT FRE(0), that you now have 64k memory (at least).

However, by experimenting with DIMensioning arrays it is apparent that no new memory is available. What's going on? Is there any way of using this memory?
Jonathon Barber,
Stockport, Cheshire.

A Congratulations, you seem to have discovered yet another bug in the Oric's ROM. On our Oric the same procedure gave us 65.5K free. It would seem that FRE is being fouled up somehow by setting HIMEM to this very low figure. 1280 is down in page 5 somewhere — which also sees the beginning of your Basic programs.

This means that HIMEM 1280 will not let you enter much of a program so is not very useful.

No, you can't access the 'extra' memory because it's only a figment of imagination on the part of the Oric ROM.

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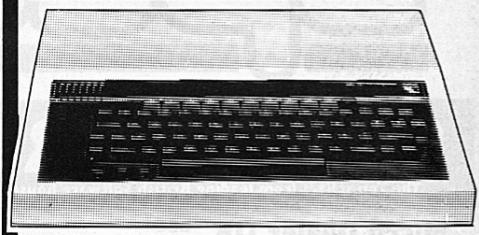
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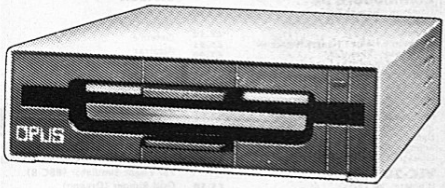
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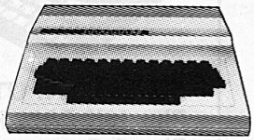
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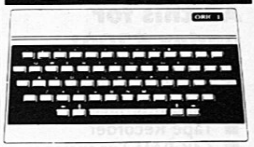
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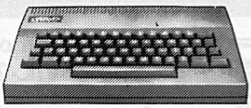


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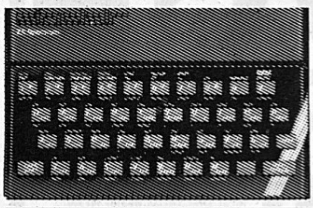
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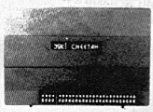
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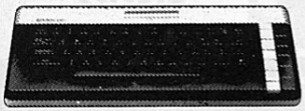
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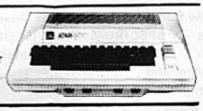
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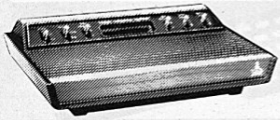
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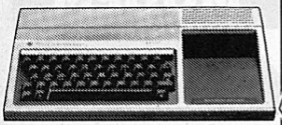




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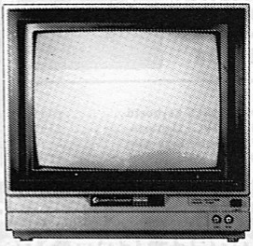
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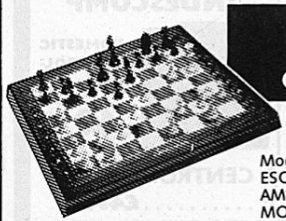
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Freezing your Commodore 64

These days more games include a freeze facility to totally suspend a game for a short while, enabling you to answer the phone, make a cup of tea etc. This version for the Commodore 64 is very simple to use.

After running the program given below, POKE 777,192 will turn the freeze routine on if the F1 key is pressed and off if the F3 key is pressed. The freeze routine can be switched off with POKE 777,167.

```
10 REM FREEZE — SET UP THE M/C
20 FOR T=49380 TO 49397
30 READ A: POKE T,A
40 NEXT T
50 DATA 165, 197, 201, 4, 240, 3, 76, 228, 167, 165, 197,201,5,208,250,76,228, 176
60 REM DEMO
70 POKE 777,192: REM FREEZE ROUTINE ON
80 PRINT B:B=B+1:GOTO 80
```

David Gristwood,
Sunderland,

Atari screen memory located

I have always wondered where the screen memory is located in my Atari, as many other routines are able to use direct PEEKS and POKES.

To find the screen location (whatever the memory) use:

```
SCREEN=PEEK(88)+PEEK(89)*256
```

```
POKE SCREEN, ASC("A")-32
```

If the character is less than 32, just add 64. To POKE anywhere on the screen use:

```
POKE SCREEN+X+(Y*40), ASC("A")-32
```

Alan Ramsey,
London

Side to side tactics revealed

Ever wondered how defender type games scroll the screen so quickly from side to side. The following example on the BBC reveals all, (or attempts to).

The routine could be used with any micro that uses the 6845 CRTC (Cathode Ray Tube Controller) such as the Lynx.

This method of screen scrolling uses register 13 of the CRTC which specifies the horizontal position of the screen.

```
10 MODE 0
20 PROCLAND
30 REPEAT
40 FOR T%=0 TO 80
50 PROCSCROLL (T%)
60 NEXT
70 FOR T%=80 TO 0 STEP -1
80 PROCSCROLL (T%)
90 NEXT
100 UNTIL FALSE
110 DEFPROCSCROLL (X%)
120 VDU23,0,13,X%,0,0,0,0,0,0
130 ENDPROC
140 DEFPROCLAND
150 LOCAL T%
160 FOR T%=0 TO 1280 STEP 128
170 PLOT 5,T%,RND(5)*30
180 NEXT
190 ENDPROC
```

Sean Owen,
Buckley, Clwyd,

The Oric LORES of movement

When using LORES 1 on the Oric-1 a problem occurs with the scrolling of the screen. Try the following:

```
10 LORES 1
20 FOR T=0 TO 30
30 PRINT T
40 NEXT
```

The screen reverts to normal TEXT as soon as the bottom is reached *ie* as soon as the Oric tries to scroll the screen. The moral of this tale is; always use PLOT to place characters onto the screen in the LORES screen modes. Unless someone knows differently?

B Stiles,
Wilmslow, Cheshire

Corruption with the BBC

On the BBC, programs stored on cassette can corrupt. If this happens it can be very annoying. When you try to load it your Beeb will refuse.

To quell this type:

```
*OPT 2,0
LOAD 'Program'
```

The computer, at some stage, will say 'Data?, but ignore this and the program will continue loading. You may then list the program and correct the bad line.

But before this, try altering the volume control on your tape recorder a bit!

D Abenshaw,
Potter's Bar, Herts.

Scrolling by numbers

Most people know that on the Oric, POKEing location 623 alters the number of lines on the screen and can be used to protect lines. But what happens when numbers greater than 27 are POKEd into this location.

The machine appears to start scrolling from some other part of the memory. Values up to one hundred or so scroll all sorts of rubbish. Numbers greater than this (up to 255) give long screen lengths. Unfortunately these are not much use as they do not appear on the screen. A program such as the following demonstrates this.

```
10 POKE 623,255
20 FOR T=0 TO 1000
30 PRINT T
40 NEXT
```

Note that the numbers wraparound at 255 and appear at the top of the screen.

To get the cursor back do a control-L, to reset the screen to normal POKE 623,27.

Barry Scofield,
Oldham, Lancs.

RENUMbering beats RESET on the Dragon

Pokeing on the Dragon 32 can sometimes cause the machine to crash unexpectedly. A very frequent crash is when the keyboard freezes and the only option open is to press RESET. After pressing RESET, type LIST and sometimes only the first few lines of pogram are there, the rest being useless jargon. To get your program back, all you need to do is type RENUMber.

Although you are unable to RUN it, you can SAVE it ad reload it after a cold start. I have found this routine worked quite often when POKEing my Dragon.

J Blatch, Newton Abbot,
S Devon.

RAM in the Lynx Basic

It is possible to make the Basic on the 96K Lynx entirely RAM based, so that it can be modified at will. This is accomplished by copying the contents of the EPROMs into the RAM which occupies the same address space, and switching out the EPROMs. An added bonus is that processing speed is increased by 13 per cent because the M1 wait state required for the 450 nS EPROMs is changed for the faster 300 nS RAMs.

In order to make your Basic RAM based, RESERVE some memory and type in the program in the listing. There is a complication because the EPROMs have to be, briefly, switched in for each screen access.

When the machine code has been entered, execute it with CALL&FB9A. To prove that it is working, type POKE&1418,ASC("O") and load in a Basic program. When it is listed, it will be seen that all occurences of the keyword LET will have been replaced by LOT. You are now in a position to customise your Lynx Basic.

Chris Cytes,
Mangotsfield, Bristol

```
FB9AH 21 00 00   LD    HL,0000H
FB9DH E5         PUSH  HL
FB9EH D1         POP   DE
FB9FH 01 00 50   LD    BC,5000H
FBA2H ED B0      LDIR
FBA4H 21 AB FB   LD    HL,FBABH
FBA7H 22 6D 62   LD    (626DH),HL
FBAAH C9         RET
FBABH CD 5E 08   CALL  085EH
FBAEH 3E 10      LD    A,10H
FBB0H 01 7F FF   LD    BC,FF7FH
FBB3H ED 79      OUT   (C),A
FBB5H C9         RET
```

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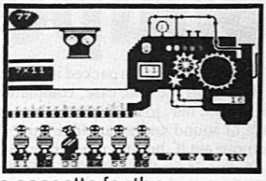
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John Lettice meets the American side of the Sinclair family and finds a lot to like.

Souped up Spectrum

Fancy a Spectrum packed inside a slim, elegant metallic case, complete with space bar, joystick ports, three channels of sound and a cartridge slot? Well, you can get it, but it'll run hardly any UK software, it won't work with your television, and you may have a little trouble with the power supply.

Yes, it's the Timex 2058, and it can be yours for under $200, exclusive of the mailing costs from the States. There are no plans to release it here — but it's a pretty looking beast, and Spectrum users can still dream dreams . . .

Documentation

As the Timex 2058 and the Spectrum are basically the same machine, the manuals have a lot in common, although the basic presentation of the Timex manual is clearer. The latter is both more and less detailed than the Sinclair version — the authors seem to have taken the view that it's more important to get users up and running than it is to given them a complete course in using the machine.

So, if you look at the chapter on maths in the Spectrum manual, you'll find the functions are covered, while maths on the Timex is apparently confined to simple arithmetic, random numbers and integers. This is the case at a number of points in the Timex manual, and while much of the balance is sketched out in the appendices, and there certainly is a need for good basic instruction, we're really starting to get into Programmer's Reference Guide territory here. Serious users will have to look for supplementary information.

This problem is made more acute by the fact that the Timex has a number of extra display modes. Display Mode 1 is the standard Spectrum screen mode, while Mode 3 is an additional normal screen and Mode 2 is an ultra-high resolution screen, using 64 columns and with resolution of 512 by 176. Mode 4 is ultra-high colour resolution, allowing you to assign colour parameters to individual rows of pixels within a character position.

But trying to access these in Basic programs is crash-a-minute stuff. The manual gives you the commands you need to select them, but there's nothing you can do without a thorough knowledge of machine code. Eager punters are referred to the forthcoming *T/S 2000 Advanced Programming Concepts Manual,* which may not be as advanced as all that if it still refers to the 2000. The 2000 was the original concept, and very much a Spectrum; although the manual refers to the 2000 throughout, Timex eventually elected to wait until the enhanced 2068 could be got ready.

At any rate, Timex seems to have looked at the Commodore concept of computing and found it good. The 2068 certainly has some pretty neat specifications, but if you want to access the most intriguing of them, you'll have to cough up the extra for the advanced programming manual.

Construction

The Timex is, by Sinclair standards, a relatively large beast. It's 14.5in wide, 7.5in deep by 1.75in high. It's finished in aluminium style plastic, and the rubber keys have gone out the window — the Timex uses hard plastic keys which are the same size as the Spectrum's but incorporate an extra caps shift, a larger enter key, and a space bar. It may be the same size but it seems a lot less cramped than the Spectrum keyboard in use.

The right hand side of the case incorporates a cartridge slot — no Interface 2 here — which has a snap-down lid. There is a power switch on the right hand side of the case, although there's no light to tell you whether it's on or off, and there is a connector on each side for an Atari-type joystick. Round the back we have sockets for power, ear, microphone, monitor and TV — UK monitors seemed to run perfectly well off the monitor output. There's a standard looking edge connector on the left hand side, complete with a clip-on cover to keep miscellaneous gubbins away from the circuit board.

UK peripherals will fit the edge connector — indeed a number of companies in this country are marketing slightly classier US variants on the ZX Printer, but the connector itself is slightly longer than the Spectrum's which implies Timex is plotting something here. The company is currently thought to be working on an 80 column printer using plain paper.

The speaker is still buzzer-ish, and surprisingly still resides on the base of the machine, but it's a bit louder. The extra sound chip allows you three channels of sound or noise, so with the necessary amplification you can get as symphonic as



Superficial differences the attractive Timex and its British predecessor. The Timex has a moving keyboard including a true space bar. The clear area to the right is a hinged lid concealing a socket for cartridge software.

Naru



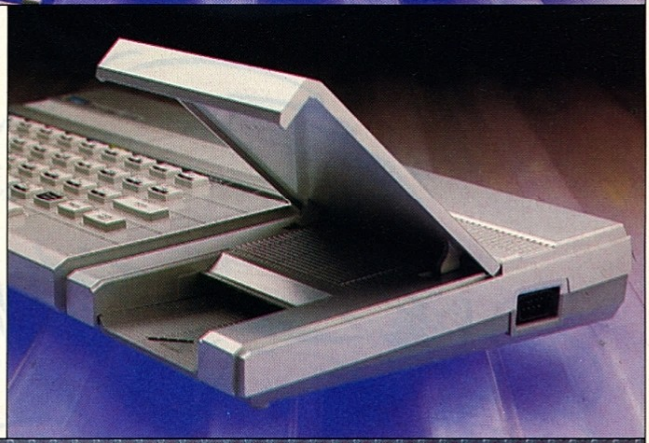
Right: the rear of the Timex with cassette, TV and monitor connectors at far right. On the left is an expansion socket for disk or printer — possibly. Below right: The cartridge socket exposed.

you fancy.

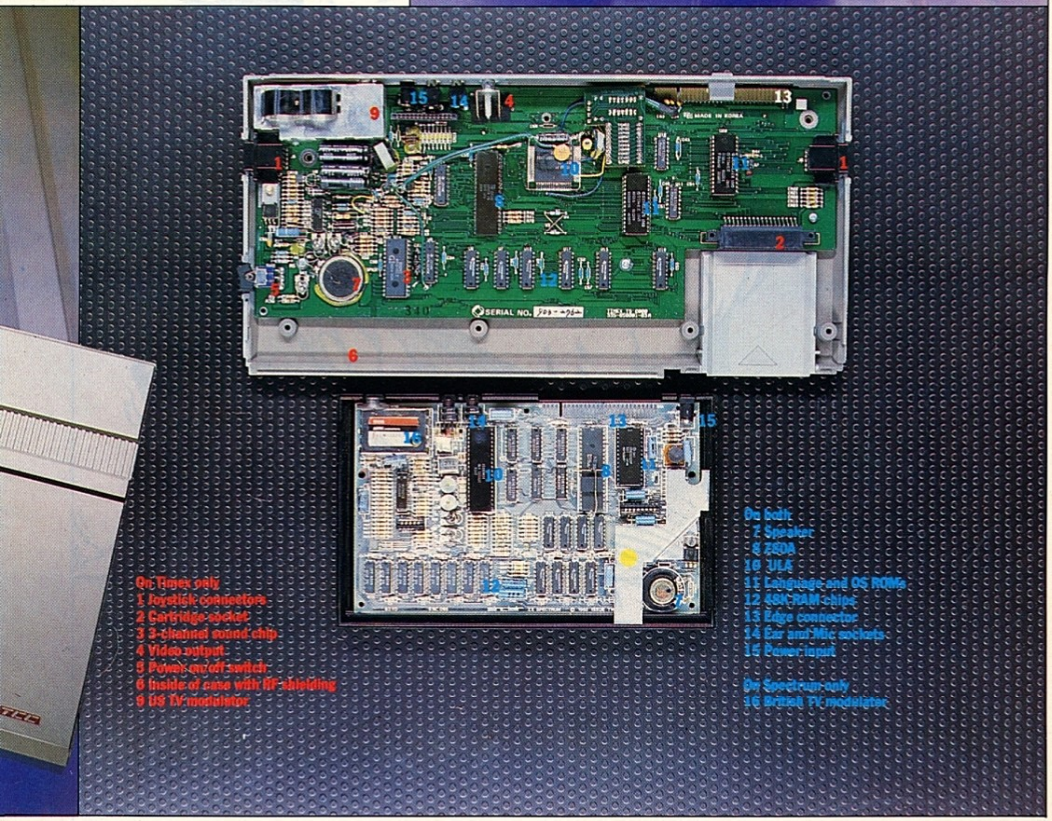
There's also a mysterious little switch beneath the machine which appears to be something to do with the banding system US TV channels follow.

Remove six screws — tougher than the eminently chewable Sinclair versions — lift off the case, and brace yourself. If I hadn't seen it behave like a Spectrum with my own eyes, I'd have my doubts about it being the same machine. The ULA, naturally, is different, and there's the sound chip, but there's also no heat sink, and it appears to do clever things with six 64K chips to produce its 48K.

The layout of the chips is different, and much gappier — no way is this a Spectrum board slotted in a big empty case. And the heat problem seems to have been dealt with quite efficiently. A couple of large wires crossing the board on the review machine indicated design revisions, but



25▶



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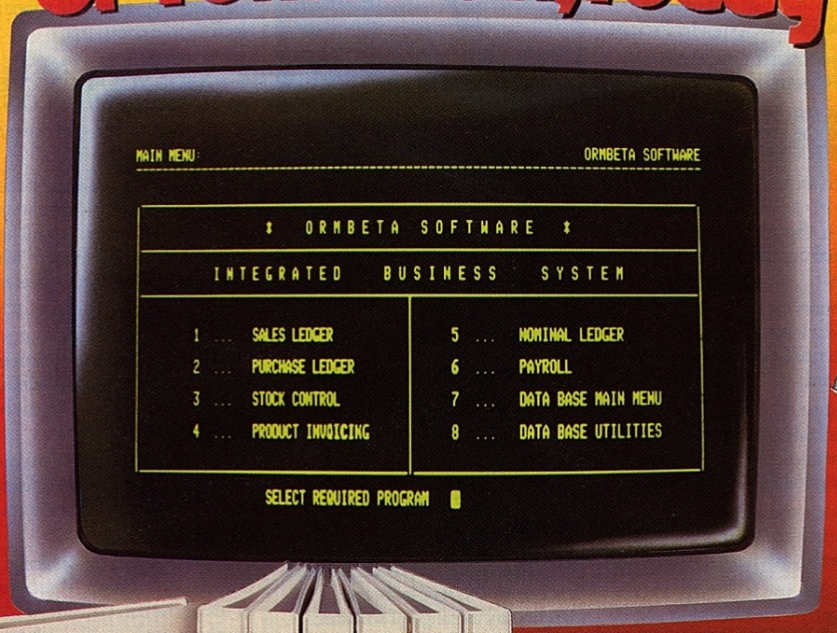
(TICK WHERE APPLICABLE)

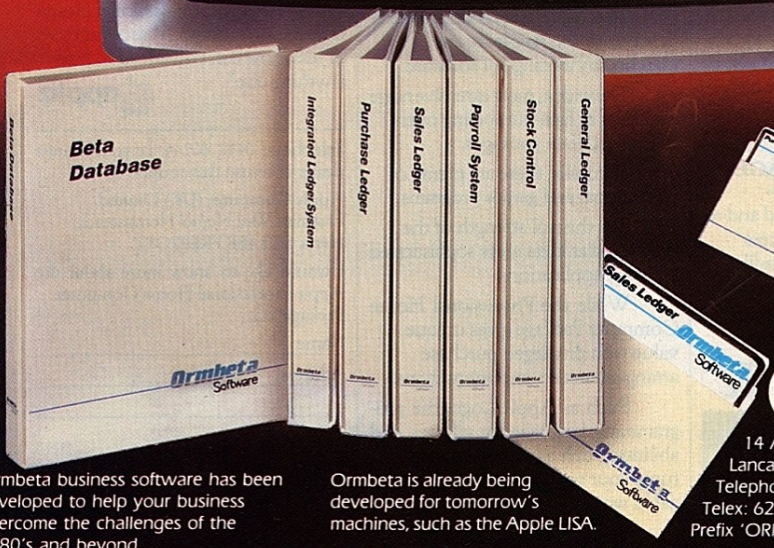


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this is no innovation as far as Sinclair products are concerned. I assume the amendments will be made more permanent — and the serial numbers printed on the board rather than painted — at a later date.

The keyboard connects to the board via a single ribbon cable rather than two as with the Spectrum, but get out the magnifying glass and check the circuits and you'll probably find a Spectrum in there somewhere.

Screen

As we've said, the Timex has four display modes, three of which are relatively inaccessible. Mode 1 has the standard 256 by 176 resolution, and is to all intents and purposes the one you'd use if all you want is a Spectrum. Experiments with OUT 255, x produced a number of exotic effects, and precious little of constructive use.

Accessing Display Mode 2, the 64 column mode, was particularly intriguing. It produced narrower characters at the bottom of the screen, but only 32 of them. This appears to be because the 64 characters are dealt with by two pages of memory, 32 characters each, and these will appear in alternate spaces. You get a better idea of this with one of the OUTs not mentioned in the manual, which produces a screen with 32 vertical bars.

However, several of the OUTs I tried appeared to scramble the RAM all over the top half of the screen, so it clearly needed a lot more investigation than I was capable of. Also, I can't see much future for me writing software for a machine they won't be selling here. With resolution of 512 by 176, though, the machine becomes far more attractive than its UK cousin, and I'd dearly like to see software using this to the full.

The second normal screen, Mode 3, is likely to be more immediately available. Again it's no picnic. Provided you can get it working without too much hassle, it'll provide a number of useful programming short-cuts. Mode 4, the 'ultra-high colour resolution' mode, is also fascinating. If you can change INK, PAPER, BRIGHT and FLASH for individual rows of pixels in single character spaces, you should be able to produce multi-coloured shimmering wonders in your graphics. All very tempting, isn't it?

Storage

Currently, storage is by tape or cartridge. Tape operates just as effectively as on the Spectrum, and we can assume that cartridge — none were available — gives results as quickly as any other cartridge system. The manual refers to 'disk or other storage medium' for the future, but doesn't commit itself.

The Microdrive maps that figure in the Spectrum's memory map have, apparently, gone out of the window, but there are a couple of areas that might still fit the bill. Bearing in mind the Spectrum's storage didn't exactly turn out the way many people expected, being cagey isn't a bad idea, and though it's possible Timex will come up with a disk system, Microdrives are not totally out of the question.

The memory itself is only 48K, but there is scope for bank switching. This means that up to 256 banks of 64K memory can be accessed in groups of 8K, with a maximum of 64K at a time, and up to a maximum 16Mb. This — how did you guess — isn't much use at the moment, but apparently some of the ROM cartridges use it, and it's likely that add-on devices to allow you to use it will be produced in the future.

Operation

The Timex Basic is essentialy Sinclair Basic, heading off on the latest phase of its campaign to conquer the world. But there are a few additions. DELETE can be found in the same place as on the Spectrum, and operates in the same way, but it also has a block delete function. So, use the command DELETE x,y where x and y are line numbers, and the relevant block of a program will be deleted.

The manual gets a bit wacky at this point. It alleges that if you type DELETE 4000, line 4000 will be deleted. Why should anyone want to do this, you may ask, when simply typing 4000 gets the same effect? Correct, and when you try DELETE 4000, it won't accept the command anyway. You've also got the word DELETE appearing on the screen when you try to delete letters in K mode. The manual again:

'It turns out that the auto-repeat key feature is your solution. With the L cursor showing, hold the caps shift and the O keys down: the word DELETE and the colon (and, likely, PAUSE and some of the line number) will be deleted.'

Honesty is certainly the best policy, but I couldn't get the thing to delete a line number at all.

Other extra commands are FREE, which gives you the RAM space remaining; STICK, which calls the joysticks; ON ERR, which seems to be on holiday from Applesoft; RESET, which is used to initialise peripherals, and SOUND. These have been added at the expense of such things as those funny curly brackets you probably never use anyway.

SOUND is the most interesting, and follows the syntax SOUND a,b;a,b; . . . The first number specifies the register, while the second specifies a value. You can designate one of 15 registers with an individual value, and up to 15 can be included in one SOUND statement. The manual's a bit sketchy on the possibilities but gives a table of note values, so it's all there if you have the patience.

I've already touched on the memory map, and on the fact that UK software is unlikely to run on the Timex. The reason for this is something I can only think of as diabolical cunning on the part of Sinclair and Timex. Basic programs seem to work fine, obviously with the exception of the extra commands detailed above, but machine code seems to be a total no-no.

The Timex's Basic program area occupies a different space from the Spectrum's, and while the memory maps are similar, they are different enough for you to be pretty well stuck if you have one of the two machines in the wrong country. In the US, this means that you'll just have to wait for Timex produced software, or for UK software to be converted.

Verdict

It seems Timex has been playing a dangerous game with this one. The original concept of selling the Spectrum in the US was probably a good one, considering the success the ZX81 has had there. But by deciding to wait until it had a machine of its own, Timex has lost time, and landed itself in the middle of a price war. The Timex came out with a list price of $199.95, and is probably selling for about $150, or about the level of the Commodore 64.

Facing such tough competition and developing a software base at the same time is going to be difficult. That said, it's a machine that deserves to succeed. Its expansion potential is massive, and well-written software, using the machine's extra facilities, could be very good indeed.

The almost universal reaction to first sight of the 2058 is 'that's what the Spectrum should look like.' Granted, the Spectrum was an excellent deal when it first came out, and it's still a very good deal now, but really it's being hoist by its own expansion facilities. Now most of the bits are there, it would be nice to be able to buy it all in the one box, with an improved keyboard, and the Timex goes some way towards this.

It may be that as far as Sinclair is concerned, this way lies madness. Redesigning a micro when it's possibly half way through its useful life probably isn't a totally smart idea, and Sinclair could well be more concerned with moving on than with tidying up.

So taking a look at this one is likely to be the closest we'll get, at least for the moment. Still, we can dream . . .

SPECIFICATION
Price $199.95 (plus 15% VAT and 6% duty).
Processor Z80A
RAM 48K
ROM 24k (16k plus bank-switched 8k)
Text screen 22 rows by 32 columns, or 22 rows by 64 columns
Graphics screen 256 by 176 pixels, or 512 by 176 pixels
Keyboard 42 multi-function hard plastic keys, or semi-typewriter style
Storage tape
Operating system Sinclair Basic

Chris Rust ties up this word processor program for the Newbrain in the third instalment.

Words wrapped-up

You're now on the point of completing our word processing program.

The keys to tape control are ONBREAK and ONERROR. They are like those poisonous fish that the Japanese eat. If the chef does the job correctly every time then you are OK. If the chef makes a tiny syntax error you're dead.

Be sure to SAVE the latest version of the listing before you even think of testing it. Then, when the Newbrain starts chasing its own tail you can pull out the plug without anguish.

The important routine is SET UP TAPE. This allows the tape to be positioned without pulling out the remote plug or leaving the program. It is no substitute for true remote control; we'll all have a good laugh about it one day, but it is the best we can do at present.

The Menu

MENU divides the screen in two. The top half is an index of pages, updated on exit from EDITOR. The bottom half is a menu of prompts.

This menu can scroll off to clear the lower half for use by other routines.

First selection of function is by a single keystroke, *eg.* 'e' for EDIT. The selected routine takes over and requests page numbers.

You can usually abort the routine with ESCAPE, returning to MENU. During LOAD you can abort with the buroon that stops tape input on your machine. On Model A it is STOP, on Model AD it is '★'.

Page number input allows for versions with two digit numbers so single key entry is out. INPUT or LINPUT are OK if you are the only user; anyone else wants a crash-proof display.

ENTER NUMBER is a highly modified screen editor which only accepts certain keystrokes. It will not let the cursor move outside a box defined by a control character ':' at each end.

READ NUMBER does what its name says and INPUT PAGE NUMBER cobbles these two together as a crashproof means to input a value within a given range.

In setting up, I referred to exotic strings used by TRAPKEY. Before running MENU and INPUT routines you must enter these strings in place of the temporary ones.

Sp$(1) traps the characters e, l, s, p, c. These are the keystrokes which select functions from MENU. The characters of this string are:

1 CHR$ (141) : GRAPHICS/m
2 CHR$ (148) : GRAPHICS/u
3 CHR$ (155) : GRAPHICS/(
4 CHR$ (152) : GRAPHICS/x
5 CHR$ (139) : GRAPHICS/k

Sp$(2) defines keystrokes acceptable to

MENU FUNCTIONS

```
MENU
Clear Screen with control code cl
 (3): clear home)
PRINT INDEX
Display list of menu functions
Display prompt "What Next?"
Select control string sp$(m1) for
 TRAPKEY
Display cursor
Get KEYSTROKE from KEYBOARD
Check KEYSTROKE with TRAPKEY
If KEYSTROKE not acceptable, go back and
 get another until it is
Set Function flag m4 to indicate menu
 function required
Perform required function
Start again
```

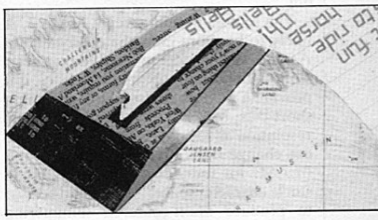
```
1999 REM MENU
2000 PUTcl:GOSUB9300
2010 ?:FORa=1TO5:?mu$(a):NEXTa:?:?pt$(0)
;
2020 m1=1:PUTcu:GOSUB20000:PUTcb:GOSUB20
100:IFm3=1THEN2020
2030 m4=m3-1:ONm4GOSUB3000,3100,3200,330
0,3400:GOTO2000
```

```
EDITOR
SET UP INPUT
Set prompt pt$(m5) to "TO page:"
INPUT PAGE NUMBER
Set TARGET and PAGE to NUMBER
If ESCAPE pressed then RETURN to MENU
Remainder of EDITOR has been described
 in previous issues
```

```
2999 REM EDITOR
3000 GOSUB10300:m5=1:GOSUB10400:tg=nn:pg
=nn:IFks=27THENRET
3050 PUT#tg,xy,1,3:m1=FALSE
3060 GOSUB20000:GOSUB20100:IFks=27THENGO
SUB22100:RET
3070 ONm3GOSUB20200,21000,21100:GOTO3060
```

```
LOAD
WIPE MENU
Print "Play Tape"
OPEN TAPE IN
If User has pressed STOP then RETURN to
 MENU
Set Line No yy and Prompt No m5 for
 VERIFY
VERIFY
If "n" pressed then start again
If ESCAPE pressed then RETURN to MENU
If "y" pressed then continue
WIPE MENU
Display name of Tape File
Set Line No and Prompt No for INPUT
Set minimum and maximum values mn & mx
 for INPUT
INPUT PAGE NUMBER
If ESCAPE pressed then RETURN to MENU
Set TARGET and PAGE to PAGE NUMBER
Set SOURCE to TAPE STREAM
PUMP
Set PAGE Title pg$(pg)
PRINT TITLE
PRINT INDEX showing new title
WIPE MENU
Set Line No and prompt No for VERIFY
VERIFY
If "n" start again
If "y" or ESCAPE then RETURN to MENU
```

```
3099 REM LOAD
3100 GOSUB10800:?pt$(4):GOSUB24100:IFks=
esTHENRET
3110 yy=mt+4:m5=5:GOSUB11000:ONm3-1GOTO
3120,3100,3190
3120 GOSUB10800:?FILE$:yy=mt+4:m5=1:mn=1
:mx=ss:GOSUB10400:IFks=27THENCLOSE#tp:
RET
3130 tg=nn:pg=nn:so=tp:GOSUB22000
3140 pg$(pg)=LEFT$(pg$(pg),2)+MID$(FILE$
,3):GOSUB9400:GOSUB9300
3150 GOSUB10800:yy=mt+3:m5=6:GOSUB11000:
ONm3-1GOTO3100,3190,3190
3190 CLOSE#tp:RET
```



```
SAVE
INPUT PAGE LIST
If ESCAPE pressed then RETURN to MENU
VERIFY (respond as in LOAD)
WIPE MENU
Display prompt "Set up tape"
SET UP TAPE
Set line number for VERIFY
Clear line
Set prompt pt$(m5) for VERIFY
VERIFY (respond as in LOAD)
Set TARGET to Tape stream
For each PAGE NUMBER in the list
    Set SOURCE and PAGE to PAGE NUMBER
    OPEN TAPE OUT
    PUMP
    Print END OF TAPEFILE string to Tape
Close last Tape File
RETURN to MENU
```

```
3199 REM SAVE
3200 m5=2:GOSUB10500:IFks=esTHENRET
3210 m5=5:GOSUB11000:ONm3-1GOTO3220,3200
,3290
3220 GOSUB10800:?pt$(3);:GOSUB24000:yy=
mt+3:PUTbl:m5=5:GOSUB11000:ONm3-1GOTO323
0,3200,3290
3230 tg=tp:FORm6=0TO10:so=pg(m6):pg=so:
IFso=0THENm6=10:GOTO3250
3240 GOSUB24200:GOSUB22000:?#tp,tr$(2)
3250 NEXTm6:CLOSE#tp
3290 RET
```

```
PRINT
INPUT PAGE LIST
VERIFY (respond as in LOAD)
```

```
3299 REM PRINT
3300 m5=2:GOSUB10500:IFks=esTHENRET
```

NEWBRAIN WP: Part 3

ENTER NUMBER. It is a bit les exotic than sp$(1). Sp$(2)="HXYZ[/] ^_ 'a0B5C"
The unusual characters are:
8 CHR$ (94) : SHIFT/+
9 CHR$ (95) : SHIFT/VIDEOTEXT
10 CHR$ (96) : GRAPHICS/;
The brackets are the SHIFTed square ones.

Sp$(3) is used by VERIFY and traps y, n and ESCAPE. Characters are:
1 CHR$ (161) : ATTRIBUTE ON — SHIFT/1
2 CHR$ (150) : GRAPHICS/u
3 CHR$ (67) : SHIFT/c

ATTRIBUTE ON is selected by SHIFT/CURSOR UP and cancelled by SHIFT/ESCAPE.

Another enigmatic item in the SETTING UP routine is the constant mt. It stands for MENU TOP and is the number of the top of the scrolling menu display.

This program uses most of the space in the Newbrain. The Newbrain doesn't like that too much — it slows down as it runs out of memory. To clear space for it to compile object code you should delete all REMarks and insert a line to delete the setting up routine once it has done its job thus:
1999 DELETE-1999

All REMARKS are on lines ending in 99.

To delete them try this:
```
60000 FORa=99TO24299step100
60010 PUT31:?:?:?"60100 DELETE":A
60020 PUT27,4,12,3
60030 MERGE#0
60110 NEXTa:RET
```

That's right, the Newbrain can write its own program lines. There are faster ways to get rid of the REMarks but I thought you might like this one as it introduces yet another little known feature of the machine.

```
Set TARGET to PRINTER                    3310 m5=5:GOSUB11000:ONm3-1GOTO3320,3300
For each PAGE NUMBER in the list          ,3390
    Set SOURCE and PAGE to PAGE NUMBER   3320 tg=pr:FORm6=0TO10:so=pg(m6):pg=so:
    PUMP                                  IFso=0THENm6=10:GOTO3340
RETURN to MENU                           3330 GOSUB22000
                                         3340 NEXTm6
                                         3390 RET
```

```
CUT AND PASTE
SET UP INPUT                             3399 REM CUT AND PASTE
Set m5 to give prompt "FROM page:"       3400 GOSUB10300:m5=2:GOSUB10400:na=nn:IF
INPUT PAGE NUMBER                         ks=27THENRET
Store NUMBER in variable na              3410 yy=yy+1:m5=1:GOSUB10400:tg=nn:pg=na
Set m5 to give "TO   page:"               :so=na:IFks=27THENRET
INPUT PAGE NUMBER                        3420 yy=yy+1:m5=5:GOSUB11000:ONm3-1GOTO3
Set TARGET to second NUMBER nn            430,3400,3490
Set SOURCE and PAGE to first NUMBER na   3430 PUT#tg,xy,1,3:GOSUB22000
If ESCAPE pressed then RETURN to MENU    3490 RET
```

INPUT ROUTINES

```
SET UP INPUT
WIPE MENU                                10299 SET UP INPUT
Set line number yy for ENTER NUMBER      10300 GOSUB10800:?:xx=16:yy=mt+3:mn=1:mx
Set maximum (mx) and minimum (mn) values  =ss:RET
 of number required
```

```
INPUT PAGE NUMBER
Display prompt pt$(m5) on line yy        10399 REM INPUT PAGE NUMBER
Set character position variable xx for   10400 PUTxy,1,yy:?pt$(m5):xx=16
 ENTER NUMBER                            10410 GOSUB10600:GOSUB10700:IFks=esTHENR
ENTER NUMBER                              ET
READ NUMBER                              10420 IFnn<mnORnn>mxTHEN10410
If ESCAPE pressed then RET               10430 RET
If NUMBER nn is outside permitted range
 then start again
```

```
INPUT PAGE LIST
SET UP INPUT                             10499 REM INPUT LIST OF PAGES
Set prompt flag m5 to give "FROM page:"  10500 GOSUB10300:m5=2:mn=FALSE:m6=FALSE
Set minimum value mn to allow null entry 10510 GOSUB10400:IFks=esTHENRET
Set list pointer m6 to zero              10520 pg(m6)=nn:PUTxy,3*m6-(m6>FALSE),yy
INPUT PAGE NUMBER                         +1:?nn;:m6=m6+1
If ESCAPE pressed then RET               10530 IFnn=FALSEORm6>10THENRET
Add NUMBER nn to list                    10540 GOTO10510
Add NUMBER to displayed list
If null return or list is 10 numbers
 then ret
Increment m6
Start again
```

```
ENTER NUMBER
Set SOURCE and PAGE to MENU screen #0    10599 REM ENTER NUMBER
Set control string for TRAPKEY           10600 so=0:pg=0:ml=2:GOSUB22600
PLACE cursor at xx,yy                    10610 PUTcu:GOSUB20000:GOSUB20100:IFM3>1
Display cursor                            4THENPUTcb:RET
Get keystroke ks from KEYBOARD           10620 PUTks*-(m3>1):GOSUB22700:IFch=58TH
Check keystroke with TRAPKEY              ENPUTit-18*(ks=lt)
If NEWLINE or ESCAPE pressed then RET    10630 GOTO10610
```

```
READ NUMBER
Place cursor at start of INPUT box       10699 REM READ NUMBER
Clear n$                                 10700 PUTxy,xx,yy:n$=""
READ CHARACTER                           10710 GOSUB22700:IFch=58THEN10730
If character is colon (end of box)then   10720 n$=n$+CHR$(ch):PUTrt:GOTO10710
 ignore next three items                 10730 IFNUM(n$)=FALSETHENnn=FALSE:RET
Add CHARACTER to n$                      10740 nn=VAL(n$):RET
```

```
WIPE MENU
Place cursor at top line of MENU         10799 REM WIPE MENU
Scroll off cursor line and the 9 lines   10800 PUTxy,1,mt+1,2,2,2,2,2,2,2,2,2:?
 below it                                mu$(m4):RET
```

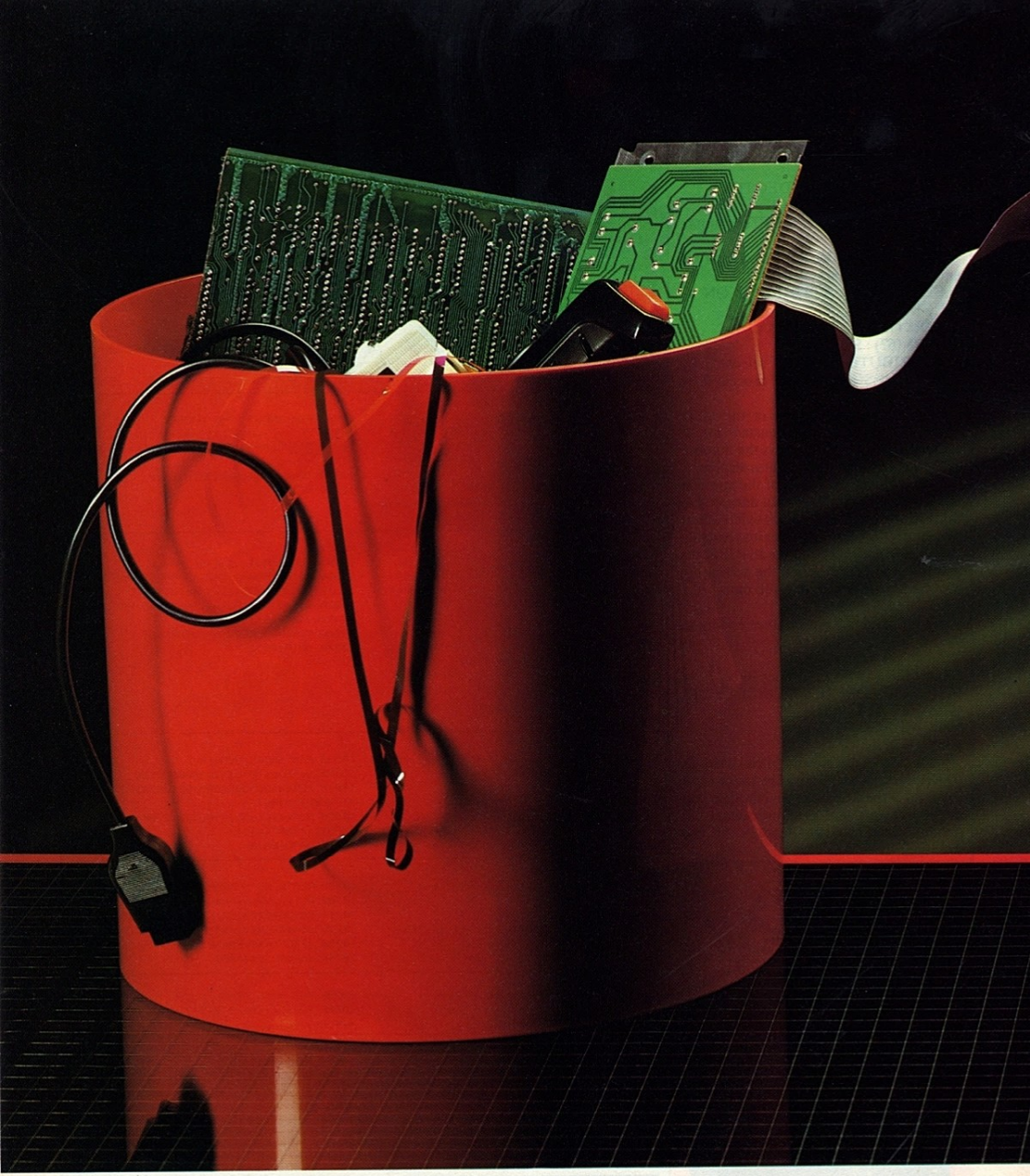
```
VERIFY
Clear line yy                            10999 REM VERIFY
Display prompt pt$(m5)                   11000 PUTxy,1,yy,bl:?pt$(m5);:ml=3
Set control string for TRAPKEY           11010 PUTcu:GOSUB20000:GOSUB20100:IFm3=1
Display cursor                            THEN11010
Get KEYSTROKE from KEYBOARD              11020 PUTcb:RET
Check with TRAPKEY
If KEYSTROKE is not acceptable go back
 and get another
```

TAPE CONTROL

```
                                         23999 REM SET UP TAPE
                                         24000 ONBREAKGOTO24080:ONERRORGOTO24090
                                         24010 VERIFY
                                         24020 ONBREAKGOTO0:ONERRORGOTO0:RET
                                         24080 RESUME24020
                                         24090 RESUME24010
                                         24099 REM OPEN TAPE IN
                                         24100 ONBREAKGOTO24190:ks=FALSE:CLOSE#tp
                                         :OPENIN#tp,1
                                         24110 ONBREAKGOTO0:RET
                                         24190 CLOSE#tp:ks=es:RESUME24110
                                         24199 REM OPEN TAPE OUT
                                         24200 CLOSE#tp:OPENOUT#tp,1,pg$(pg):RET
                                         24299 REM CLOSE TAPE OUT
                                         24300 ?#tp,en$:CLOSE#tp:RET
```







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

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Cavern code

SS Ram, our arcade quality Scramble-type game for the Dragon, now enters its penultimate week. We're giving you a double helping of the game Darren Eteo devised this time round, but don't panic — next week's listing will complete it, and the final part is quite short.

The game has so far been published in *PCN issues 38 and 39*, and if you've missed them they're available from the *PCN* Back Issues Service, 53-55 Frith Street, London W1A 2HG.

```
055C C1AA
055E 2627
0560 9A
0561 26F4
0563 3089FF61
0567 8605
0569
0569 E684
056B 308820
056E C1AA
0570 2615
0572 4A
0573 26F4
0575 3088A1
0578 8603
057A
057A E684
057C 308820
057F C1AA
0581 2604
0583 4A
0584 26F4
0586 39
0587
0587 3530
0589 B66FB2
058C 4A
058D B76FB2
0590 8604
0592 B76FCC
0595
0595 8E0600
0598
0598 EC84
059A 43
059B 53
059C ED81
059E 8C10FF
05A1 25F5
05A3 7A6FCC
05A6 26ED
05A8 B66FB2
05AB 8100
05AD 102FFB01
05B1 86CA
05B3 B76FCF
05B6 8E2000
05B9
05B9 301F
05BB 26FC
05BD
05BD B6FF00
05C0 8421
05C2 8101
05C4 2602
05C6 20F5
05C8
05C8 16FACC
05CB
05CB F670A8
05CE C114
05D0 2506
05D2 8614
05D4 B770A8
05D7 39
05D8
05D8 10BE6FCA
05DC 860113
05DF
05DF A13F
05E1 2504
05E3 44
05E4 4C
05E5 20F8
05E7
05E7 ABDE
05E9 C620
05EB 3D
05EC C3073F
05EF 1F01
05F1 10BE70A9
05F5 B670A8
05F8 8802
05FA
05FA AFA6
05FC B770A8
05FF 8603
0601 B76FCF
0604 10BE7000
0608
0608 ECA1
060A ED84
060C 308820
060F 7A6FCF
0612 26F4
0614 39
0615
0615 B670A8
0618 2601
061A 39
061B
061B B76FCF
061E 10BE70A9
0622 AEA6
0624 8603
0626 B76FCC
0629 CCAAAA
062C
062C ED84
062E 308820
0631 7A6FCC
0634 26F6
0636 3089FEE0
063A BC6FCD
063D 240D
063F E6830140
0643 C1AA
0645 260F
0647 308840
064A 200A
064C
064C E680C0
064F C1AA
0651 2603
0653 3088C0
0656
0656 10BE7000
065A 8603
065C B76FCC
065F
065F ECA1
0661 ED84
0663 308820
0666 7A6FCC
0669 26F4
066B B66FCF
066E 10BE70A9
0672 3089FEDF
0676 AFA6
0678 8302
067A 2E3F
067C 10BE70AA
0680 B670A8
0683
0683 E6A6
0685 C41F
0687 C100
0689 2611
068B 8E70A9
068E F670A8
0691 AEB5
0693 4A
0694 AFA6
0696 4C
0697 C002
0699 F770A8
069C
069C 8302
069E 8101
06A0 22E1
06A2 39
06A3
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06A8 8101
06AA 2601
06AC 39
06AD
06AD 8D2F
06AF 17020D
06B2 30
06B3
06B3 3410
06B5 B6FF23
06B8 8A08
06BA B7FF23
06BD 8E0001
06C0
06C0 86FD
06C2 B7FF20
06C5 7FFF20
06C8 8D0D
06CA 3001
06CC 8C0032
06CF 25EF
06D1 B6FF23
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06E7 B66FCE
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06EB 861F
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06EF B76FCF
06F2 B76FCC
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0702 A684
0704 81AA
0706 2618
0708 E780
070A 7A6FCF
070D 26F3
070F 8E0500
0712
0712 301F
0714 26FC
0716 B66FC6
0719 56AA
071B
071B A780
071D 7A6FCC
0720 26F9
0722 39
0723
0723 8D8E
0725 BF6FC4
0728 8601
072A B76FCC
072D 1F10
072F 836FC6
0732 2706
0734 BE6FC4
0737 F76FCC
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073A F66FC5
073D C41F
073F F76FCF
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0749 AEA6
074B BC6FC4
074E 224F
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0757 BC6FC4
075A 2543
075C 4C
075D E6A6
075F 4A
0760 C41F
0762 F16FCF
0765 2638
0767 F6704E
076A AEA5
076C AFA6
076E C002
0770 F7704E
0773 54
0774 F7708A
0777 BE6FC2
077A 8603
077C B76FCF
077F CCAAAA
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0784 308820
0787 7A6FCF
078A 26F6
078C BE6FC6
078F 86AA
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0791 A780
0793 7A6FCC
0796 26F9
0798 CC0200
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079E 39
079F
079F 8002
07A1 2EA6
07A3 10BE70A9
07A7 B670A8
07AA
07AA AEA6
07AC BC6FC4
07AF 2253
07B1 BF6FC2
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07B8 BC6FC4
07BB 2542
07BD 4C
07BE E6A6
07C0 4A
07C1 C41F
07C3 F16FCF
07C6 2708
07C8 5C
07C9 F16FCF
07CC 2202
07CE 2034
07D0
07D0 F670A8
07D3 AEA5
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07D7 C002
07D9 F770A8
07DC BE6FC6
07DF 86AA
07E1
07E1 A780
07E3 7A6FCC
07E6 26F9
07E8 3503
07EA B76FCF
07ED CCAAAA
07F0 BE6FC2
07F3
07F3 ED84
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07FB 26F6
07FD CC0500
0800 FD70E1
0803 39
0804
0804 8002
0806 2EA2
0808 10BE6FC4
080C A6A4
080E C612
0810 8E7030
0813
0813 A180
0815 2722
0817 5A
0818 26F9
081A
081A 10BE6FC4
081E A6A4
0820 C60C
0822 8E2024
0825
0825 A180
0827 2748
0829
0829 5A
082A 26F9
082C
082C BE6FC6
082F 30AA
0831
0831 A780
0833 7A6FCC
0836 26F9
0838 39
0839
0839 301F
083B A61E
083D A1ABE0
0840 2708
0842 A602
0844 A1A820
0847 2704
0849 3001
084B 20CD
084D
084D C812
084F 53
0850 5C
0851 C4FE
0853 8610
0855 3D
0856 53
0857 43
0858 C30001
085B 31AB
085D 31ABE0
0860 860A
0862 B76FCF
0865 CCAAAA
0868
0868 EDA4
086A 31A820
086D 7A6FCF
0870 26F6
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0874
0874 301F
0876 A61E
0878 A1ABE0
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087D A602
087F A1A820
0882 2704
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0888 C00C
088A 53
088B 5C
088C C4FE
088E 8610
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0891 53
0892 43
0893 C30001
0896 31AB
0898 31A8E0
089B 8608
089D B76FCF
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08A3
08A3 EDA4
08A5 31A820
08A8 7A6FCF
08AB 26F6
08AD FC6FC0
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08BF FC6FC0
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08CF 8606
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08E2 8E0002
08E5 AFA6
08E7 B770C2
08EA AE84
08EC 8CAAAA
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08F1 39
08F2
08F2 10BE70C4
08F6 B670C2
08F9 2601
08FB 39
08FC
08FC E6A6
08FE C41F
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0902 2211
0904 8E70C3
0907 F670C2
090A AEB5
090C 4A
090D AFA6
090F 4C
0910 C002
0912 F770C2
0915
0915 8002
0917 2EE3
0919 B670C2
091C 2601
091E 39
091F
091F 10BE70C3
0923
0923 AEA6
0925 CEAAAA
0928 301F
092A C606
092C F76FCF
092F
092F EF84
0931 3088E0
0934 7A6FCF
0937 26F6
0939 308900C1
093D 3088F7
0940 AFA6
0942 AE84
0944 8CAAAA
0947 2704
0949 8D22
094B 201B
094D
094D 3422
094F AEA6
0951 10BE7042
0955 8606
0957 B76FCF
095A
095A ECA1
095C ED84
095E 3088E0
0961 7A6FCF
0964 26F4
0966 3522
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0968 8002
096A 2EB7
096C 39
096D
096D 3422
096F F670C2
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0974 EEA6
0976 AFA6
0978 C002
097A F770C2
097D C605
097F F76FCF
0982 CCAAAA
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0988
0988 EDC4
098A 33C8E0
098D 7A6FCF
0990 26F6
0992 33C900C0
0996 FF6FC2
0999 F66FC3
099C C41F
099E F76FCF
09A1 10BE704F
09A5 B6704E
09A8
09A8 AEA6
09AA BC6FC2
09AD 224C
09AF BF6FC4
09B2 30830120
09B6 BC6FC2
09B9 2540
09BB F66FC5
09BE C41F
09C0 F16FC7
09C3 5C
09C4 2535
09C6 C002
09C8 F16FC7
09CB 222E
09CD C603
```

34 ▶

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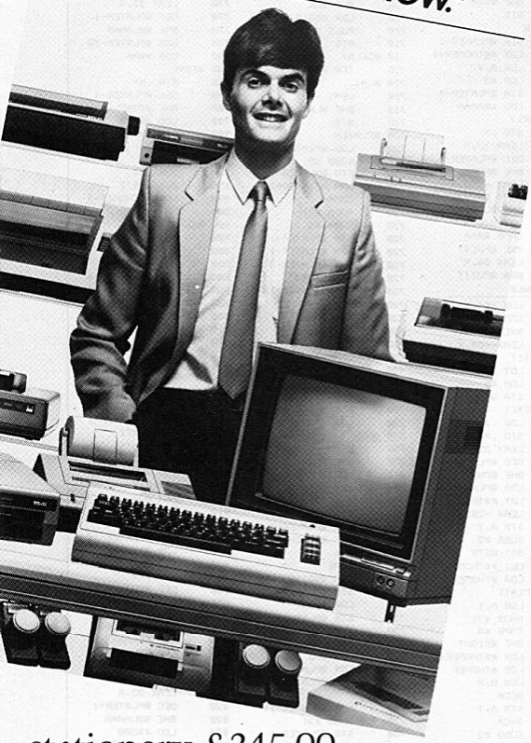
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(Please tick appropriate box.)

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Address

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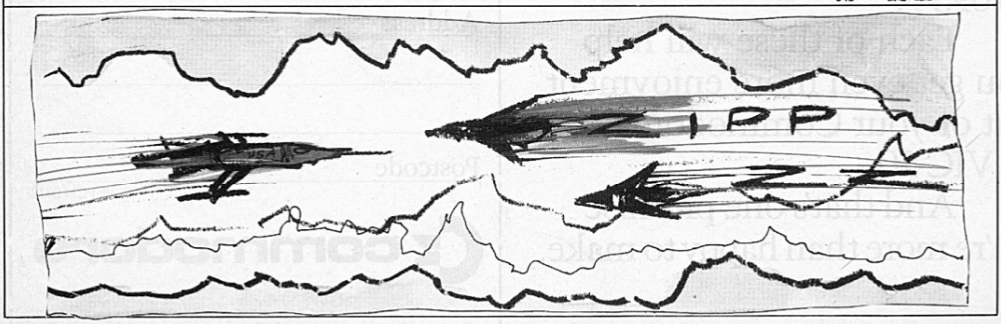
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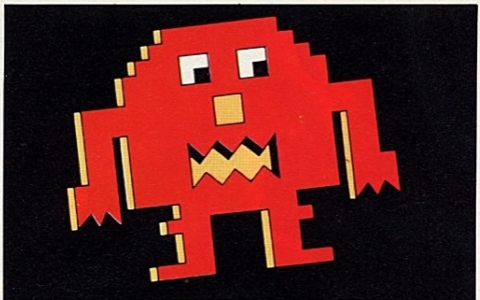
commodore

DRAGON ACTION

```
09CF F26FCF
09D2 F6704E
09D5 EEA5
09D7 EFA6
09D9 C002
09DB F7204E
09DE 54
09DF F7208A
09E2 BE6FC4
09E5
09E5 CEAAAA
09E8 EF84
09EA 308820
09ED 2A6FCF
09F0 26F3
09F2 CC0200
09F5 FD70E1
09F8 1080A0
09FB
09FB 8002
09FD 2EA9
09FF 10BE20A9
0A03 B020A8
0A06 FE6FC2
0A09
0A09 AEA6
0A0B BC6FC2
0A0E 2248
0A10 BF6FC4
0A13 30C90120
0A17 BC0FC2
0A1A 259C
0A1C F66FC5
0A1F C41F
0A21 F16FC7
0A24 C802
0A26 2530
0A28 C003
0A2A F16FC7
0A2D 2229
0A2F C609
0A31 F76FCF
0A34 F670A8
0A37 EEA5
0A39 EFA6
0A3B C002
0A3D F720A8
0A40 BE6FC4
0A43
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0A46 EF84
0A49 308820
0A4B 2A6FCF
0A4E 26F3
0A50 CC0500
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0A56 204C
0A58
0A58 8002
0A5A 2EA0
0A5C 8602
0A5E B76FCC
0A61 BE6FC2
0A64
0A64 C60C
0A66 F76FCF
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0A6B 8155
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0A75 270E
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0A77 2A6FCF
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0A81 26E1
0A83 201F
0A85
0A85 F60001
0A88 E1A4
0A8A 2703
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0A91 2702
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0AA1 FD70E1
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0AB5 FD6FC0
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0AB9
0AB9 5F
0ABA BE1D6B
0ABD 3086
0ABF E784
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0AC4 E78040
0AC7 E78060
0ACA C655
0ACC E701
0ACE E78021
0AD1 E78041
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0ADA 830001
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0AFC
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0B12
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0B22 7F6FCF
0B25 ABB2
0B27 ABA2
0B29 8103
0B2B 2308
0B2D 8AAA
0B2F 7F6FCF
0B32 7C6FCF
0B35
0B35 A7A4
0B37 4F
0B38 5A
0B39 26E4
0B3B BE7AE5
0B3E C60A
0B40
0B40 6F92
0B42 5A
0B43 26F8
0B45 39
0B46 39
0B47
```

```
620     CMPB #$AA
620     BNE @LOST
620     DECA
620     BNE @LOOPQ
620     LEAX,-159,X
620     LDA #5
620 @LOOPK
620     LDB ,X
620     LEAX 32,X
620     CMPB #$AA
620     BNE @LOST
620     DECA
620     BNE @LOOPK
620     LEAX -35,X
620     LDA #3
620 @LOOPP
620     LDB ,X
620     LEAX 32,X
620     CMPB #$AA
620     BNE @LOST
620     DECA
620     BNE @LOOPP
620     RTS
630 @LOST
630     PULS Y,X
630     LDA #PLAYER-30
630     DECA
630     STA #PLAYER-30
630     LDA #4
630     STA #PLAYER-4
630 @LOP12
630     LDX #$6000
630 @LOOPG1
630     LDD ,X
630     COMA
630     COMB
630     STD ,X++
630     CMPX #$1DFF
630     BLO @LOOPG1
630     DEC @PLAYER-4
630     BNE @LOP12
630     LDA @PLAYER-30
630     CMPA #0
630     LBGT @START1
631     LDA #202
631     STA #PLAYER-1
640     LDX #$2000
640 @LOS
640     LEAX -1,X
640     BNE @LOS
640 @POU
640     LDA #$FF00
640     ANDA #1
640     CMPA #1
640     BNE @RTD
640     BRA @POU
640 @RTD
640     LBRA @START
650 @THOMER
650     LDB @THOMER
650     CMPB #20
650     BLO @CONT
650     LDA #20
650     STA @THOMER
650     RTS
650 @CONT
650     LDY @PLAYER-6
650     LDA 275
650 @AS
650     CMPA -1,Y
650     BLO @OKEYED
650     LSRA
650     INCA
650     BRA @AS
650 @OKEYED
660     ADDA -2,Y
660     LDB #32
660     MUL
660     ADDD #$600+319
660     TFR D,X
660     LDY #@THOMER+1
660     LDA @THOMER
660     ADDA #2
660
660     STX A,Y
660     STA @THOMER
660     LDA #9
660     STA #PLAYER-1
660     LDY #@HOMER
660 @FORM
660     LDD ,Y++
660     STD ,X
660     LEAX 32,X
660     DEC #PLAYER-1
660     BNE @FORM
660     RTS
670 @UPDATE
670     LDA @THOMER
670     BNE @STR
670     RTS
670 @STR
670     STA #PLAYER-1
670     LDY #@THOMER+1
670     LDX A,Y
670     LDA #9
670     STA #PLAYER-4
670     LDD ##$AAAA
670 @FORT1
670     STD ,X
670     LEAX 32,X
670     DEC #PLAYER-4
670     BNE @FORT1
670     LEAX -283,X
670     CMPX #PLAYER-3
670     BHS @LOWER
670     LDB 320,X
670     CMPB #$AA
670     BNE @PUTIT
670     BRA @PUTIT
680 @LOWER
680     LDB -64,X
680     CMPB #$AA
680     BNE @PUTIT
680     LEAX -64,X
680 @PUTIT
680     LDY #@HOMER
680     LDA #9
680     STA #PLAYER-4
680 @NNEXET
680     LDD ,Y++
680     STD ,X
680     LEAX 32,X
680     DEC #PLAYER-4
680     BNE @NNEXET
680     LDA #PLAYER-1
680     LDY ##THOMER+1
680     LEAX -283,X
680     STX A,Y
680     SUBA #2
680     BGT @STR
690     LDY #@THOMER+2
690     LDA @THOMER
690 @REPEAT1
690     LDB A,Y
690     ANDB #31
690     CMPB #0
690     BNE @RIGHT
690     LDX #@THOMER+1
690     LDB @THOMER
690     LDX B,X
690     DECA
690     STX A,Y
690     INCA
690     SUBB #2
690     STB @THOMER
690 @RIGHT
690     SUBA #2
690     CMPA #1
690     BHI @REPEAT1
690     RTS
700 @FIRE
700     LDA #FF00
700     ANDA #1
700     CMPA #1
700     BNE @PRESSED
700     RTS
700 @PRESSED
700     BSR @FLAZER
700     LBSR @DBOMBS
700     RTS
710 @NOISE
710     PSHS X
710     LDA 65315
710     ORA #8
710     STA 65315
710     LDX #1
710 @LK
710     LDA #253
710     STA 65312
710     CLR 65312
710     BSR @DELAY
710     LEAX 1,X
710     CMPX #55
710     BLO @LK
710     LDA 65315
710     PULS X
710     RTS
710 @DELAY
710     TFR X,Y
710 @LA1
710     LEAY -1,Y
710     BNE @LA1
710     RTS
720 @FLAZER
720     LDD @PLAYER-10
720     SUBD #5
720     STD @PLAYER-10
720     LDA @PLAYER-2
720     COMA
720     ANDA #31
720     SUBA #2
720     STA #PLAYER-1
720     STA #PLAYER-4
720     LDD #PLAYER-3
720     ADDD #163
720     STD @PLAYER-10
720     TFR D,X
720     LDB ##55
720 @PLOOP
720     LDA ,X
720     CMPA ##AA
720     BNE @HITSOME
720     STB ,X+
720     DEC #PLAYER-1
720     BNE @PLOOP
730     LDX ##500
730 @LOH
730     LEAX -1,X
730     BNE @LOH
740     LDX #PLAYER-10
740     LDA ##AA
740 @AGAIN11
740     STA ,X+
740     DEC #PLAYER-4
740     BNE @AGAIN11
740     RTS
750 @HITSOME
750     BSR @NOISE
750     STX #PLAYER-12
750     LDA #1
750     STA #PLAYER-4
750     TFR X,D
750     SUBD @PLAYER-10
750     BEQ @NO
750     LDX #PLAYER-12
750     STB #PLAYER-4
750 @NO
750     LDB #PLAYER-11
750     ANDB #31
750     STB #PLAYER-1
750     LDY #@MTABLE+1
750     LDA @MTABLE
750 @ISIT
750     LDX A,Y
750     CMPX #PLAYER-12
750     BHI @NOT
750     STX #PLAYER-14
760     LEAX 288,X
760     CMPX #PLAYER-12
760     BLO @NOT
770     INCA
770     DECA
770     BNE @ISIT
770     RTS
770 @FLAZER
770     LDD @PLAYER-10
770     SUBD #5
770     STD @PLAYER-10
770     LDA @PLAYER-2
770     COMA
770     ANDA #31
770     CMPB @PLAYER-1
770     BNE @NOT
770     LDB @MTABLE
770     LDX B,Y
770     STX A,Y
770     SUBB #2
770     STB @MTABLE
770     LSRB
770     STB @MTABLE1
770     LDX @PLAYER-14
770     LDA #9
770     STA @PLAYER-1
770     LDD ##$AAAA
770 @BLANKM
770     STD ,X
770     LEAX 32,X
770     DEC @PLAYER-1
770     BNE @BLANKM
780     LDA @PLAYER-10
780     LDA ##AA
780 @FORF
780     STA ,X+
780     DEC @PLAYER-4
780     BNE @FORF
780     LDD ##200
780     STD @USCORE+7
780     RTS
790 @NOT
790     SUBA #2
790     BGT @ISIT
900     LDY #@THOMER+1
900     LDA @THOMER
900 @ISIT1
900     LDX A,Y
900     CMPX #PLAYER-12
900     BHI @NOT1
900     STX #PLAYER-14
900     LEAX 288,X
900     CMPX #PLAYER-12
900     BLO @NOT1
910     INCA
910     LDB A,Y
910     DECA
910     ANDB #31
910     CMPB @PLAYER-1
910     BEQ @RIT1
910     INCB
910     CMPB @PLAYER-1
910     BEQ @RIT1
910     BRA @NOT1
910 @RIT1
910     LDB @THOMER
910     LDX B,Y
910     STX A,Y
910     SUBB #2
910     STB @THOMER
920     LDX @PLAYER-10
920     LDA ##AA
920 @FORF1
920     STA ,X+
920     DEC @PLAYER-4
920     BNE @FORF1
920     LDA #9
920     STA @PLAYER-1
920     LDD ##$AAAA
920     LDX @PLAYER-14
920 @BLANKH
920     STD ,X
920     LEAX 32,X
920     DEC @PLAYER-1
920     BNE @BLANKH
920     LDD ##500
920     STD @USCORE+7
920     RTS
930 @NOT1
930     SUBA #2
930     BGT @ISIT1
940     LDY @PLAYER-12
940     LDA ,Y
940     LDB #18
940     LDX #@METOR
940 @DO
940     CMPA ,X+
940     BEQ @FOUND1
940     DECB
940     BNE @DO
```





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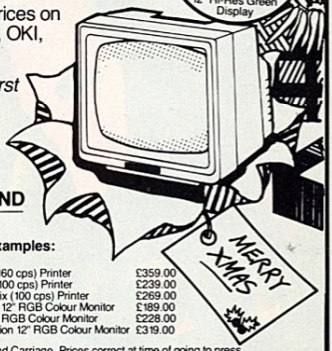
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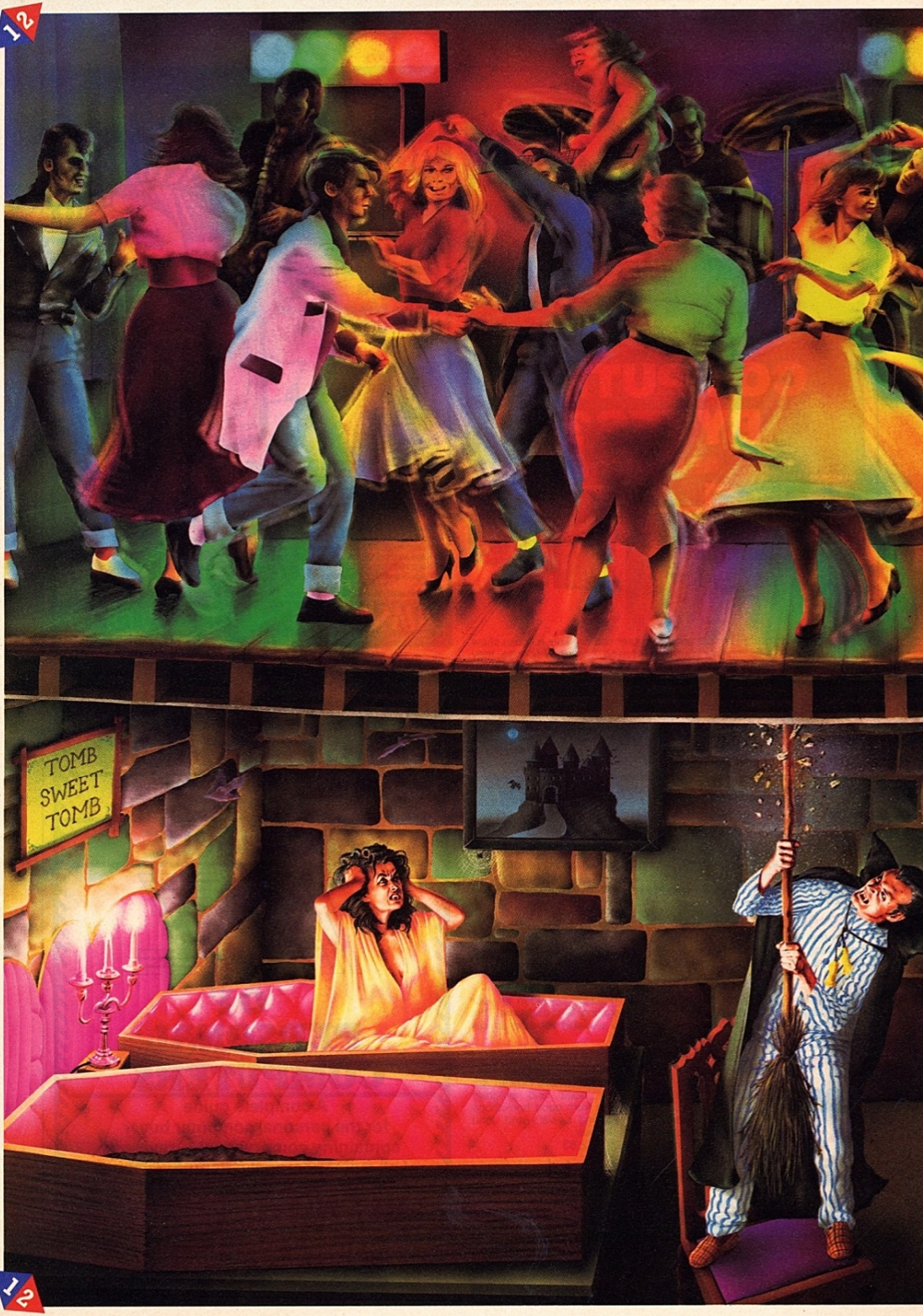
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Twice the fun with two on one.

Bill Davies looks at a new contender in the budget printing field — the Tandy TP-10.

A little print

Tandy's recently released TP-10 printer will interest anyone with an RS232 serial interface.

Not only is the TP-10 widely compatible, it's also cheap. £79.95 will buy you surprisingly good thermal print quality on 4.5 inch paper with 32 characters per line. It's ideal for the production of clear program listings and should especially appeal to Spectrum/Interface 1 owners looking for a reliable and higher-quality replacement for the ZX Printer.

Like most Tandy products it comes in a cardboard container with polystyrene supports. Enclosed with the machine is a power cord and a 13 amp three pin plug.

One look at the instruction book will alert you to the fact that this is an economy machine. The well-written manual is A5 size instead of the normal A4 and contains only 27 pages.

The printer is small, 210mm × 150mm × 80mm, and weighs only 1.5kg (just over 3 pounds). It has an off-white rigid plastic case with a transparent smoked plastic hinged lid.

The TP-10 has the ability to print a 96 ASCII character set, plus 12 graphics characters. The 4.5in paper width restricts the print width to only 32 characters per line. The TP-10 has software-controlled access to character and graphics, elongation and repeat function.

The printer has only a serial RS232 interface, but this shouldn't produce too many problems if your computer has the standard connections. Obviously, the machine is designed to interface with the Tandy computers — the new MC-10 or the older, larger Colour Computer. However, Dragon owners used to compatibility between Dragon and Tandy hardware should remember the Dragon does not support a serial interface.

The printer should work with many other popular computers, such as the Aquarius, Spectrum with interface, Colour Genie and so on, but the BBC is unsuitable without a special 5-pin plug to go into the RS423 port.

The printer's only controls are an on/off switch which is located at the side of the machine and a paper feed touch-sensitive button at the front. There is a power LED on/off indicator.

Loading paper into the TP-10 is fairly simple, although the manual points out some do's and dont's. It warns the user to feed the paper into the machine straight to avoid paper jams and that care must be taken in clearing a paper jam, since any paper remaining in the printer means disassembling the machine to clear it. The white heat-sensitive paper also has to be loaded the correct way round.

To load you must place the roll of paper in the printer, turn the power on, and then use the paper feed button first to feed on, and then to feed the paper through the slot and round the platen. Once in the machine, the paper is protected by a plastic top.

Switching on the power and pressing the paper feed at the same time will give you your first chance to see the character set.

The limitations of the 32 character width are immediately obvious, but the print is clear and easy to read. The characters produced by the machine are standard 5×7 dot matrix which gives you a normal ten characters per inch. The elongated character set is exactly double. The graphics set is made up of a 7×12 dot matrix, again with 32 characters per line. If a line contains both elongated and normal characters the printer will not split up an elongated character when it appears at the end of a line.

The printer is limited in its operations to those described above, so it only recognises limited printer control codes, line feed, carriage return, large/normal print graphics etc. Trying to send anything else only causes it to print out some spurious character.

The printing speed of 30 cps is a little slow, but it is unlikely that you will be using it for any serious application which may require a faster print speed. It is almost silent in operation.

Obviously the paper is heat sensitive. Many people were caught last summer because they left their printouts near a window and heat of the sun erased all their hard work. As yet no-one has come up with a solution to this.

The TP-10 is very good for limited printing: it's a godsend, for instance, if you don't want to invest in a more expensive, more sophisticated printer just for program listings.

Because it uses white paper the print is easy to read and its quality is good for the price. At £79.95 the TP-10 is very competitive, but be warned that the special paper rolls can prove expensive — at £2.79 for two rolls you could soon find yourself paying out lots of money.

Item Thermal Printer **Model** TP-10 **Manufacturer** Tandy Corporation, Bilston Road, Wednesbury, W Midlands **Outlets** Tandy retail stores **Price** £79.95 (inc VAT).



Tandy's new small printer is ideal if your printing requirements are limited.

Now you can use a joystick with any Spectrum game. Roger Howorth reports.

Give it some stick

Unlike many joystick/interface combinations currently available for the Spectrum, the Cambridge Computing device is software programmable. What this means is that rather than the interface being pre-configured for a certain combination of keys, the Cambridge interface has to be 'programmed' before you can use it. This is easy enough as each interface is supplied with a program that does just that.

The advantage of a set-up like this is that you can use this interface with any game (or whatever else), even if the writer made no allowance for the use of joysticks.

Interface and software are sold for £24, and the joystick itself costs £7. Together they cost £29.90. It isn't the cheapest of systems, but it's certainly one of the most flexible. If you bought just the interface, you could plug into it any joystick with a standard nine pin 'D' connector.

The Cambridge Computing Joystick isn't particularly beautiful — nor is it the easiest of joysticks to use. On the other hand it is cheap to buy, and it features two independent 'fire' buttons. This can make the difference between a joystick being worthwhile or not for some applications.

The device is fairly comfortable to hold, which is fortunate as it isn't the sort that can be stuck down with suction cups. The problem with it is that you need to be very precise with the stick's positioning in order to get it to respond correctly; for example, it is easy to think you are moving directly upwards, but in fact be moving in an up/right direction.

While on some programs this operator error could be seen and corrected immediately, others, particularly games, may not make this deviation obvious until it's too late (and the galaxy lost).

However you can use any Atari-type joystick, so you are not a hostage to your interface if this problem really bothers you.

The interface

The interface is a neat black box that sits on the back of your Spectrum, RAMpack style. However, it is so designed that it doesn't seem susceptible to 'wobble' problems. The only connections present are one nine pin 'D' connector for your joystick and the rear edge connector to hook up to the computer. The interface also has its own rear edge connector which duplicates the Spectrum's and so allows you to use other peripherals at the same time.

As with all devices that link into the computer's 'bus', you must only connect or disconnect the interface with the computer turned off.

The software

As mentioned in the introduction, the interface is programmable, which of course means you must tell it which keys to emulate, before it and the joystick can be of any use. You could do this directly from the keyboard with a series of 'OUT' commands, or, more simply via the program supplied by Cambridge with every interface.

This program is called 'joy' which is ironic, as using it is pretty boring. To be fair, it's not required to be fun, as it is a utility after all.

The program is mainly Basic, with a tiny piece of machine code. It's fully menu-driven and is very well error trapped. In fact, it's so well error trapped that you're forever ploughing through 'are you sure' type questions.

Naturally, with all this protection, it is impossible to accidentally crash and the program does its job very well, even if it does seem a bit over the top.

You can list it, which means it's fairly simple to find out how to program the interface directly from your own programs.

Another useful feature of this program is that it keeps a library of the different games that you've used with the interface, so that having programmed the interface once for a particular game (and SAVEd 'joy' with the new library) you need only to tell it to prepare the interface for game X in future.



Verdict

This system is slightly more expensive than most, but its advantages are both obvious and real. With systems like this you're not dependent on software suppliers making their games compatible with your joystick — in fact you can just as easily use it with a game that doesn't use joysticks at all. While it's programmable, the interface doesn't use up any of your computer's memory as it has its own (1K) RAM built in. The interface seems reliable and though the Sinclair Interface 2 will probably become the joystick interface standard, and thus theoretically remove the need for a product like this, it will take some time to happen and won't help you with any of your existing software. And, lastly, Cambridge's allowance for two independent fire buttons is a big bonus that few other interfaces offer.

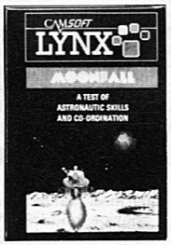
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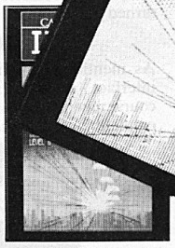
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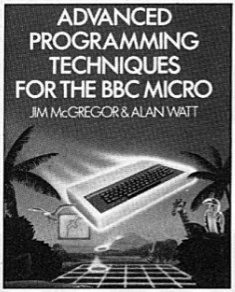
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Which book would your micro want you to buy? *PCN*'s review page helps you choose.



'Advanced Programming Techniques for the BBC Micro' by Jim McGregor and Alan Watt from Addison-Wesley Publishing Company at £7.95 (paperback 376 pages)

This is the follow-up companion book to *The BBC Micro, Basic, Sound, and Graphics,* from the same publishers, also by McGregor and Watt. Even though you may not have been introduced to its predecessor, this most recent work does not directly rely upon the preceding volume.

Interestingly enough all the programs are executed entirely in Basic, with not even the slightest digression into machine code. Although some specific parts of the BBC Basic language are explained, an ongoing relationship with writing Basic programs of one sort or another is required.

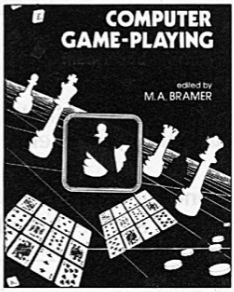
However, the authors argue strongly for the modern method of writing programs, with 'top-down' structures and 'modular' techniques. Avoidance of GOTO and GOSUB instructions is their motto, and indeed, every one of the example programs is constructed entirely free from pollution by G*T* and G*S**!

Wrinkled old 'standard Basic' programmers may develop palpitations at the thought of saying things like REPEAT, UNTIL, and PROC, or, what's worse, allowing a finished program to be even slightly readable. However, such are the ways of progress, and if you haven't fully rid yourself of any bad habits by the time you finish this book, shame on you!

The book is usefully laid out. In this case it is not absolutely necessary to proceed in the usual 'start-to-finish' manner through the text. Chapters are relatively self-contained, and do not greatly overlap each other. You may start with sorting and indexing, or automatic music composition, or a language interpreter, or even hurl yourself boldly into recursion.

Simple 'how-it-works' explanations accompany most of the complete examples, although numerous exercises are left incomplete, in the best tradition of educational texts. The printed pages have actually been produced with the aid of a somewhat conservative word-processing program and daisy-wheel printer (as a few amputated paragraphs attest), so hopefully the example programs are at least free of 'typos'.

Software cassettes are available.



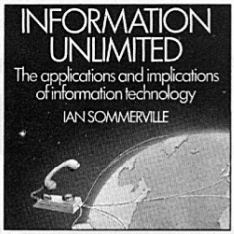
'Computer Game—playing theory and practice' edited by MA Bramer published by Ellis Horwood at £25, distributed by John Wiley (hardback, 306 pages).

To set the record straight from the start it is worth quoting the stated readership for this book: 'Professional, academic and research workers and advanced students in computer science, artificial intelligence, and cognitive philosophy. Also the interested home computer hobbyist.'

It is the latest in the Ellis Horwood Artificial Intelligence series, and comprises a collection of articles by international experts on artificial intelligence. The fact that this has been done while maintaining a coherent structure is a tribute to Mr Bramer's editing.

The book is certainly a challenge to the intellect; when programs are decided upon (or the ideas for them), they tend to be aimed at list processing and symbol manipulation languages like Lisp and Prolog. There's no talk of everyday languages like Basic, though some ideas could be programmed in Pascal.

Academically interesting and stimulating, I can't see this book capturing the imagination of the average home hobbyist, especially since it costs £25, but it would be a valuable addition to a student's library. **PL**



'Information Unlimited: the applications and implications of information technology' by Ian Sommerville, published by Addison-Wesley at £6.95 (paperback, 192 pages).

This is one of those 'computers and society' books, written for the interested lay-person who knows something important is going on and wants to know what it is.

There is a sensible mix of sociological passages on the 'automation of man' and such like, along with the more down-to-earth information on making microchips, text and television and so on.

Unfortunately, the book is somewhat marred by the classy covers not fulfilling their promise of nice production between them. It seems to have been type-set on a daisywheel printer—a small point, perhaps, but an annoying bit of cost-cutting.

Information Unlimited is not as pro-technology gung-ho as the title might suggest. The author is refreshingly restrained on topics such as artificial intelligence and pours cold water on the idea we're all doomed to pledge everlasting fealty to the intelligent computer god at the big AI breakthrough.

The author seems to know his topic and the writing style, if not exactly the bounciest I've encountered, is at least concise and informative. All the topics of great moment are discussed at a level consistent with the presumed 'lay' status of the target readership. This should provide good reading for anyone wanting to understand where we're all headed. **IS**

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CHOOSING A HOME MICRO

WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

"DON'T LET THE ADD ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost.
These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums.
e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit.
Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited.
Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution.
Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications: very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU. If it is less than 32K think again, is it enough?

● Computer Language

It is too dificult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest.
A de facto standard in the computer industry is Microsoft BASIC.
Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you; able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money.

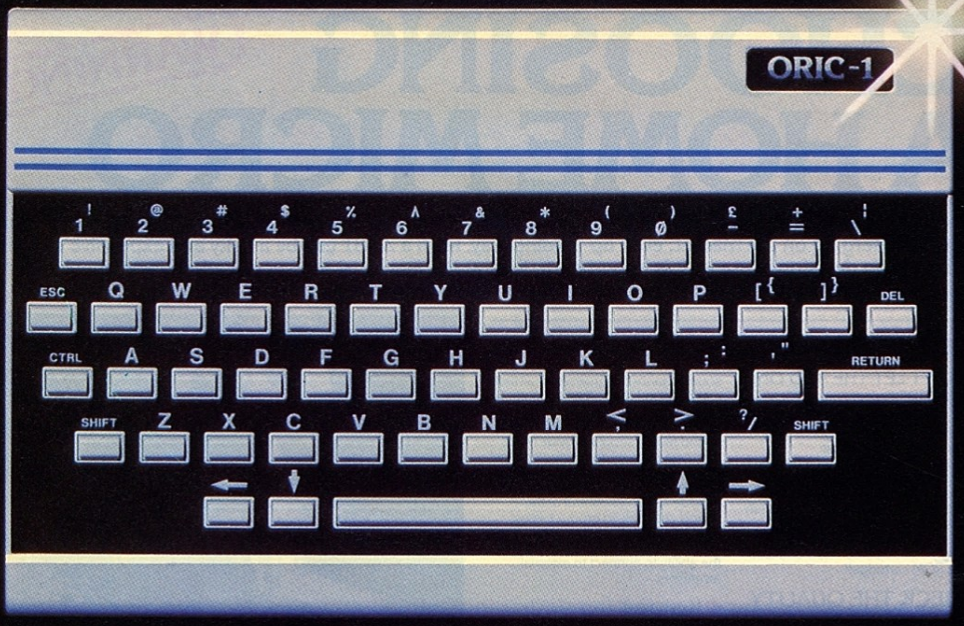


Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

To find out which company offers you the right choice, with:-

- Good value, high specification, quality micros.
- A quality, 4 colour, plain paper printer/ plotter.
- Communications Modem.
- Micro Disk Drives.
- Comprehensive and growing range of software

TURNOVER... →



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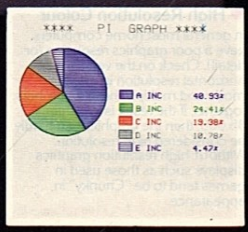
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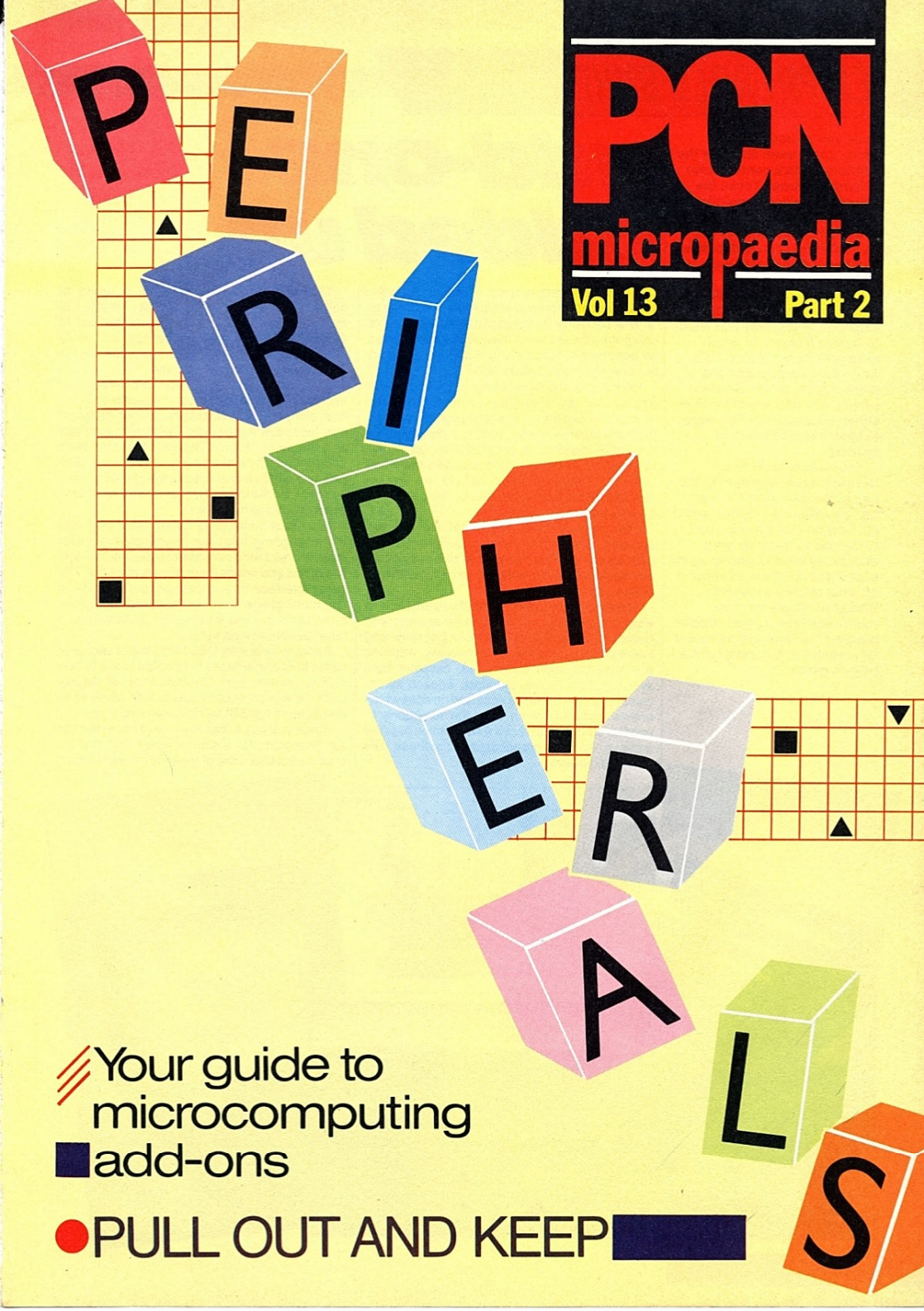
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PCN micropaedia

Vol 13 Part 2

Your guide to microcomputing add-ons

PULL OUT AND KEEP

add-ons added up

Once you've bought your micro, you'll soon discover the purchase of that central piece of hardware wasn't even the half of it. You'll start learning about the capabilities of your chosen machine, and as you go you'll find you want to do a number of things that require add-ons.

You may want to handle large quantities of data, for example, or you may just want to handle it faster, in which case you'll need a disk drive. And you'll want some hard copy output, so you'll need a printer. Not just any old printer either, because you may want to have a specific kind of printout.

You're also likely to be having trouble negotiating the use of the domestic TV — so can you afford a monitor, and if so, how do you choose one? Once you've got it all, your micro may want to phone up its mates and tell them all about it, so what about a modem? What's available for your micro, and how do you choose the best? All this and more will be revealed in our peripherals buyers guide.

Microcomputers are not very useful without other pieces of equipment for them to control or be controlled by. In the world of computers these pieces of equipment are known as peripherals; a clumsy and unfortunate term but one which we're stuck with.

Peripherals aren't just things which you add on as a luxury or afterthought as the term may imply. In a technical sense just about everything apart from the processor chip itself is a peripheral — the RAM memory is a peripheral, as is the keyboard, the various interfaces and the video circuitry. These features instruct or are instructed by the logic produced by the processor and the software.

This section deals with what we will call add-ons. Add-ons are always peripherals, but they are peripherals of a special kind in that they are designed to be optional extras, hardware enhancements.

They are the bits of equipment you are likely to want to buy once you have come to grips with Basic programming and are looking for new and interesting ways to use your machine. Add-ons are products such as printers, cassette tape systems, disk drives, monitors, speech synthesisers, graphic input devices and devices which enable communication over the telephone to another computer or receive information over the airways from a broadcasting database like Oracle or Ceefax.

This Micropaedia will look at a range of off-the-shelf peripherals for a variety of machines and give you an idea of the sort of things you can buy, what you can use them to do and what you should look out for when you're deciding which item to purchase.

In many cases an add-on will require an interface to enable it to communicate with the host computer. The two most common standard interfaces are the parallel Centronics interface and the serial RS232. Parallel interfaces send information a byte at a time down a ribbon cable (the bits which make bytes travel in rows like a line of cars driving side by side down a multi-lane roadway during rush-hour).

The serial interface is rather like a one lane off-ramp going from our imaginary multi-lane road. It straightens our rows of bytes into a single line of bits and sends them off one at a time. The serial interface is a necessary prerequisite to communicating over a telephone line, though it is often used to send information to printers and other peripherals as well.

A computer like the BBC Micro is well endowed with a host of interfaces to enable it to talk to disk drives, printers and different sorts of display units. However, in comparison with many of its competitors the BBC is an expensive micro.

When you buy a less expensive micro like the ZX Spectrum, for instance, you'll find that it's cheap because most of these I/O (input/output)



features have been left out of the design. To compensate, the cheaper machines often have an edge connector. This is really just an extension to the micro's bus (the parallel pathway taken by the data around the circuit board).

With the provision of the edge connector, Sinclair Research was able to offer add-ons like the ZX printer, Interface 1 and Interface 2. But the problem with this approach is that the user is limited to add-ons which are specifically designed to be used with a particular computer. You can't (without expensive adaptions) use the ZX Printer with other computers, and you can't use just any old printer with the Spectrum. It wasn't long, therefore, before independent manufacturers were producing what are known as standard interfaces as add-ons for the Spectrum so that users could configure and use a wide range of standard add-ons, especially printers.

But even hobbyist computers with interfaces can suffer from compatibility problems. Commodore owners, for instance, will be well aware that the interfaces on their machines are not industry standard ones, and they are therefore limited to buying printers and disk drives from Commodore. So it's not surprising that there are several interface adaption units now on the market that enable the Commodore interfaces to communicate with standard printers.

Joysticks are becoming especially popular add-ons for most machines. Many computer manufacturers seem to have been caught napping, under-estimating the interest in action games. Providing the necessaries has often fallen on third-party manufacturers. The Spectrum, especially, has been deluged with various joysticks and interfaces to control them.

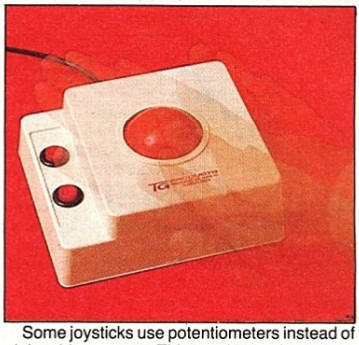


Again, especially with the Spectrum, the problems concerning standards comes to the fore. Fortunately, Sinclair has now released its Interface 2 for the Spectrum. This unit, which plugs onto the edge connector, allows you to plug in standard joysticks. It also has a games cartridge slot for Sinclair's own range of games.

The importance of Interface 2, is it will enforce a standard on software writers. Before Sinclair's release the different controllers available had different ways of controlling the screen action, so a game written with one set of joystick routines wouldn't necessarily run with another.

Most of the games produced for machines without joysticks as standard were configured to use a combination of key depressions to control the action on-screen. So some of the joystick controllers on offer get you to configure them so they know which key is supposed to be depressed and send the program the character string it's looking for.

On other machines the joystick controller is no problem. On the BBC, Atari, Commodore and so on there are joystick ports as standard. But users are not limited to simply using the joysticks on offer from the manufacturer as there are a bewildering variety of custom sticks available from the third-party people.



Some joysticks use potentiometers instead of plain old contacts. This tends to give you a greater degree of precision. Some sticks have been designed to be hand-held, with the stick on top of a pistol grip handle and a trigger as the fire button. Others are table-top types, also with a pistol-grip but with a button on the top for the thumb to fire.

Some games controllers aren't joysticks at all. The Apple, for instance, can be fitted with a track-ball device instead of a joystick.

Communications is another popular area to expand your machine into. The costs of the devices necessary to hook yourself into the telephone network are coming down in price rapidly as chip manufacturers produce the wherewithal to do it on smaller and smaller slivers of silicon.

What you normally need is an RS232 and a modem. The modem can be either directly or acoustically coupled. The attractions of the modem have increased recently with the establishment of Micronet, a specialist information provider on Prestel which gives the latest micro news and provides a large array of free software which can be downloaded by its subscribers.

Whatever the sorts of add-ons you wish to acquire, the most important consideration is that of compatibility. As you can see from the run-down above, compatibility (or lack of it) is the thing which probably promotes the most nail-biting among users.

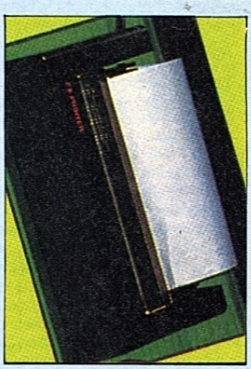
This consideration applies most of all to storage. There have been some wonderful and innovative storage devices touted recently. Unfortunately, these are of much less use to the average punter if they are not widely supported by the people who produce the software. In many cases it will be impossible to move your existent games and commercial programs across to your new media as the programs will be protected.

With add-ons, get assurances that they are going to do the job for which you require them *before* money changes hands.

Interfacing is a crucial question for the micro owner. A cheap micro like the Spectrum is cheap partly because it doesn't have a range of interfaces built in. You can buy interfaces for it, both Centronics and RS232, but if you just have the basic machine the only printer you can connect it to is the ZX Printer, which is cheap, cheerful, and a shade illegible.

With a BBC, on the other hand, you get RS232 and Centronics interfaces built in, so you can hook it up to an Epson, say, or the Shinwa CP80 quite easily.

The same principle applies to other add-ons, such as joysticks, disk drives and monitors, so if you want to hook your micro up to a lot of things, and you have one of the machines that is short on interfacing, your first step is to get some.





Printers probably offer the most diverse range of choices to people who want to do a spot of adding on. They can be divided roughly into three broad categories.

The most popular type of printer is probably the dot matrix. This uses a column of tiny wires which punch through ribbon creating each character as a matrix of dots. This technology produces the best possible of all printer worlds, with fairly high-quality results when printing text, the possibility (with the right software) of doing graphical output and a reasonable speed and price to cap the package off.

Dot matrix printers usually achieve at least 40 cps (characters per second), and more outlay will get one which can do up to 160 or more cps. Most hobbyists would probably find 40 to 80 cps quite adequate. Printers with this sort of speed and reasonable flexibility can now be bought for between £200 and £300.

Although dot matrix text is eminently readable, it's not thought to be quite up to the standard of the traditional typewriter-type of output, which of course uses solid moulded characters stamped through a ribbon to create a precise character image.

To cater for people who plan to use their printers mostly for turning out letters there is a category of printers called daisy-wheels. These are basically typewriters designed to be used by computers.

Enough print arms to support the alphabet and various special symbols radiate from a central hub. The wheel is rotated back and forth so that the desired character appears under a hammer which then strikes the moulded character through a ribbon and imprints it on the paper. The assembly containing the wheel and hammer is drawn back and forth across the page as the paper is fed through the mechanism.

Unlike dot matrix printers, which use a tractor mechanism to feed through continuous paper, the daisywheel is usually set up to accept single sheets. Because it's a very mechanical device it's also slower than a dot matrix when it's priced in a similar bracket. Money will buy you a fast daisy, but it is usually a lot of money.

There are now a few daisies under £500, and these tend to plod along at about 12 to 15 cps — usually enough time to walk around the block while a reasonably sized piece of text is being printed out. Considering the noise a lot of them make, this might not be a bad idea.

There is a third category of printers which we can call 'alternative technologies'. These are usually either electrostatic or thermal. As a rule, if you get rid of as many precision moving parts as possible you keep the price down. These printers often cost around £100 or less) like Sinclair's ZX Printer, an electrostatic printer which selectively burns a special coated paper as it passes through.

Tandy has just released the TP 10, a thermal printer, which achieves much the same result by applying heated elements to special paper. These printers usually work on narrow rolls of paper, and are targeted at users who only want to have a hard-copy of listings and dabble with a few graphics.

There is no 'best of all worlds' in buying a printer. Without spending a gigantic amount of money you are going to lose out on either print quality, graphics ability or speed — it's very difficult to get all three together. The following examples are typical of what's available on the market. The different capabilities will give you an idea of what you should look for in the printer you require.

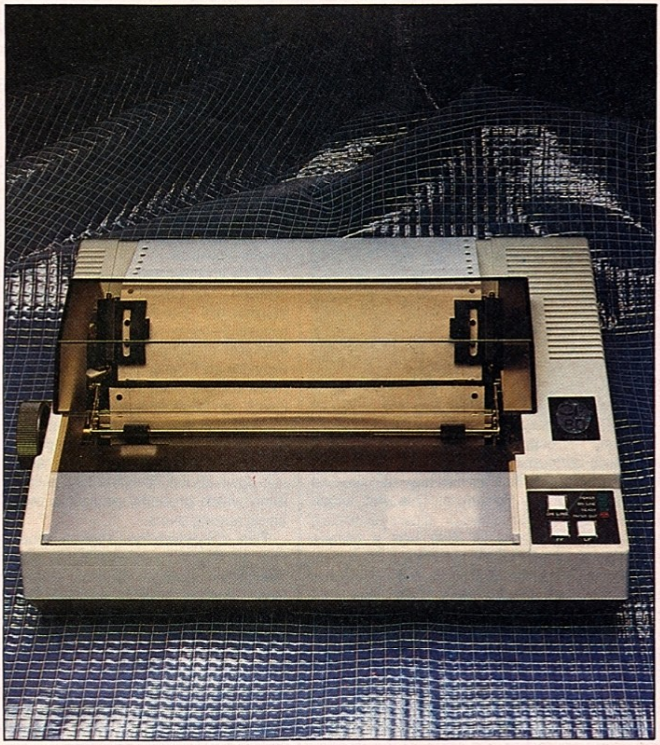
The CP 80 should serve as a similar pointer to the dot matrix market. We think it's a particularly nice little printer and it is competitively priced.

The first thing you notice about the CP 80 is that it is light and fairly small. The second thing you notice is that the paper is fed in by the tractors from the rear of the printer rather than dragged out once it's been printed. This seems to work without a hitch, and enables you to start a new lot of continuous paper without wasting a piece by feeding it into the tractor mechanism.

This printer has both a tractor and normal typewriter-type rollers, so you can use single sheets of paper as well.

There is the normal clutch of buttons and warning lights. The printer is capable of about 80 cps. Another interesting feature is its carbon film ribbon which is slightly more expensive than your normal dot matrix ribbons, but this drawback has been allowed for by the manufacturers. The penny pinchers among us are able to change the ribbon in the cartridge up to 4 times instead of throwing the cartridge away. This ribbon gives very sharp and dense text.

The dip switches are inside the machine. Using these and the control codes you are able to do such things as choose between normal, enlarged, condensed, emphasised, double strike, subscript, superscript and underline typestyles. You can switch the character set to italics, and do bit image graphics superscripts, subscripts, alter line spacing in 216ths of an inch, change the form length and the line length and line spacing.



When the Juki 6100 Daisywheel printer was released in May 1983, it caused as much of a stir in the industry as any printer is likely to cause. Here was a daisywheel with lots of nice features, high-quality print, and all for a price of just £399. Previously you would have been shelling out at least twice as much for a printer of similar quality.

The Juki can provide you with a benchmark. You are unlikely to find anything much cheaper with the same features. If you look at more expensive daisies you can work out for yourself whether their features are worth the extra cost to you.

The Juki uses standard Triumph Adler daisywheels and IBM ribbons. It's a plodder, not a racer, and churns along at about 17 cps. In doing this, however, it tends to make a high pitched whining noise which is minimised to some extent by lots of insulation on the interior casing — still, you can't have everything. The maximum paper width is 13 inches and this can be fed in sheet form or you can use continuous stationery if you're that way inclined.

The pitch (that's the number of characters per inch) can be varied between 10, 12 and 15. You can buy a wide selection of wheels featuring different typefaces and different pitch sizes.

The all-important dip switches (there are 10) control the automatic line feed, form length (it can be 11 or 12 inches) and the number of lines per inch (6 or 8). You can specify continuous or cut paper.

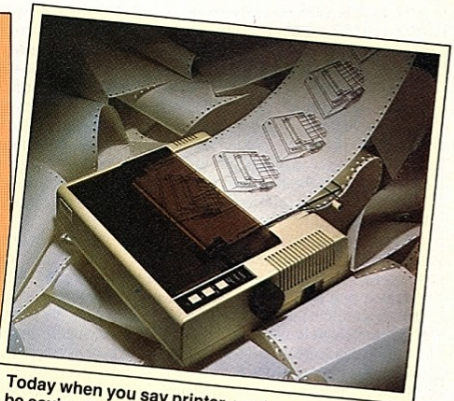
In addition to the dip switches, of course, there is a big selection of control codes. They enable you, among other things, to backspace by one column, do an upward or downward paper feed and to insert sub or superscripts. You can do bold or shadow printing, set the left and right margins as well as the top and bottom and you can get the printer to print its extra symbols on the daisywheel.



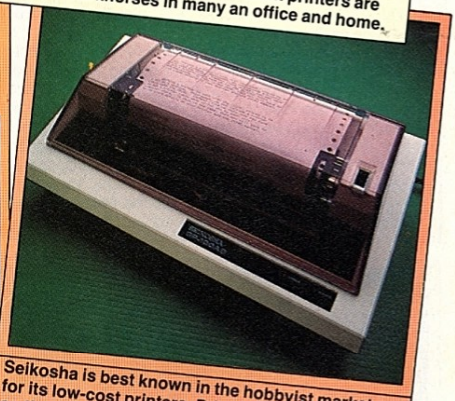
The Juki 6100 was something of an advance for daisywheel printers when it came out in the early Summer. At around £450 it brings the cost of letter quality daisywheel printers within striking distance of dot matrix.

It's fairly good for the price, and importantly for daisywheel printers, is relatively quiet. Overall it's a highly creditable debut in the printer market for Juki.





Today when you say printer, you're very likely to be saying Epson. The Epson matrix printers are reliable workhorses in many an office and home.



Seikosha is best known in the hobbyist market for its low-cost printers. Print quality isn't as easy on the eye as more expensive models, but they're still excellent value.



Mannesman Tally printers tend to be more upmarket, but the company does also sell the MT80, which is aimed more at the Epson end of the market.

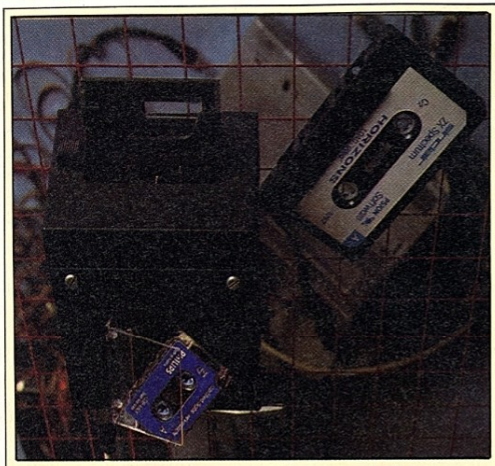
Storage is a vexing problem for the low-cost micros. By their very precise mechanical nature, magnetic storage devices must be priced at a level which usually puts them completely out of the scale with the micros at the bottom end of the market. It's difficult to justify linking up a full-scale disk system costing several hundred pounds to a £99 Spectrum, for instance.

Yet cassette tape storage is so slow and inefficient, that there have been many attempts to find a middle course between the cost of a floppy disk system with all its random access and variable length file-handling capabilities and the out-of-depth domestic cassette tape recorder, which, after all, was designed to play analogue music tapes.

Despite the problems, however, prices in the disk drive area are falling, due mostly to increased volume and more streamlined distribution methods. There are, after all, a lot of Dragons and BBCs out in the field and last year's computer buyers are often this year's disk drive purchasers. It is possible to buy single 40 track drives below £200 now, but the chances are that this particular technology is not going to get much cheaper in the near future.

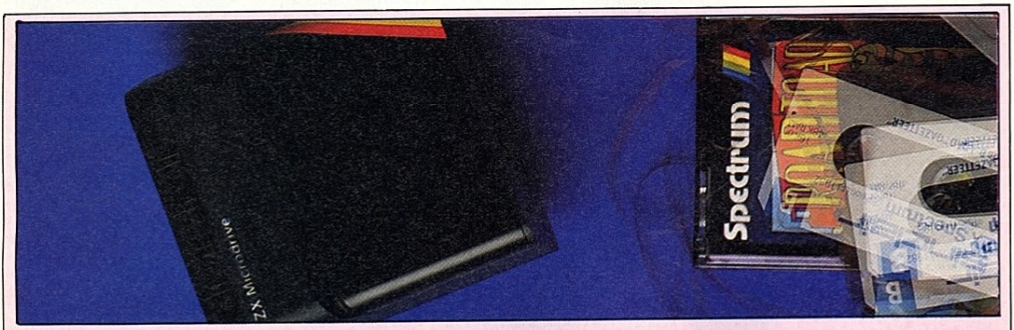
Disk drive buyers must pay careful attention to the details concerning compatibility with existing disk operating sytems and disk interfaces. The point is that a disk drive is only really useful if it gives you access to a wealth of off-the-shelf disk-based software.

Always seek assurance that the program you want to run will be formatted for the drives you are buying. And don't be too certain that you can save your existing tape-based games and programs to the disk. Many of these are protected by the program to make them unlistable so they can't be copied. What makes the floppy disk drives so expensive is the precision components necessary to rotate the disk at the correct speed and align it in the spindle at the correct angle. Then there is a stepper motor which must position the read/write head at exactly the right position over the disk as it spins.



The Hobbit was released earlier this year as a halfway house between disk and cassette for BBC users. It gains access to the BBC micro through the user port and uses Philips digital microcassettes to store data. Its operating system is housed on a ROM which goes into one of the free 'sideways' ROM sockets in the BBC.

Once installed, the operation of the drive is completely under software control. Data is loaded at about 750 bytes per second — much faster than a domestic tape recorder. It has a full set of file handling commands and operates in much the same way as a very slow disk drive.



When it comes to alternatives, the most successful so far must be Sinclair's Microdrives. The Microdrives can be used by the Spectrum with the addition of the Sinclair Interface 1. Instead of a disk, the drives house an endless tape cartridge, so there's no stepper motor and no finicky alignment problems. The tape is wound right through in about 10 seconds and because it's wound off the middle of its spindle and simultaneously wound back on the outside it's ready to go through again immediately. Because of the speed of the data tansfer (about 16 Kilobits per second) it can do a good job of simulating genuine random access. *ie* you can specify a file and the system will go through the tape reading all the information and keeping the relevant sectors in its memory.

Unlike a cassette tape system it has an operating system which allows it to maintain variable length files. If you save a file and then save another one or two after it, you have no way of increasing the length of the first or second file without saving a new version on another tape.

As with a disk, the Microdrive splits its media up into segments of 255 bytes and then splits up the file and writes them to as many of these segments as the length of the file requires. Then if you load the file and perhaps add more information to it, the operating system will simply save it to its former segments and any other free segments it can find on the tape. After you've been using the tape for some time loading, changing, resaving and deleting files, all the sectors of all the files will be scattered right over the length of the tape.

It's to be hoped that the Microdrive will be the forerunner to other such devices for other computers. At the moment it is only being sold by Sinclair on a strict rotation basis to mail-order purchasers of the Spectrum, but it shouldn't be long before it's readily available to one and all. Once this happens it's almost inevitable that enterprising concerns will engineer interfaces so that other machines can also take advantage of its cheap price.

Choosing a modem at the right price is becoming an easier proposition these days as the prices of the components which go into the things plummets for the manufacturers who put them together.

Modem stands for MODulator/DEModulator, and its task is to act as the go-between for the digital computer and the analogue telephone system. A modem takes the digital pulses that race around a computer and converts them into modulated tones that can be sent down a telephone line. The digital pulses first have to be straightened out by an RS232 interface into a serial form (one bit at a time).

If your computer has an RS232 interface it is a fairly straightforward task to put a communications system together. Most standard modems will plug straight in. If you haven't got any interfaces on your machine then the procedure is a little more problematic.

The Spectrum, for instance, now offers two fairly reliable routes to the wonderful world of telephone communication. The addition of Sinclair's Interface 1 (when it becomes generally available) will enable you to directly connect the necessaries as Interface 1 has its own RS232 interface.

Alternatively, Spectrum users can opt for the new VTX 5000 from Prism, which has built-in RS232 and software and plugs directly into the Spectrum's esge connector. For other machines there is rather more diversity.

There are dozens of standard modems on the market to choose from. Modems sort themselves out into two broad categories. These are acoustically coupled modems and hardwired or directly coupled modems.

As the name suggests the hardwired modem is plugged directly into the telephone network via a standard Telecom wall socket. The acoustically coupled modem attaches itself to the telephone's handset where a speaker in the coupler opposes the handset's mouthpiece and a microphone opposes the earpiece.

The acoustic coupler has the advantage of being more portable than the hardwired modem and, up until recently, seemed to be slightly more popular because the prices of the directly-wired variety were higher. This was presumably because of the stiff regulations placed in the way of directly connected modems. (Telephone companies are always wary of allowing items running off the mains to be attached to their expensive networks. Think of the damage a short-circuit could do by sending 240 volts into the telephone system).

Acoustic couplers can also suffer from background noise corrupting the data. Direct modems are often capable of dialing their own numbers and automatically receiving a call and accepting data.

Terms you will encounter when buying a modem are likely to include *half* and *full duplex*. Full duplex describes modems which are capable of simultaneously sending and receiving data. Why, you may ask, should a modem want to do this. It acts as a check on the integrity of the data being received at the other end. The full duplex computer receiving the data is immediately sending it back again to check its validity. The sending and receiving is done at different frequencies so that the data doesn't get tangled up.

Half duplex mode only sends data one way at a time. Because it is only using a single area on the bandwidth it is less likely to be the victim of interference. Most modems are now capable of both half and full duplex.

Baud rate is another bit of obscure jargon guaranteed to confuse and frustrate the budding communicator. Baud is a measure of the number of modulations per second (the modulations represent the binary code).

It's important to know what the baud rates of your likely digital correspondents will be before you purchase your modem, as you can't always select a full range of transmission or receive speeds, especially with the cheaper products. Micronet for instance, a micro enthusiast's database on Prestel, operates at 1200 baud receive and 75 send (from the user's point of view).





Prism Microproducts is at the forefront of the new generation of (mostly) hardwired modems. *PCN* recently reviewed its latest release, the VTX 5000, an all-in-one communications package for the edge connector of the Spectrum to enable it to hook up to Micronet. (Issue 30.)

Prism's general purpose hardwired modem costs £89.95, and we'll look at this to give you an idea of some of the features you should expect to get for the price, now that Prism has set a new standard in value for money.

Although it's been targeted at Prestel and Micronet, this is no ordinary Prestel modem. It does have the requisite 1200 receive/75 transmit baud rates for the service, but it also offers 1200 baud in half duplex, opening up the possibilities of micro-to-micro communication over the telephone system.

We tested this one on a BBC using the standard Micronet terminal software and it performed faultlessly. Don't pay more than £89.95.

The Prism VTX5000 modem for the Spectrum (top) is designed to hook the Spectrum up to Micronet 800. It's important because it's a cheap, hardwired modem that gives a mass market machine easy – and comprehensible – access to the outside world in the form of Micronet and Prestel.

Modems in general tend to be less accessible than this, but the idea is really that you can get your micro to talk to other micros over the phone.

Joysticks are a subject close to the hearts of many micro enthusiasts. It was (probably still is) widely predicted that action games would be a flash in the RAM phenomenon like the hoola hoop — a quick craze that will die out once users realise the joys of programming.

Indeed this seems to have been the thinking behind the Sinclair computers. Both the ZX81 and Spectrum were released without any type of joystick facility. The idea was that the users would learn how to do Basic programming, and their widespread success seemed to bear this idea out.

But it's probably true to say that the Spectrum and ZX81 sold despite their being stickless — because they were affordable while their games-playing competitors were out of reach.

It wasn't long, in the Spectrum's case, before manufacturers produced joystick controllers. Sinclair Research didn't take too long to cotton on as well, and released the Interface 2 about three months ago — it's reported to be selling well.

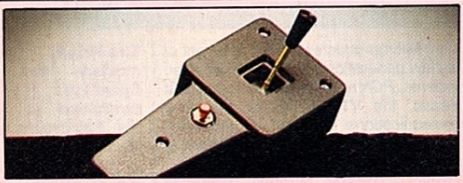
Most other micros have joystick facilities as standard. Those that don't, like the Spectrum, have at least one independent supplier of controllers.

But the good news with joysticks is that once the controller has been sorted out, compatibility isn't too much of a problem. Add-on joysticks for the portless computers seem to have settled on the 9-way D-Plug joystick socket arrangement.

Computers like the BBC and Dragon have their own separate plugs and sockets, but the computer manufacturers, for once, seem to have left the field open to the third-party manufacturers. At best they only make a token effort in providing their own joysticks which, if available, are usually fairly cheap and nasty. Sinclair hasn't even attempted to provide joysticks, just the controller with a D-socket so you can choose your own.

It's pretty easy to tell a good, rugged, well constructed joystick from a flimsy, liable-to-fall-to-pieces one. Ruggedisation (as the computer industry likes to call anything that prevent kit from disintegrating at the slightest excuse) is of prime importance when you're picking a joystick, especially if you're the excitable type and actually think you are repelling invaders.

Here are three joysticks which illustrate three basic approaches to the problems of controlling screen objects in a precise manner. All three are very solidly constructed and should stand a lot of abuse.



The Flight Link Joystick takes yet another approach with its potentiometer joystick. Instead of a mechanical assembly closing one or two of four contacts to return the appropriate character strings to the processor, the Flight Link has two potentiometers on a universal joint mechanism which sit at right angles to each other. The potentiometers fix the desired direction of movement by plotting an x/y co-ordinate according to the rotation of the potentiometers. To you or me, this means that there is no spring loading. Instead, the stick moves freely on its axis and stays where you leave it.

The stick itself is very small and you are required to be dainty rather than brutish to make the best use of the system. Thumb and forefinger rather than clenched fist is the way to handle this one. You can keep it on the table or hold it in your hand, and it's ruggedly constructed so you can probably drop it a few times as well.

Available from Flite Link Control (0420) 87241.



Kempston's Competition Pro is a good, solid family saloon type of joystick. Nothing flash or innovative here, just attention to detail and precise control.

The stick's 'throw' (the distance you have to move it to get things moving on screen) is very short, and this means that its base is capable of supporting the assembly without you having to tie up your remaining hand to prevent it toppling over as you dash to the other side of the screen to zap an alien. This also makes it extremely responsive.

Kempston claims the shaft is nylon covered steel, which sounds impressive. There's also a comfortable knob on top so you don't develop a permanent extension to your life line — often an unfortunate side-effect after extended playing with some of its angular competitors. The firing buttons are 'hair trigger' and the merest hint of push will set off whatever is supposed to be set off. The Kempston features a standard D-plug.

Available from Kempston (0234) 852997.



The Spectravision Quickshot changes the joystick recipe with a helicopter-style grip and a choice of fire buttons. Many people prefer this sort of grip to the more conventional Kempston type because it's easier to keep the whole assembly in the one position when you are playing.

Damage is done on screen by either the thumb or one of the fingers of your free hand. The Quickshot also proudly features what is described as a contour groove to give your free hand better purchase around the auxiliary fire button on the base. If all this doesn't keep the thing steady, you can resort to using the suction caps on the four corners.

Accuracy, again, is very good and the triggers are very responsive. Again the standard plug to suit Atari, Commodore, NEC and Spectrum (Interface 2).

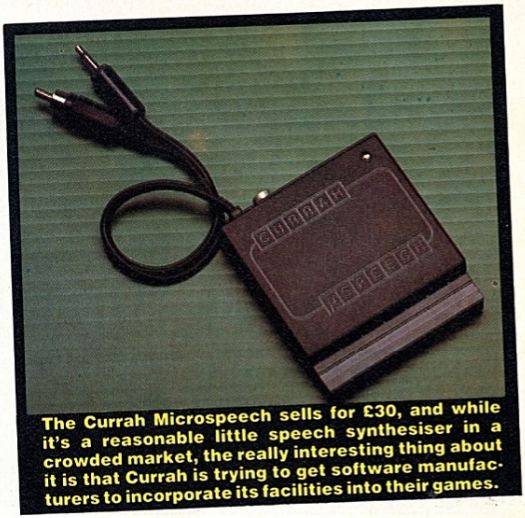
Available from most Atari and Commodore dealers.

Speech synthesisers are just starting to graduate from being experimental whizz-bang gadgets, with which you can amaze and delight your friends, to everyday features. Not run-of-the-mill you understand, but at least useful aids in their own right — especially to enhance the realism of games, both the action and adventure types.

They also appear regularly in educational-type products such as spelling aids.

Up until recently it was left up t o the users to program speech into their own programming creations. usually the user (listener) is given a couple of levels of entry into the system. At a basic level there is generally a set of tailor-made words in ROM which the user can just POKE into a program. These may include the letters of the alphabet and the numbers and perhaps a few Basic keywords.

Some synthesisers feature a second level. Here you can actually phonetically concoct your own words by typing allaphones. Allaphones are alphabetical symbols which stand for the 64 (yes only 64) distinct sounds we make when we talk. By combining allaphones with suitable pauses you can laboriously put your own words together. It gets better with practice and not surprisingly, even if you don't learn anything about computers doing it you do gain an understanding of speech. The slightest milli-second pause makes all the difference between a word making sense or sounding foreign.



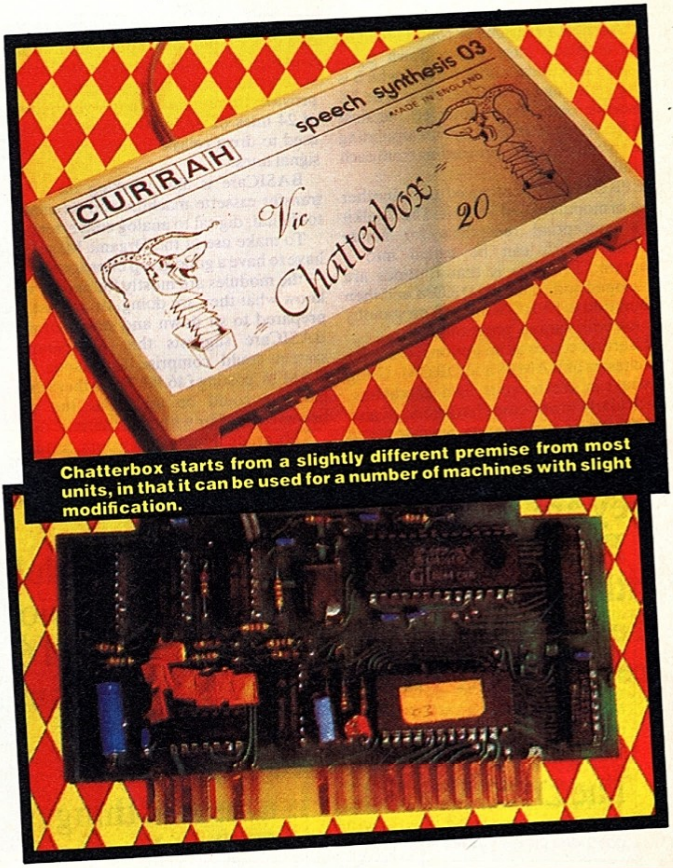
The Currah Microspeech sells for £30, and while it's a reasonable little speech synthesiser in a crowded market, the really interesting thing about it is that Currah is trying to get software manufacturers to incorporate its facilities into their games.

The Namel Supertalker is a good all-rounder. It can make use of phonemes, another form of coding the human voice's composite sounds, and it also has its own built in 550-word vocabulary.

It's also very versatile because, unlike many of the other products, it works through an RS232 interface and so can work with any micro which possesses RS232 output.

The Supertalker has its own processor and RAM, so you can download a custom vocabulary and call up the words you want when you want them.

Its sound comes from a built-in speaker driven by a small amplifier. Not the cheapest but certainly one of the best.



Chatterbox starts from a slightly different premise from most units, in that it can be used for a number of machines with slight modification.

The BBC Microcomputer, with all its extra nooks and crannies, can play host to a couple of ROM chips supplied by Acorn; which impersonate veteran newscaster Kenneth Kendall. No untidy black boxes for Acorn, Kenneth is tucked right out of sight and his voice comes through the BBC's built-in speaker.

You can access 165 words provided in the PHROM (Phrase Read Only Memory). To make up your own words you have access to what Acorn calls compound words, made up by combining two or more words from the 165 word vocabulary. Silent periods can also be generated.

You can write in assembly language straight to the processor, though this is a very tedious process and can use up a disproportionate amount of the already limited user RAM on the BBC, so most users will probably stick to the words provided.

The sound is recognisably Kenneth Kendall, though he does sound a little muffled.

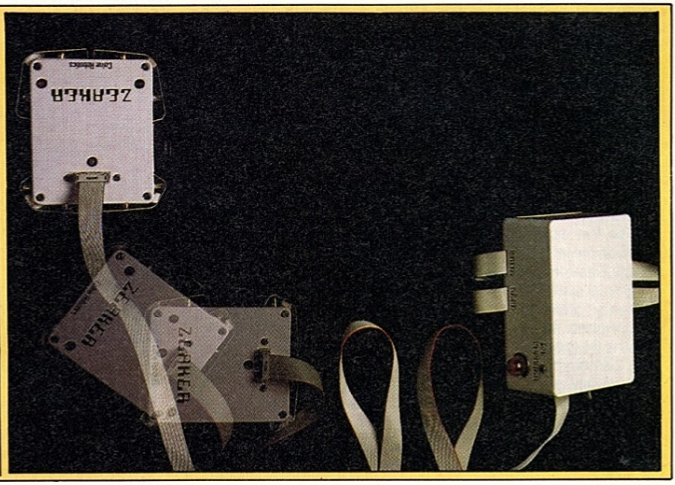
For the micro that has everything, you could do worse than buy it its own little robot. The Zeaker Turtle measures just 5in by 5in by 2in, and not only can it move around, it also has an artistic bent — in fact drawing on the floor is its forte.

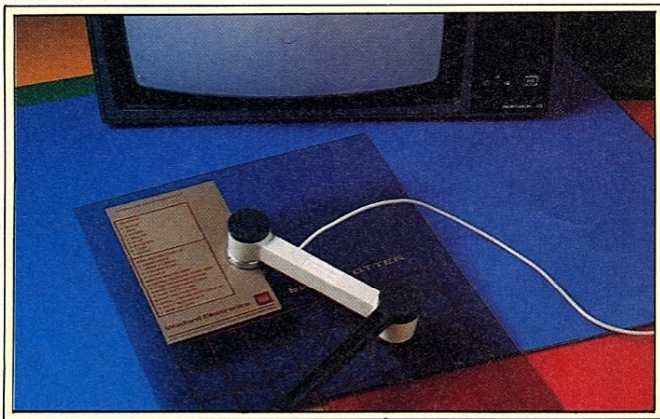
The Zeaker can work with the BBC, Spectrum or ZX81; the latter through special adaptions for the edge connector. You control it through a high-level language called Snail Logo. This gives you commands like Forward, Left, Right, Pen up, Pen down and soon on, and all this can be looped and repeated.

It's very simple, but it is fun to use and the beauty of it is that it provides the budding programmer with very positive and immediate feedback. You are actually getting something concrete happening through you own programming efforts.

The Zeaker can also turn out reasonable graphics — nothing like a plotter of course, but with care the results can be quite pleasing.

Contact Colne Robotics (01) 892 8197.





The Beebplotter is not what it sounds — it is for the BBC, but it's not a plotter — it can more accurately be described as a tracer.

It plots graphics onto the screen. It can work as a light pen, translating your free-hand sketches to the computer's memory. But it beats the light pen because it's also capable of tracing outline. If your drawing's like mine you'd rather lift someone else's artistic efforts in any case. It's ideal for copying maps or diagrams.

Beebplotter can be used in any of the BBC's graphics modes and it plugs into the analogue port. It supports a number of commands to do things like fill enclosed spaces with a specified colour. The results can be dumped to a Seikosha or Epson printer and your efforts can obviously be saved to disk or tape.

Contact Watford Electronics (0923) 40588.

What about a system that accepts voice commands for the Apple II? VIM (Voice Input Module) represents a major advance in packaging what was previously mainframe experimental technique on a tiny card at a relatively tiny price (£899 inc VAT). The card disappears into the Apple and the only obvious bit of hardware is a microphone.

You load up the requisite software and are ready to input. This is really a very sophicated device as it scans the sound waves we offer it as input at several frequencies and samples them at specific points in time.

You have to build up your own vocabulary of course, so that the thing knows what you're talking about. You type in a word and the system asks you to make the audio equivalent several times. Then it can get a good idea of how you are likely to say it .



Micropaedia Editor: Geof Wheelwright
Contributors: Ian Scales, John Lettice
Design: Nigel Wingrove

NEXT WEEK

To finish off our series of buyer's guides we will be looking at a range of 'popular software' – otherwise known as games. Just in time for the Christmas rush, you can choose your stocking fillers from our selection of games for the Spectrum, Dragon, BBC, Oric, ZX81, Vic-20 and Atari.

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

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					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
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

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					Distributor
			I-EEE	Centronics	20ma	RS232	Others ●	Others (+)																			Fan Fold	Roll	Cut Sheet	Tractor	Frictional	
Centronics 159/2	£881	M 9×7		●					N/A	768	6	5,8.18,10,16.36	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
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	£1,917	Daisywheel	+	+	+	●			19200	4000	6	10,12,15	24	141	17	52.8×37	13	6	●	●	●	●			●	●	●		●	●	●	I5
Olympia ESW103KSR	£1,263	Daisywheel	+	+	+	●			19200	4000	6	10,12,15	24	212	17	52.8×43.1	14.5	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
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
Printex 920	£2,012	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 III	£2,261	M 7×7				+	●		9600	1000	2,3,4,6,8,12	5,6,6.6,8.25,10,13.2,16.5	180	132	15	69.9×60.9	46.4	3	●						●	●	●		●			R1
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

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	15	515×542×136	10	3	●	●	●	●	●	●	●	●	●	●	●	●	●	M7
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	16	71.7×61	53	6			●		●		●	●	●			●		S4
Tandy TRS 80 DW2	£1,299	Daisywheel		●					9600	2000	6	10,12	43	163	16.5	62.4×20.4	27	4	●	●	●	●				●	●		●	●	●	S1
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	£1,898	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

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 8050	£1,029	1Mb	2	77	Soft	SS.DD	●									C2
Commodore 8250	£1,489	2Mb	2	154	Soft	DS.DD	●									C2
Commodore VIC 1541	£229	171K	1	35	Soft	SS.DD									●	C2
Control Data 9408	£221	250K	1	40	Both	SS.BD					●					C7
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
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 100-1	£158	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 disks	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

8" 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
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 Code
AD 1223	£287.50	D	1200	RS232		●			●		●	●	A6
AJ 311	£320	B	300	RS232		●			●	●	●	●	A5
AJ A211	£263	A	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
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
DXY 100	£699	Flat	1	A3	7	Centronics	R4
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
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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
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
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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
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W1 Walters Microsystems Int Ltd, High Wycombe 445175
X1 X-Data Ltd., Slough 723331
Z1 Zygal Dynamics, Bicester 3361

David Williams tries his hand at turning the BBC Micro into a musical instrument.

Roll over Beebhoven

The BBC computer has a better than average capability to reproduce sound. Anyone who has used many of the commercially produced games with the machine can only have been impressed with some of the music which has been used with the software. Three programs which have been released recently all give you the chance to try your hand at the ivories.

I know a little about music, but by no stretch of the imagination would I call myself a musician. My piano lessons foundered on the fourth grade, but I did have a solid musical education in other respects. I say all this because I started to review these programs with a little trepidation, but more than a passing interest.

All three of these new programs use the keyboard of the computer like a piano keyboard, but the approach differs slightly.

Beebsynth

This program comes on cassette and it loaded into the machine first time with no problems. I was a little disappointed with the written instructions that came with the program; they were all contained on one A4 sheet with a minimum of hits. However, to be fair, the manufacturer does state that the object of the program is to provide a very easy to use yet powerful sound generating program for expert and novice alike.

Unlike the other two programs, Beebsynth does not allow you to compose and record a tune. This, says the publisher, requires a user to know both musical theory and the ENVELOPE command. Just who is the program aimed at?

When run, the screen is filled with an envelope definer, using the cursor keys. This consists of a number of boxes, each of which controls a different aspect of the sound generated. On-screen HELP commands show you the way round the program, give you the option to alter and change the various sound envelopes. Pressing the space bar plays the sound.

A second screen can be generated which gives you a graphic keyboard. Using the qwerty keys it is then possible to use the predefined envelopes to produce sounds. You are encouraged to modify and change the program to your own requirements and to experiment.

Music Processor

Music Processor is a different kettle of fish. The program sets out to simulate a synthesiser. One display is used which packs the screen with information. A feature any cassette user will find useful is a digital counter which can be used to find items recorded on tape with drive indicators for all tape functions.

There is no keyboard display with the program, but the documentation is good and sounds can be entered using the qwerty keyboard. A nice touch is the ability to input expression into the sounds. This is because the envelope details are stored and displayed independently for each note.

In its basic form the program uses a lot of memory to store any one tune, and each note requires ten bytes. There is a long-play facility which compresses the storage and adds about half as much again. This means that you can store up to 3,250 notes in the 32K machine.

The program comes with three demonstration programs on cassette — including a very seasonal carol selection.

Synth

Again, there were no problems loading from cassette. The first on-screen option asks you if you want to record to disk.

The program comes in three parts, each of which chains from the other. The documentation was good and easy to follow, but the author also provides full on-screen instructions.

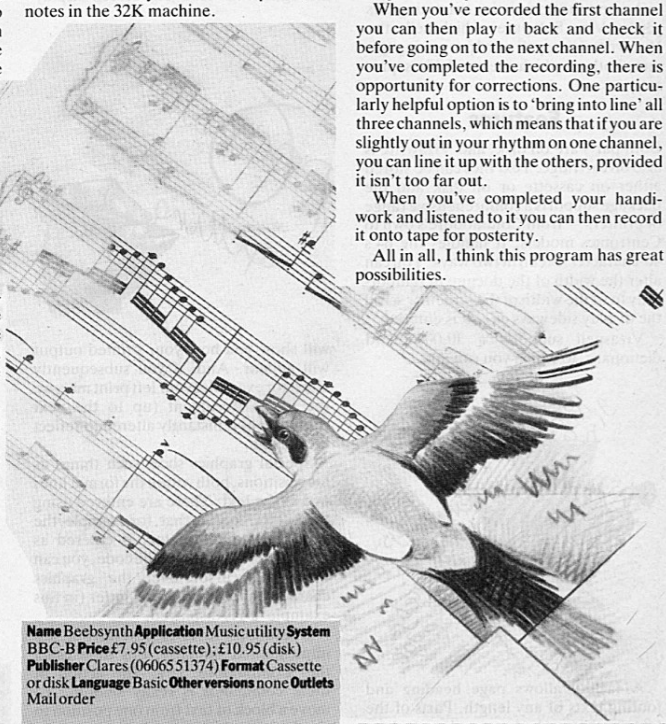
Synth gives you the option to record up to three-part harmonies together with a fourth channel which reproduces a sound — *ie* a drum beat or a rhythm track.

Following the on-screen instructions is easy. Each channel can be recorded independently and different pitches, volume and so on can be selected. At the top of the screen is a piano keyboard layout and you use the top two rows of keys on the computer to input the notes.

When you've recorded the first channel you can then play it back and check it before going on to the next channel. When you've completed the recording, there is opportunity for corrections. One particularly helpful option is to 'bring into line' all three channels, which means that if you are slightly out in your rhythm on one channel, you can line it up with the others, provided it isn't too far out.

When you've completed your handiwork and listened to it you can then record it onto tape for posterity.

All in all, I think this program has great possibilities.



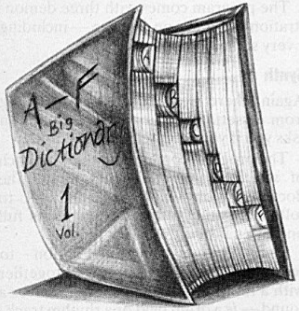
Name Beebsynth **Application** Music utility **System** BBC-B **Price** £7.95 (cassette); £10.95 (disk) **Publisher** Clares (06065 51374) **Format** Cassette or disk **Language** Basic **Other versions** none **Outlets** Mail order

Name The Synth **Application** Music utility **System** BBC-B **Price** £8.50 **Publisher** Musicsoft 12, Fallowfield, Ampthill, Beds. **Format** Cassette **Language** Basic **Other versions** none **Outlets** Mail order

Name Music Processor **Application** Music utility **System** BBC-A & B **Price** £14.95 **Publisher** Quicksilva (07032 0169) **Format** Cassette **Language** Basic **Other versions** none **Outlets** Mail order & retail

Trevor Jones is impressed with a new word processor package containing its own dictionary.

Writing with Viza



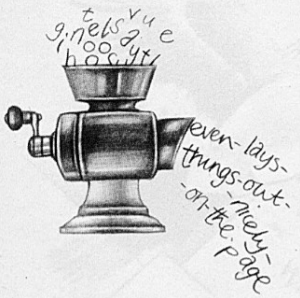
The Commodore 64, much vaunted for both office and home uses, is most likely to straddle the two in its capacity as a word processor. Not surprising, then, that among the rash of serious software written for it are several word processing packages.

Among the companies cramming this gap is Viza Software, which sells the Vizawrite/Vizaspell word processing system, both of which are available separately.

Features

Both parts are on disk, and Vizawrite is also on cartridge. Text files can be stored either on cassette or on disk and the package supports a comprehensive range of printers — from Commodore's own to Centronics models. It handles the 64's 40-character screen in two ways. You can alter the width of the document temporarily to fit the width of the screen or scroll the display sideways as text is entered.

Vizaspell supports a 30,000 word dictionary, to which you can add.



A facility allows page heading and footing texts of any length. Parts of the text can be marked as 'mail merge', so similar documents can be sent to any number of people. It is also possible to merge all or part of a document into another, whether written using Vizawrite, or various other WP packages, such as Wordpro.

A number of utilities supplied with Vizaspell make it possible to copy disks etc, and Vizawrite lets you issue disk commands and display the disk directory.

Presentation

The documentation is excellent: two manuals, one for each program, each contains a section for the newcomer, while experienced users get a no-nonsense guide. There's a text file with 'help' information, which can be printed out for reference.

In use

The beauty of Vizawrite is that it formats text as you type, using 'format' lines.

In these special lines, which appear in the text you specify print margins, tab positions and so on. There can be any number of them so you can vary features throughout the text. The screen display



will show you how your printed output will appear. And, if you subsequently alter, for example, your left print margin, the whole document (up to the next format line) is instantly altered to reflect the change.

Special graphics show such things as tab positions, both within the format lines and in the text. These are entered using the 'CTRL' key, so that, for example, the command to centre text is entered as 'CTRL-c'. If you forget the code, you can move the cursor over the graphics character and the required letter (in this example 'c') is displayed.

Operations to alter text layout are implemented similarly, this time using the 'Commodore' key. The action of these commands is really smooth. To move a block of text from one position to another, you first move the cursor to the start of the block and then press the 'Commodore' key followed by 'm'. The system then prompts you to indicate what is to be moved, to where. At the end of the operation the text is moved quickly and both portions of text are reorganised.

Many commands are carried out in this way. As well as the more usual ones, such as find and delete, there are others, such as displaying the disk directory, saving the document to disk and so on.

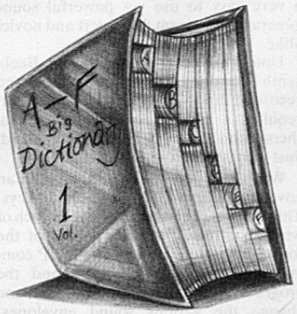
It is this method which is used to call up Vizaspell. This is called in from disk and to count the words in the document, which are checked against the system dictionary. You can then scan through your text and look at words not in the dictionary, which are highlighted. Corrections can be made and new words added to the dictionary. This is a very powerful feature, which is implemented extremely smoothly.

A wide range of options is available once the document is ready for printing. The text is displayed on the screen during printing. Parts, or all of it can be printed, and you can string documents together during printing.

Verdict

This program was a pleasure to use. It ran smoothly, did the job professionally and gave no problems. With that, and the extra touches that add to its flexibility, I can give it very high ratings, particularly for ease of use.

RATING
Features
Documentation
Performance
Usability
Reliability
Overall value



Name Vizawrite/Vizaspell **System** Commodore 64 **Price** Vizawrite £79, Vizaspell £68, Combined £99 **Publisher** Viza Software, 9 Mansion Row, Brompton, Gillingham, Kent, ME7 5SE. **Format** Disk or cartridge (Vizawrite only) **Language** Machine code **Other versions** Foreign language versions available + Commodore 700 **Outlets** Mail order and from shops.

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Atari 410/1010 Cassette Recorder	£49.99
Vic Joysticks (Usual Price £7.50)	£6.99
Atari Joysticks	£13.99
CBM 1541 Disc Drive	£229.99
CBM 1520 Printer/Plotter	£169.99
CBM 801 Printer	£229.99
Atari Disc Drive	£229.99
Atari Printer	£229.99

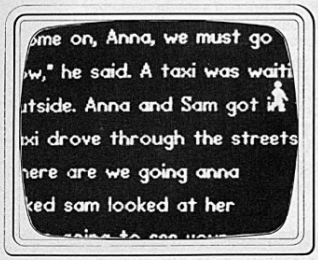
Stocks of some items are limited and may not be available in all branches particularly when demand is heavy. Items have been specially reduced but may not have been sold at the higher price for a period of 28 consecutive days in the previous 6 months.

837

Currys
The electrical people

Learning can be fun with open-ended games. Theodora Wood investigates some Spectrum Software.

Play to learn



Pete punctuating

Heinemann, one of the large educational software publishing houses, has produced four software packages 'designed by a team of 24 teachers and educational advisers from the Dudley Metropolitan County'. Each tape is accompanied by a glossy booklet that not only tells you how to operate the program but also contains interesting background information and suggestions for other activities associated with it. Overlays for the keyboard provide an easy method of controlling the programs which are aimed at the 8-12 age range.

Punctuation Pete is the most traditional of the four packages in its use of graphics and educational methodology. Pete himself is a rather jolly character who moves along a line of text displayed on the screen and stops at all the spaces between the words to enable the child to enter the correct punctuation or capital letter. There are four levels of reading difficulty to select and three levels of punctuation difficulty.

After correcting the punctuation the child has to press ENTER and Pete will either jump for joy if it is correct, or walk to the first mistake. Three attempts are allowed before the correct punctuation is given.

Punctuation Pete introduces children of this age to elementary word-processing skills as well as being an interesting way to learn punctuation.

Ballooning is a simulation program which involves flying a hot air balloon over a series of landscapes. The child can take off, fly and land a balloon by operating the burner and the vent controls. Three levels of difficulty can be chosen: Flying School, Flying Test or Live Mission.

Flying School allows the child to practise at the controls of the balloon in all phases of flight, Flying Test tests these flying skills, and Live Mission gives a series of tasks to be performed, but only if the balloon is landed in the designated spot. Hazards are also introduced, such as instrumentation failure or high winds.

The balloon flies over the landscape on the top half of the screen, while the instrument panel displays the rate of climb, temperature of the air inside the balloon, altitude and fuel level.

The program operates in real time which makes it more vivid. A pause facility stops the balloon moving and allows the information on the dials to be assimilated and recorded. This leads to such activities as keeping graphs of the relationship between the temperature of the air inside and outside the balloon and its altitude.

Car Journey is not as immediately accessible as the other two packages discussed. The objective is to make money by running a delivery service, and this is not as compulsive as flying a balloon, especially for the younger children in the age group.

There are four difficulty levels: Driving School, Driving School with hazards, Delivery Service and Delivery Service with hazards. The type of car can be selected; they appear on the screen with each one of the four shown in profile with maximum speed, capacity for fuel and a petrol consumption graph.

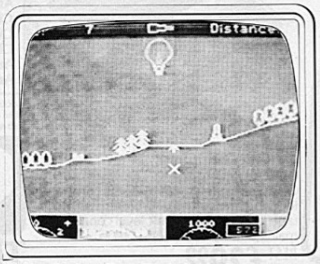
Driving School enables the child to move around the country and work out how much petrol has been used, and also the positions of the major cities in England, Scotland and Wales.

On the lefthand side of the screen there is a space for hazard reports, a speedometer displaying speed controlled by keys 1 and 2, a bar chart of fuel consumption and a digital readout which indicates time elapsed since the beginning of the journey.

Delivery Service enables the child to see contracts available by pressing 0, BREAK SPACE to cycle through them and ENTER to choose one. Contracts vary from computer parts to Persian carpets, with pickup and delivery places and times.

One business colleague loved the way the money bags mounted up on the progress chart (seen by pressing 6) and wished his office programs were the same. Hazards include snow and road repairs, the everyday occurrences which can lay waste a delivery timetable.

The booklet covers the history of roads, how a car works, and again plenty of suggestions and games to extend its use. I think perhaps the difficulty level is too high for the younger children of the age group who showed little interest after the excitements of Ballooning. The upper level could probably be extended to 14 and beyond.

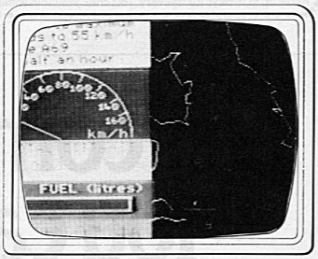


Ballooning . . . attempting to land

Special Agent, the fourth, is an adventurequiz game based on the idea of catching an enemy spy moving round Europe, rather similar to the BBC's Puzzle Trail. Pressing 6 will bring a map of Europe to the screen with all the main cities marked. Intelligence reports appear at the bottom of the screen while the top lefthand corner displays total cost so far, day number and time elapsed. The time between these reports can be speeded up by pressing 7.

These reports can be very cryptic; some of them are based on the descriptions of the major cities given in the booklet while others would need an atlas or an adult to help. Other reports are in code. There is a facility to stop the clock to give the child time to decode the message.

Sometimes an informer will be willing to sell information and this can be bought for £100.



Car journey . . . setting off

To travel to other cities in hot pursuit of the spy, air and rail departures can be checked through and chosen. The user can also see the timetables for other cities so that a journey can be planned in two stages if required.

This said, Special Agent provides a vehicle by which a child in the 9-14 age range can become aware of the positions of the major cities of Europe, and the distances and relative travelling times between them. It also involves them in the logical process of route planning with timetables, and the brainteasers in the codes.

Heinemann has produced an impressive range of programs as its first move into the educational software market.

Punctuation Pete, Ballooning, Car Journey, Special Agent (£9.95 each), Heinemann (Five Ways Software), Heinemann Computers in Education: Book, 22 Bedford Square, London WC1B 3HH.

sinclair special 6



Inside...

Setting new standards in educational software with Sinclair-Macmillan

Plus six other learning programs

TODAY, LEARNING IS A NEW GAME

Subsidised microcomputers are now commonplace as teaching aids for the very youngest children and the ZX Spectrum is prominent amongst those micros at use in schools.

In the relatively short time that the Spectrum has been at work in the classroom, two questions have been answered. Yes: with the right software, the micro can and does teach effectively and thoroughly (and gives teachers more time to devote to individual pupils). Yes: young children think little of working rapidly and successfully, with a screen and keyboard, on even quite complex subjects.

In this Sinclair Special we reveal a range of educational software specifically designed to make full use of these advantages. The programs produced by Sinclair in collaboration with Macmillan Education are fascinating. They deal imaginatively and most effectively with early reading skills and take a truly refreshing approach to basic science.

In the Blackboard range we've programs which bring a light-hearted clarity to the tricky matters of spelling and punctuation.

These programs are designed for use both at home and in the classroom. Each program is accompanied by full documentation which gives parents helpful advice and guidance on the educational objectives.

The programs covered on these pages represent only a fraction of the full and fast-growing list of Spectrum software. Be assured we'll keep you in touch with new developments as they happen.

David Park
Education Marketing Manager

NEW WAYS TO LEARN WITH THE ZX SPECTRUM™

Programs from Blackboard Software

The new range of educational programs from Blackboard Software makes learning an enjoyable process by involving the child in a game which teaches as it entertains.

Each program has a step-by-step example section and gives correct answers after a number of attempts. Vocabulary changes can be made, allowing each program to keep pace with the child's development. This flexibility can also be used in the classroom to cater for children of differing ability.

The instructive and colourful games which follow the successful completion of each group of sentences provide useful practice in letter recognition and increase familiarity with the Spectrum keyboard.

All programs are written for the 48K RAM Spectrum.



Alphabet Games

Three games of letter recognition (using either upper or lower case) to help children learn the alphabet and find their way round the computer keyboard.

Alphagaps — The full alphabet is displayed, along with a second, incomplete version. The child must fill in the missing letters.

Random Rats — Press the letter key that is displayed on the gun to destroy the rats which have invaded the cellar!

Invaders — Stop little green men from landing on Earth by pressing the appropriate letter.

Early Punctuation

While an animated matchstick man marches above displayed sentences the child must decide which punctuation mark is missing and where to insert it. At the touch of a key the matchstick man drops the mark into place. After successful completion of every sentence in the exercise, light relief comes in the form of a bottle-shooting game!

The Apostrophe

As each sentence is displayed, a bird appears with a worm in its beak. The keyboard is used to move the bird and drop the worm into the correct place for the apostrophe. When ten sentences have been corrected, the Grub Game is displayed. Press the correct character to change the grub into a butterfly...before it munches through a flower!

Capital Letters

A program to teach the use of capital letters. Sentences incorporating proper nouns and sentences without opening capitals are displayed. The child inserts the correction by guiding an animated figure to the appropriate letter.

For each correct answer an apple grows on a tree. After ten correct answers the child's skills in recognising letters and using the Spectrum keyboard are needed to save the apples as they fall to the ground.

Speech Marks

A comprehensive program including sentences with one or two sets of speech marks ("inverted commas") and exercises in both direct and reported speech.

Using the Spectrum keyboard, a cursor is used to guide speech marks to the correct position. The program offers three levels of difficulty, with full examples for each section. Guide Max the mouse through a maze, after the correct completion of five sentences from each section, but beware of Persian cats!

Castle Spellerous

A spelling game with ten levels of vocabulary, including words with silent first letters, double letters and other difficult words. The Princess has been captured and carried off to Castle Spellerous. Helped by ten soldiers, the child can attempt a rescue by giving the right answers. Part of a siege tower is built for each correctly spelt word. Mistakes are costly — the wicked wizard appears as a vampire bat, turning the men into frogs, butterflies and bats!

When ten words are spelt correctly the rescue begins and the wizard takes flight.

SINCLAIR + MACMILLAN: A NEW DIMENSION IN EDUCATIONAL PROGRAMS

Sinclair have joined forces with Macmillan Education to produce a completely new and different range of educational software. The results so far can be seen in these exceptional programs.

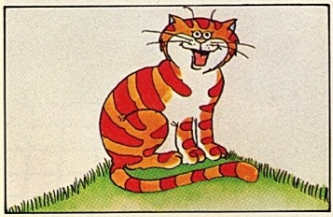
The Learn to Read series is derived from Macmillan Education's best-selling primary school reading scheme, Gay Way. It offers a unique opportunity for parents and teachers to participate in the child's first experience in reading.

Macmillan Education's Science Horizons is one of Britain's most successful school science schemes. Each program concentrates on key scientific ideas and, through simulation of real life, makes the learning process entertaining and enjoyable.



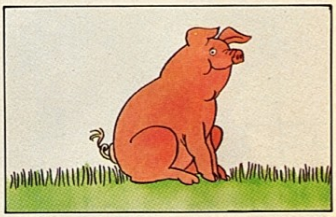
Learn to Read 1

Learn to Read 1 is designed for children who are just beginning to read. It is in four parts, each of which develops skills central to the reading process — letter recognition, sight vocabulary, early spelling and memory. The program is full of colour and fun and children will enjoy learning to read as they meet the animal characters — Ben the dog, Jip the cat and their friends.



Learn to Read 2

Learn to Read 2 extends the fundamental reading skills practised in the first program, as well as encouraging logical thinking. The child's vocabulary is gradually built up as new words such as "red," "green," "car," "ship" and "bus" are introduced. In addition, Learn to Read 2 features an attractive 'reward' system enabling children to see their achievements grow.



Learn to Read 3

Learn to Read 3 builds on the child's progress so far, so that he or she can gain the confidence to move on through the complex reading process. Learn to Read 3 features four different activities, all of which are colourful and lively. Further vocabulary is introduced until the child is reading more than 30 words.



Learn to Read 4

Learn to Read 4 is the alphabet program in the Learn to Read series.

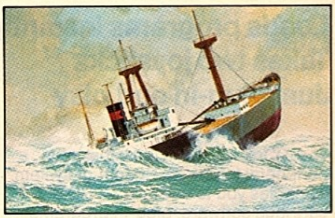
Using various stimulating activities the program gives the child plenty of practice in working with the alphabet — matching initial letters to words and pictures and spotting missing letters. These exercises build familiarity with simple sequences within the alphabet.



Learn to Read 5

Learn to Read 5 teaches positional language — often difficult to understand and remember — by using words and phrases such as "behind" and "in front of," "inside" and "outside."

The program first demonstrates the meanings of the words using clear pictures. It then tests the child's understanding of the words in two lively games.



Cargo

Set sail around the world. Choose your ports of call — New York, Tokyo, Belem, Helsinki — then the real challenge begins! You must reach your destinations safely, weathering storms on the way. But first, load your cargo — using all your knowledge and skill. Poor loading can mean capsizing and sinking. Your rank, if not your life, is always at stake!



Glider

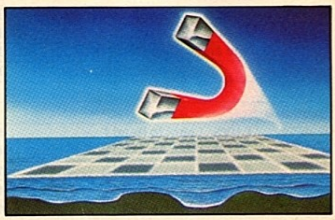
Be a glider pilot! The glider models real-life gliding conditions so that you can learn through experience. As the pilot you must consider the time of day, the amount of cloud cover and the kind of terrain below you in order to find the up-currents of air that will keep you airborne. Try to fly as far as possible and, when you are high enough, navigate your way back to your home airfield and land safely — if you can.



Survival

Discover what it is like to be an animal in the wild! Be a lion stalking your prey, escaping human hunters. Or be a hawk, mouse or even a butterfly, searching for food and avoiding predators.

Survival models the natural world and brings to life hazards that different creatures must face in their struggle to stay alive.



Magnets

With an army of small magnets you set out to conquer the powerful supermagnets of your opponent. You have one weapon — your forces of magnetic attraction and repulsion.

The strategy is simple: attract smaller magnets to build strength to repel the super-magnet. When cornered, just turn your poles on your enemy and see what happens!

Learn to Read and Science Horizons programs are written for a 48K RAM Spectrum, and are supplied complete with comprehensive supporting documentation for parents and teachers.

ZX INTERFACE 2
THE NEW ROM CARTRIDGE AND JOYSTICK INTERFACE

Now available in shops



Loads programs instantly
Takes two joysticks
Just plug-in and play

The ZX Interface 2 is the latest new peripheral for the ZX Spectrum system. It enables you to use new ZX ROM cartridge software: plug-in programs that load instantly. There are ten terrific games already available on cartridge. ZX Interface 2 also allows you to use one or two standard joysticks without the need for separate special interfaces.

To use new ZX ROM Cartridge programs, just connect Interface 2 to the rear of your Spectrum or Interface 1 and plug in the cartridge of your choice. Switch on and the program is then loaded, ready to run!

You can use any joystick that has a 9-way D plug. Use one or two of them for extra fun with suitable ZX ROM cartridge or Sinclair cassette programs — or with dozens of other Spectrum programs.

ZX MICRODRIVE/ ZX INTERFACE 1

The ZX Microdrive System is unique. This compact, expandable add-on system provides high-speed access to massive data storage. With just one Microdrive and a ZX Interface 1 you'll have at least 85K bytes of storage, the ability to LOAD and SAVE in a matter of seconds, the beginnings of a local area network of up to 64 Spectrums *and* a built-in RS232 interface. The cost? Less than £80.

How to get ZX Microdrive and ZX Interface™ 1

Spectrum owners who bought direct from us by mail order have been sent full details. Order forms are being mailed in strict rotation. If you haven't yet received your order form please bear with us. We're making good progress in meeting the huge demand.

If you didn't buy your Spectrum by mail order, send us the form at the bottom of this page and we'll add your name to the mailing list.

How to order

Complete the appropriate sections on the order form below. Note that there is no postage or packing to pay on software purchases. Orders may be sent FREEPOST (no stamp needed). Credit card holders may order by phone, calling 01-200 0200, 24 hours a day. Please allow 28 days for delivery.

™Sinclair, ZX Spectrum, ZX Microdrive, ZX, ZX Interface are trade marks of Sinclair Research Ltd.

sinclair™

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Telephone: (0276) 685311.

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR. **ORDER FORM**

Section A: Hardware

Qty	Item	Code	Item Price £	Total £
	ZX Interface 2	8501	19.95	
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: Software

E10/S	Learn to Read 1	4309	9.95
E11/S	Learn to Read 2	4310	9.95
E12/S	Learn to Read 3	4311	9.95
E13/S	Learn to Read 4	4312	9.95
E14/S	Learn to Read 5	4313	9.95
E15/S	Cargo	4314	9.95
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E17/S	Survival	4316	9.95
E18/S	Magnets	4317	9.95
E19/S	Early Punctuation	4318	7.95
E20/S	Speech Marks	4319	7.95
E21/S	Apostrophe	4320	7.95
E22/S	Capital Letters	4321	7.95
E23/S	Castle Spellerous	4322	7.95
E24/S	Alphabet Games	4323	7.95
			TOTAL £

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £

*Please charge my Access/Barclaycard/Trustcard account no:

*Delete/complete as applicable.

Signature

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Address

PCN 912

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ZX Microdrive™ information request

Please add my name to the Microdrive Mailing List *and* send me a colour brochure with full specifications of ZX Microdrive/Interface 1 ☐ *(tick here).*

Free Sinclair ZX™ Software Catalogue

Please reserve my priority copy of the January 1984 Sinclair ZX Spectrum Software Catalogue ☐ *(tick here).*

Please use the form above to send your name and address

Dragon 32

Flawed diamond

Name Lost in Space **System** Dragon 32 **Price** £9.95 **Publisher** Salamander Software, 17 Norfolk Road, Brighton, East Sussex BN1 3AA **Format** Cassette **Language** Basic **Other versions** None **Outlets** Mail order, Boots, other dealers.

A few months ago Salamander launched detective Dan Diamond on the first of a trilogy of adventures, Franklin's Tomb, which was greeted with rather mixed reviews. Lost in Space is the second in the series, with Fishy Business still to come.

Objectives

Dan is now trapped aboard a derelict space ship that's patrolled by security robots and his task is to find his way to the bridge and take control of the ship.

First impressions

Salamander's packaging gets larger all the time. This arrived in a wallet the size of a Spectrum and with an accompanying 16-page 'Case File' containing 13 pages of illustrations of some of the game's locations. You also get the sub-Chandler introduction: 'My name is Diamond. Dan Diamond. I'm a private investigator, or at least I used to be. Now I'm a first class schmuck.'

In play

What a shame the game itself contains none of the humour suggested by the advertising and packaging.

In a text-only adventure, that text is all-important, and the opening location description of 'You are standing in the transporter chamber' is hardly witty, or even descriptive. Unfortunately it is typical. About the only thing approaching humour, and that from a long way off, is the response 'Don't be silly' when you try to be.

You can carry three items, and single commands only can be entered in the usual verb-noun way.

Although in Basic, responses are quick, and as you wander round the ship (which is difficult — the only thing in its favour) you will encounter the traditional mazes, security guards sneaking up on you now and again, and tempting buttons to push and levers to pull . . . which curiosity impels you to try, even if it does mean starting all over again. That's a fast enough procedure, and there is also a SAVE facility, all the instructions being in the Case File along with helpful hints like 'Don't be afraid to do stupid things,' followed by 'Don't go around doing stupid things all the time.'

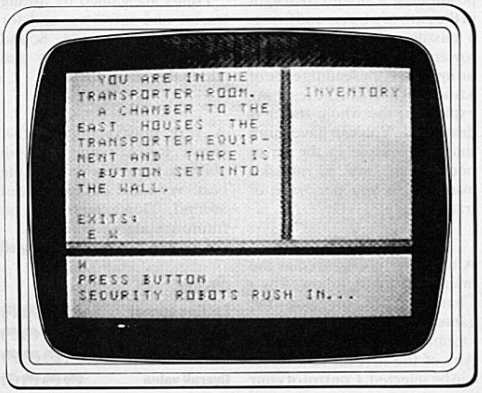
Verdict

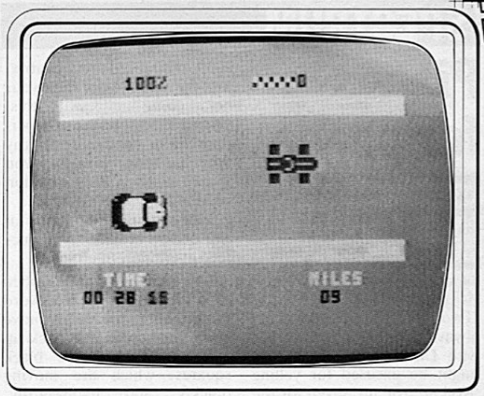
Lost in Space can be played independently of Franklin's Tomb, though you may get one or two extra clues from having played the earlier game, but for me the adventure was disappointing after the promise of the packaging.

Mike Gerrard

RATING

Lasting appeal	
Playability	
Use of the machine	
Overall value	





Morris dance

Name Maurice Minor **System** Dragon 32, 1 joystick **Price** £6.95 **Publisher** J Morrison (Micros) Ltd, 2 Glendale Street, Leeds **Format** Cassette **Language** Machine code **Other Versions** None **Outlets** Mail order, retail

As there are now several Grand Prix games for the Dragon, a new one has to offer something unusual, which is certainly what this one tries to do. It has you behind the wheel of that old family favourite the Morris Minor, which has somehow strayed onto a racing circuit.

Objectives

The aim is to complete ten miles of the track in the shortest possible time. I criticise the bit of advertising which suggests your car falls to pieces as you go, which is not the case; there's merely a counter at the top of the screen keeping track of the number of bumps you've had.

In play

You're first asked your name, in case you make the Hall of Fame, and can then choose from the six skill levels, Kingpin at the top or Sunday Driver down the bottom.

Your Maurice stays in the same position close to the left of the screen while the track scrolls towards you from the right. Admittedly it's not much of a track, being dead straight and with no other graphics apart from cars and the odd patch of oil, but with your own car badly in need of a diet it's as well there are no other hazards or twists in the track to deal with as getting past the Formula One cars is tricky enough. It's not too bad at the easier levels, but as you climb towards Kinpin you move much faster, and you can't play safe and drive slowly or other cars appear from the left and go right up Maurice's bumper. At the harder levels too, there's less joystick control, the slightest touch moving you off-course, which makes overtaking a very delicate manoeuvre indeed, and not for anyone with the shakes or a wonky joystick.

The screen shows your timer at bottom left, mileage remaining at bottom right, with your accident counter across the top. You receive one chequered flag per bump, and when the line of flags has reached 100 per cent that's the end of Maurice. If you complete the ten miles intact then you may find your name in the Hall of Fame, and you can then choose to have another race at the same level or change to another by returning to the start.

The game could hardly be described as spectacularly colourful, but it's noisy enough with the crashes and a revving sound that increases in pitch as you accelerate, and overall it is hard to play.

Verdict

I usually find Grand Prix games boring, but this is the least boring one I've seen for the Dragon, so, if you're more of a fan than I am you won't go far wrong with Maurice the Morris from Morrison. **Mike Gerrard**

RATING

Lasting appeal	
Playability	
Use of the machine	
Overall value	

SPECTRUM

Pieces for peace

Name The Black Planet **System** 48K Spectrum **Price** £5.95 **Publisher** Phipps Associates, 172 Kingston Road, Ewell, Surrey KT19 0SD **Format** Cassette **Language** Machine code, some Basic **Other versions** None **Outlets** Mail order

'Two for the price of one' always was good sales spiel, but with *The Black Planet* Phipps might be excused for yelling 'Roll up, roll up, seven for the price of one!' as that is the number of separate games incorporated into this space quest.

Objectives

As the 21st Century draws to a close, and Planet Earth's empire stretches throughout the Galaxy, you must assume the role of the good guys yet again in order to conquer the pirates who are threatening the Galaxy's peace and harmony. To destroy the pirates you must collect the seven pieces of the key which will then enable you to obliterate the sunless Black Planet where they hide out.

In play

In practice, so long as you have the instructions handy, the game becomes reasonably straightforward to play, yet very hard to master. The main screen is the nose of your rocket ship travelling through space, with read-outs for shield strength, helm co-ordinates, target co-ordinates and distance to target. The K key sets your target co-ordinates, such as 30,30 for the planet Bellatrix, and the cursor keys align your helm co-ordinates with this. Then, with careful use of hyper-jumping or gunfire to destroy the pursuing pirates, you should reach your destination and the first game challenge.

You can visit the planets in any order, provided you succeed eventually at all seven.

One game could be described as Frogger on a crossword puzzle, where you have to move down the screen and back up again using just the black squares, which are moving quickly and haphazardly. Another is a diamond-shaped draughts board across which you plot your course a square at a time, alternating moves with a mobile fire that is protecting the piece of key that you're after. Others involve you in shoot-outs, minefields, monsters and jumping off cliffs into tiny boats. To add to your problems there will be a decreasing fuel supply and diminishing shield strength, to be replenished by a tricky docking at the Starbase from time to time.

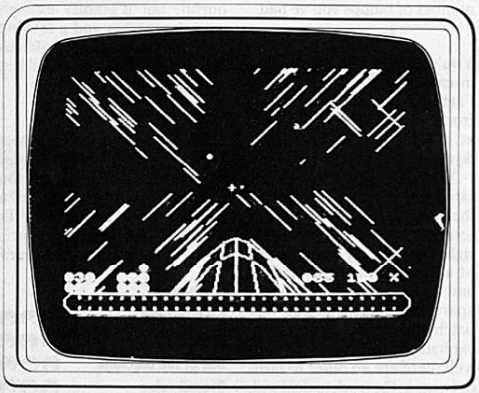
Verdict

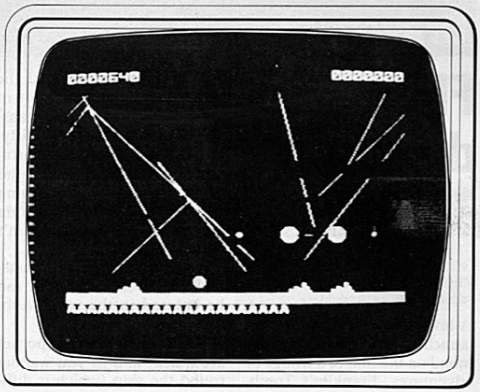
Anyone who succeeds at destroying the Black Planet will discover a secret codeword, and revealing this to Phipps will earn you a free badge. Despite limitations on graphics and sound, *The Black Planet* is both different and difficult.

Mike Gerrard

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





Cross them out

Name Armageddon **System** Spectrum **Price** £5.90 **Publisher** Ocean Software, Ralli Building, Stanley Street, Manchester M3 5FD **Format** Cassette **Language** Machine code **Other versions** None **Outlets** Sinclair dealers

One day we may be regaling our grandchildren with nostalgic tales of those marvellous games we played long ago on that museum-piece, the microcomputer. No doubt among our reminiscences one game will be recalled with warmth and affection — Missile Command. If you've never tried it, you might like to invest in Armageddon, an excellent version for the Spectrum by Ocean Software.

Objectives

Six cities are under attack from nuclear tracers. Leaving a trail in their wake, these tracers roll down the screen, sometimes forking, towards the cities. By positioning a small cross-sight in the path of a tracer and firing, a missile will race unerringly toward the marker, detonating on impact. If the leading edge of a tracer is caught in the resulting explosion, the whole tracer is destroyed. You can have more than one missile in the air at once; there are 32 missiles available to you per wave of tracers.

In play

A title page is displayed as the main game loads, followed by a Charles Atlas dragging the game options into view (an Ocean trademark, I expect). Any of the first six skill levels can be selected. Control of your defences is by keys or Kempston joystick. Using the keyboard is difficult, since you have to cover five keys, but not impossible.

The first tracers descend fairly calmly and are not too difficult to stop, though you have to watch out for the odd one that sneaks in at the side of the screen. Subsequent waves are more of a problem, especially when an individual tracer head decides to gallop off in all directions — it splits up to form a Nile delta effect.

Quite frequently, a spy satellite floats across, which you can pot for extra points. It's harmless but can distract you from the main business in hand since it always flies across the top half of the screen. You re-adjust your sight after blasting one, and find you're minus a city or three.

Between rounds is a pleasant pause while your score is updated, the number of missiles and cities remaining are confirmed, and the unknown enemy are having a half-time orange.

Points are gained by hitting tracers and satellites, and for every unfired missile. Sound effects are used sensibly and add to the atmosphere.

Verdict

A very satisfying game that caters for a range of skill abilities. I rate this as one of the best versions of the breed around. Don't miss out on future nostalgia—get it now.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

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COMMODORE

At full tilt

Name Pinball Wizard **System** Vic20 (unexpanded) **Price** £7.95 **Publisher** Terminal Software, 25 Church lane, Prestwich, Manchester M25 5AJ **Format** Cassette **Language** Machine Code **Other Versions** None **Outlets** Mail order/Retail

Just what the game player ought to like: an obvious game with no complicated rules to learn and which gets down to business as soon as it is LOADed.

First impressions

It comes in a mini-video type box, with a remarkably restrained black-and-white sleeve when you consider the simple but colourful screen graphics which capture perfectly the effect of playing any arcade pin table, including the tantalising way the ball seems to hang in space as it comes off the release plunger.

Objectives

Anyone who's been within earshot of a penny arcade will know how to play this — though the terrifying thought strikes me that invader clones have driven the beloved pintables out of the collective consciousness.

In play

Well then, you launch a ball round a table — which ought to be oblong-shaped but here it's sort of square (to fit on the screen) — and you have to keep it in play as long as possible using the flippers and (illegally but universally) leaning on one side or other of the table to roll the way you want. This is called nudging. (Not strictly lawful, as I said, but considered to be part of the accepted technique.)

Each time the ball hits a bumper you get 100 points, each time it goes through a little tunnel (the rollover) you get 10, and there's a jackpot of 1000 points.

Function keys are used to select a one or two person game, to pull back the plunger and fire the ball.

The Commodore key operates the flippers and there's even a nudge function, operated by the space bar — but you've got to use it carefully or you'll get the dreaded TILT display.

Verdict

Either you're a pinball wizard or you're not. This is not a game to have universal appeal.

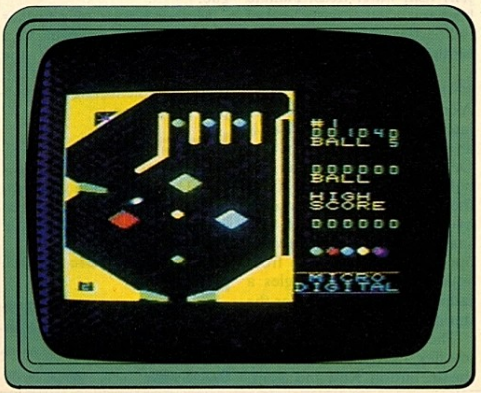
If, like me, you're an addict, this game is the next best thing to standing in one of those caverns under the Brighton Esplanade, your scooter parked outside and your anorak tied by its sleeves around your waist, as you try to beat the last player's best score.

The sound effects are simple but effective. However, no one has managed to get VIC's sound generator to simulate the clanging sound of the ball hitting the bumper.

Karl Dallas

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





The arms race

Name The Quest of Merravid **System** Commodore 64 **Price** £7.95 **Publisher** Martech Games, Bay Terrace, Pevensey Bay, East Sussex BN24 6EE **Format** Cassette **Language** Basic **Other versions** Vic20 **Outlet** Mail order

The joys of microcomputing — switch on, load up and you become Merravid, son of Aranord, on the road to fame and fortune.

Objectives

You are Merravid and the dwarves have chosen you from among many courageous candidates to rescue the magical firestone from the lair of a large, ill-tempered dragon on a mountain in the land of Thargon.

In order to afford you some form of protection, the dwarves will not allow you to confront the dragon without being fully armoured but there is only one set of armour in Thargon. And therein lies the problem. You have to find it all before battle can commence.

In play

A successful loading instantly dumps you in the environs of Lower Blackwood.

As with many adventures, no graphics are used. You are simply given a description of what the place looks like, what kind of objects are lying around waiting to be picked up, where you can find the exits and what course of action you want to take.

It is in instructing the computer on your course of action (which can be done in sentences of up to nine words or simply by using key words) that you need both plenty of imagination and plenty of patience. Although the instructions give you a few pointers as to the phrases the computer will understand you have to work out most of it by trial and error.

I can tell you now that, whatever you try, the most frequent response I got was: 'I don't understand you'.

However, as you wander from place to place, you'll gradually get the hang of it and by the end of it all, you'll be ordering the computer around like the toiling, obedient servant it is!

But let's not over-simplify. There's a bit more to it than that: a riddle to decipher here and there, and the possibility of prematurely ending the adventure by making a wrong decision.

Verdict

One of the things this game has going for it, I feel, is its relative simplicity as far as adventure games for the Commodore go, and consequently it serves as a good introduction to computing's equivalent to the blood and thunder sagas.

For this reason I can forgive it some of its shortcomings such as illogical answers and the occasional programming slip which, in one place actually gave away the existence of a vital piece of clothing miles from where it was actually to be found.

Keith Mason

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

Atari

Ocean of motion

Name Wavy Navy **System** Atari 400/800/XL series **Price** £14.95 **Publisher** Sirius Software, USA **Format** Disk **Language** Machine code **Other versions** Apple **Outlet** Silica Shop, 1-4 The Mews, Hatherley Road, Sidcup, Kent DR14 4DX 01-301 1111

Messing about on the river may be a pleasant way to spend an afternoon but controlling a PT boat on the storm-tossed high seas while being dived at and bombed from an enemy-filled sky is a different kettle of fish.

Objectives

As well as being thrown about by 30ft waves, your PT boat is also under attack from squadrons of enemy bombers and Kamikaze fighters. Backing these up are helicopters with blazing machine guns, followed by Exocet missiles. The sky is not the only source of danger—the ocean has been seeded with mines.

In play

A tiny boat floats vulnerably on the crest of a wave and a stormy sea. In the sky, a large squadron of planes gathers, above which hovers a fleet of helicopters. The planes peel off and it's soon clear they are flown by Kamikaze pilots.

The boat moves left and right. As it does so, it slithers sickeningly down one side of a wave and then up the other, adding to the difficulty of potting the enemy with your onboard rocket launcher.

Planes missing you crash into the sea but if one hits you, the result is startling—your boat is blown clean out of the water before sinking, with a gurgling sound, to the sea bed. Lose all your boats and the band strikes up with 'Good Evening, Friends'!

The helicopters fly down to hover nearby, letting rip with their machine guns which fire diagonally. Wipe out a fleet of planes and choppers and the band plays a suitable shanty to signify your promotion from galley slave to boatswain.

The challenge increases with each round. Later screens include floating mines, planes which enjoy blanket bombing, and Exocet missiles which scream toward you from either side. The ocean gets decidedly rougher too. There are ten rounds, each of which can be played at any of four levels of intensity. If you're good enough, you might end up as an Admiral or Defence Chief.

Verdict

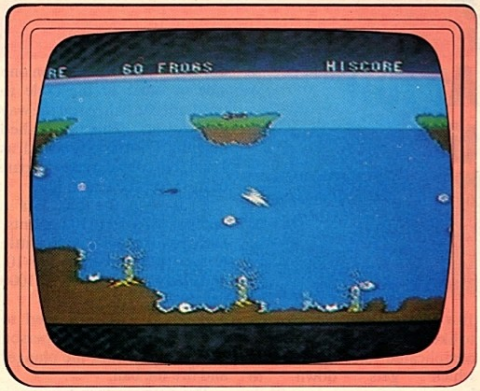
A completely new slant on the Invader/Galaxians theme. The game is graphically and aurally superb (the exploding planes, the missiles and PT boat are particularly outstanding) and it is enormous fun to play. Buy it, but buy some sea-sickness pills as well—you might need them.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	





Terror of the deep

Name Savage Pond **System** Atari (16K) 400/800/XL series **Price** £14.95 **Publisher** Starcade Software, 2 Elworthy Avenue, Liverpool L26 7AA 051-487 0808 **Format** Disk **Language** Machine code **Other versions** None **Outlet** Mail order from Starcade or at Centresoft stockists.

As tranquil as a mill pond. That old cliche is given the lie by this completely novel game of dark deeds beneath still water.

Objectives

Your task is to keep a tadpole alive long enough for it to grow up and start its own family. The tadpole feeds on appetising amoeba, wiggling worms and delicious dragonfly eggs. If left uneaten these eggs eventually hatch into larvae and subsequently become voracious dragonfly nymphs.

Other perils include deadly-tentacled hydra, water spiders, jelly fish, water fleas, bumble bees and a rather nasty load of radioactive waste jumped by Mother Nature's worst enemy.

In play

A cross section of a pond comes into view, at the top of which is an island, occupied by a log. Dotted around the water are pulsating pink amoeba while at the bottom, nestling near some hydra, are three eggs of frog spawn. Gradually one cracks open and, with a nudge from your joystick, out wriggles a tadpole, your alter ego for the duration of the game.

The tadpole is guided by a joystick movement, aided by the fire button. Now and again, a dragonfly zooms overhead and dropping an egg into the pond, which the tadpole eats by touching.

Occasionally, an egg falls under a hydra. As contact with the tentacles means instant death, the tadpole must gobble up one of the many suicidal worms which jump into the pond—these make it invincible for several seconds.

An uneaten egg turns into a lava which scuttles for the safety of the bank, to return later as a fearsome nymph. The tadpole's only chance is to keep swimming and hope the nymph decides it's time it pushed off to become a dragonfly.

If it survives, the tadpole's next lesson is to avoid the sticky web of the water spider, the sting of jelly fish, indigestible radioactive waste deposited in the pond courtesy of a dumper truck, and water fleas which like nothing better than frogs' spawn for luncheon.

At a certain stage, a frog visits the island log. By pressing the space bar, the frog can capture a passing dragonfly with its tongue.

Mother Nature may further smile on your by arranging for a handsome frog to visit the island for some discrete mating, thereby replenishing the tadpole population.

Verdict

An original game and educational to boot. Good graphics, challenging to play, and guaranteed to generate a Save The Tadpoles campaign.

Bob Chappell.

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

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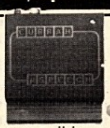
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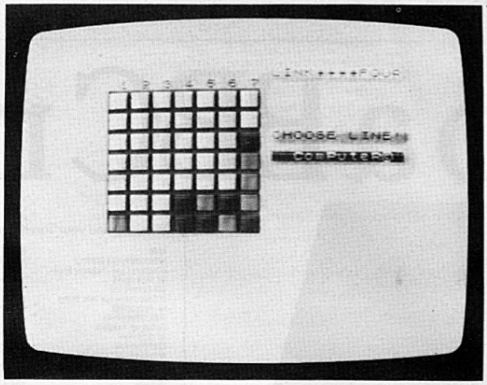
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SPECTRUM

PCN PROGRAMS

LINK FOUR




```
  1 REM  Copyright J.G.Sherratt
 1983©
 50 CLEAR
 60 LET c$="  ComPuteR© "
 65 LET d$="              "
 69 REM Graphics "AB"="▛" and
 "CD"="▙"**********************
 70 LET g$="▛": LET h$="▙"
 100 FOR f=USR "a" TO USR "f"+7
 110 READ a: POKE f,a
 120 NEXT f
 130 DATA 255,255,192,192,192,19
2,192,192
 140 DATA 255,255,3,3,3,3,3,3
 150 DATA 192,192,192,192,192,19
2,255,255
 160 DATA 3,3,3,3,3,3,255,255
 170 DATA 0,42,42,42,42,20,20,0
 180 DATA 0,162,178,170,166,162,
162,0
 190 LET q$="*"
 200 PAPER 5: BORDER 5: INK 1: C
LS
 210 DIM a(7,7): DIM b(7): FOR x
=1 TO 7: LET b(x)=7: NEXT x
 215 DIM c(2): LET c(1)=100: LET
 c(2)=10
 230 FOR x=1 TO 14 STEP 2
 240 FOR y=1 TO 14 STEP 2
 250 PRINT PAPER 7;AT x+2,y+3;g$
;AT x+3,y+3;h$
 255 NEXT y: NEXT x
 260 FOR x=1 TO 7
 270 PRINT AT 2,(x*2)+3;x: NEXT
x
 275 FOR x=16 TO 1 STEP -1: BEEP
 .1,x: PRINT AT x+1,19;d$: PRINT
 AT x,19; PAPER 7;"LINK***FOUR"
: NEXT x
 280 IF q$="y" OR q$="Y" THEN GO
 TO 350
 285 DIM a$(2,12)
 290 REM lines 295-320=computers
play?**************************
 295 INPUT "Do you want to play
the computer  Y/N ";q$
 300 IF q$="y" OR q$="Y" THEN LE
T a$(1)=c$: GO TO 340
 310 IF q$="n" OR q$="N" THEN GO
 TO 330
 320 GO TO 290
 330 INPUT "1st players name ";q
$: IF LEN q$>12 THEN GO TO 330
 335 LET a$(1)=q$
 340 INPUT "2nd players name ";q
$: IF LEN q$>12 THEN GO TO 340
 345 LET a$(2)=q$
 350 LET rnd=INT (RND*2)+1
 360 FOR w=1 TO 49
 365 IF rnd=1 THEN LET rnd=2: GO
 TO 375
 370 IF rnd=2 THEN LET rnd=1
 375 LET co=rnd*2: GO SUB 500
 380 NEXT w
 390 INPUT "Do you wish to play
again Y/N";q$
 400 IF q$="y" OR q$="Y" THEN IN
PUT "With same players Y/N";q$:
GO TO 200
 410 IF q$="n" OR q$="N" THEN GO
 TO 2200
 420 GO TO 390
 499 REM          *****START******
**********************************
 500 PRINT AT 7,19; PAPER 6;"CHO
OSE LINE!";AT 9,19; PAPER co; IN
K 7;a$(rnd)
 509 REM line=510 computer play?
 ******************************
 510 IF a$(rnd)=c$ THEN GO TO 10
00
 520 BEEP .2,18: PAUSE 0
 530 LET code=(CODE INKEY$)-48
 540 IF code<1 OR code>7 THEN GO
 TO 520
 550 IF b(code)=0 THEN GO TO 520
 560 LET line=(b(code)*2)+1
 565 LET colume=(code*2)+2
 570 FOR x=3 TO line STEP 2
 580 IF x>3 THEN PRINT OVER 1; P
APER 7;AT x-2,colume;"  ";AT x-1
,colume;"  "
```

Title : *Link Four*
Machine: *Spectrum 48K*
Application: *Game*
Language: *Spectrum Basic*
Author: *J G Sherratt*

The following program, from J G Sherratt of Gloucester, is a game called Link Four for the Spectrum.

The object of the game is to link, in a straight line, four of your coloured squares; on a grid of seven by seven (49 moves). After the players have entered their names the computer chooses at random who is to go first. The player whose go it is then selects a column into which a square is dropped. The square drops to the lowest position possible in that column, building towards the top.

Since the program is written in straightforward Basic it should be quite easy to convert it to run on another machine. Problems may occur with things like the user defined graphics, used to draw the board and win square, and the screen colours. These are explained in the notes that come below the listing, and should allow programmers to convert without too much trouble.

The game is for either two players or one player against the computer, but it can be made to run for just two players by omitting lines 60, 295 to 320, 510 and 1000 to 1230. Thus removing the computer's ability to play.

Program notes . . .

50	Reset the variables, screen files, plotting position etc.
60	c$ is the computer's playing name.
65	d$ is used to blank out various pieces of text.
70	Set up the user defined graphics. Most machines can cope with this, but the command to do so varies from machine to machine. In the case of the Spectrum, USR"a" returns the address of the memory location where the character is defined.
130-180	This is the data for the defined characters. It is set

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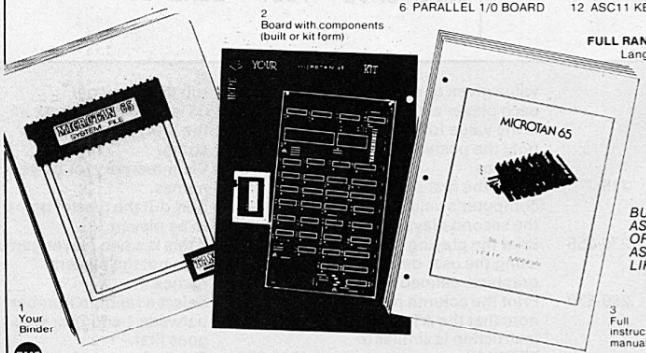
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```
 590 BEEP .1,10: PAUSE 5: PRINT
OVER 1; PAPER co;AT x,colume;"
";AT x+1,colume;"  "
 600 NEXT x
 605 BEEP .5,10
 610 LET a(b(code),code)=c(rnd)
 620 LET b(code)=b(code)-1
 630 IF w<7 THEN RETURN
 640 PRINT AT 7,19; FLASH 1; PAP
ER 0; INK 7;"  CHECKING  "
 649 REM    **CHECK WINNER**
*******************************
 650 FOR x=1 TO 4
 660 FOR y=1 TO 7
 665 IF a(x,y)=0 THEN GO TO 690
 670 LET total=0
 680 LET total=a(x,y)+a(x+1,y)+a
(x+2,y)+a(x+3,y)
 685 IF total=40 OR total=400 TH
EN GO TO 2000
 690 NEXT y: NEXT x
 700 FOR x=1 TO 7
 705 FOR y=1 TO 4
 710 IF a(x,y)=0 THEN GO TO 730
 715 LET total=0
 720 LET total=a(x,y)+a(x,y+1)+a
(x,y+2)+a(x,y+3)
 725 IF total=40 OR total=400 TH
EN GO TO 2000
 730 NEXT y: NEXT x
 750 FOR x=1 TO 4
 755 FOR y=1 TO 4
 760 IF a(x,y)=0 THEN GO TO 790
 765 LET total=0
 770 LET total=a(x,y)+a(x+1,y+1)
+a(x+2,y+2)+a(x+3,y+3)
 780 IF total=40 OR total=400 TH
EN GO TO 2000
 790 NEXT y: NEXT x
 800 FOR x=1 TO 4
 805 FOR y=4 TO 7
 810 IF a(x,y)=0 THEN GO TO 840
 815 LET total=0
 820 LET total=a(x,y)+a(x+1,y-1)
+a(x+2,y-2)+a(x+3,y-3)
 830 IF total=40 OR total=400 TH
EN GO TO 2000
 840 NEXT y: NEXT x
 850 RETURN
 999 REM line 1000-1230=computer
 play?************************
1000 LET ton=300: IF w<6 THEN GO
 TO 1210
1002 FOR x=1 TO 4
1005 FOR y=1 TO 7
1010 IF a(x,y)=0 AND a(x+1,y)=0
THEN GO TO 1040
1015 IF b(y)=x+3 AND ton=a(x,y)+
a(x+1,y)+a(x+2,y) THEN LET code=
y: GO TO 540
1020 IF b(y)=x+2 AND ton=a(x,y)+
a(x+1,y)+a(x+3,y) THEN LET code=
y: GO TO 540
1025 IF b(y)=x+1 AND ton=a(x,y)+
a(x+2,y)+a(x+3,y) THEN LET code=
y: GO TO 540
1030 IF b(y)=x AND ton=a(x+1,y)+
a(x+2,y)+a(x+3,y) THEN LET code=
y: GO TO 540
1040 NEXT y: NEXT x
1050 FOR x=1 TO 7
1055 FOR y=1 TO 4
1060 IF a(x,y)=0 AND a(x,y+1)=0
THEN GO TO 1090
1065 IF b(y+3)=x AND ton=a(x,y)+
a(x,y+1)+a(x,y+2) THEN LET code=
y+3: GO TO 540
1070 IF b(y+2)=x AND ton=a(x,y)+
a(x,y+1)+a(x,y+3) THEN LET code=
y+2: GO TO 540
1075 IF b(y+1)=x AND ton=a(x,y)+
a(x,y+2)+a(x,y+3) THEN LET code=
y+1: GO TO 540
1080 IF b(y)=x AND ton=a(x,y+1)+
a(x,y+2)+a(x,y+3) THEN LET code=
y: GO TO 540
1090 NEXT y: NEXT x
1100 FOR x=1 TO 4
1105 FOR y=1 TO 4
1110 IF a(x,y)=0 AND a(x+1,y+1)=
0 THEN GO TO 1140
1115 IF b(y+3)=x+3 AND ton=a(x,y
)+a(x+1,y+1)+a(x+2,y+2) THEN LET
 code=y+3: GO TO 540
1120 IF b(y+2)=x+2 AND ton=a(x,y
)+a(x+1,y+1)+a(x+3,y+3) THEN LET
 code=y+2: GO TO 540
1125 IF b(y+1)=x+1 AND ton=a(x,y
)+a(x+2,y+2)+a(x+3,y+3) THEN LET
 code=y+1: GO TO 540
1130 IF b(y)=x AND ton=a(x+1,y+1
)+a(x+2,y+2)+a(x+3,y+3) THEN LET
 code=y: GO TO 540
1140 NEXT y: NEXT x
1150 FOR x=1 TO 4
1155 FOR y=4 TO 7
1160 IF a(x,y)=0 AND a(x+1,y-1)=
0 THEN GO TO 1190
1165 IF b(y-3)=x+3 AND ton=a(x,y
)+a(x+1,y-1)+a(x+2,y-2) THEN LET
 code=y-3: GO TO 540
1170 IF b(y-2)=x+2 AND ton=a(x,y
)+a(x+1,y-1)+a(x+3,y-3) THEN LET
 code=y-2: GO TO 540
1175 IF b(y-1)=x+1 AND ton=a(x,y
)+a(x+2,y-2)+a(x+3,y-3) THEN LET
 code=y-1: GO TO 540
1180 IF b(y)=x AND ton=a(x+1,y-1
)+a(x+2,y-2)+a(x+3,y-3) THEN LET
 code=y: GO TO 540
1190 NEXT y: NEXT x
1200 IF ton=300 THEN LET ton=30:
 GO TO 1001
1210 LET code=INT (RND*7)+1
1220 IF b(code)=0 THEN GO TO 121
0
1230 GO TO 540
1999 REM Graphics "EF"="WIN"*****
*******************************
2000 PRINT FLASH 1; INK 7; PAPER
 co;AT (x*2)+1,(y*2)+2;"WIN";AT (
x*2)+2,(y*2)+2;"**"
2005 PRINT AT 7,19; INK 7; PAPER
 co;" WELL DONE! "
2020 GO TO 390
2200 PAPER 7: BORDER 7: INK 0: C
LS
2210 PRINT AT 6,6;"PROGRAMME STO
PPED";AT 8,6;"Keyword GO TO 200"
;AT 10,10;"to rerun"
2500 STOP
4000 SAVE "four" LINE 50
```

◀ 80

	out as an 8 by 8 grid. The definition consists of 8 numbers, each between 0 and 255, representing an 8 bit binary number defining the bit pattern of the appropriate line.		value given to squares by each player's move and b is the value for columns, to note the position of empty squares.
200	Set up the basic screen colours. Paper is the background screen colour and is set to cyan. Border is the section of the screen that surrounds the printable section, this is set to cyan also. Ink is the printing or foreground colour and is set to blue.	215	c(1) is the first player's or computer's value. c(2) is the second player's value.
210-215	Dimension and initialise various arrays, a is the	230-255	Print the playing table using the user defined graphics, defined in 70.
		260-270	Print the column numbers, note that the AT instruction is similar to TAB(X,Y) on other computers.
		275	Print the name of the game and move it up the screen while beeping; use d$ to rub the name out.
		280	q$ is used throughout as the reply to questions string.
		285	Clear memory for players names.
		295-320	Sort out the type of game to be played.
		330-345	If this is a two player game then get the players' names.
		350	Select a random number between 1 and 2 for who goes first.
		360-380	This is the main loop that runs the program using the routine at 500 it also alternates the players goes.

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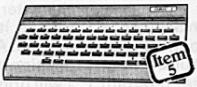
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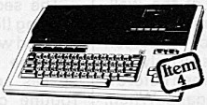
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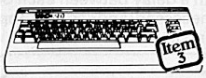
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390-420	Prompt for another game and take action on the answer.
500	Enter the player's names in turn.
510	Check for the computer's go, check the name.
520	Make a beep and pause.
530-540	Get a key from the keyboard and check it for validity. INKEY$ on the spectrum checks the keyboard in passing and returns a null string if no key has been pressed. CODE converts the string to its ASCII value.
550	If column is full get another entry from the keyboard.
560	Get the line to where the piece is to be placed.
565	Get the column position.
570	Begin the routine to drop the piece into place.
580	Print the piece.
590	Beep and rub out the piece.
600	Keep going.
605	A final beep.
610	Put piece into the grid.
620	Update the number of pieces in the column.
630	If less than seven goes then don't bother checking.
640	Print up the checking sign.
650-690	Check for four identical pieces in a row horizontally.
700-730	Do same for vertical.
750-790	Again for right diagonal.
800-840	And again for the left diagonal.
850	Return to calling section.
1000	Computer plays and selects a random position if there have been less than 6 moves.
1002-1200	Computer selects a place to put its piece. ton is the first value of three computer squares with one to win; and then player two squares to stop win with one square left.
1210-1230	If the above is clear then select random position and make sure it has not been used.
2000-2020	Print up the winner with the UDGs in the appropriate square.
2210	End of program prompt.
4000	Auto run routine. The program is run from here and saved onto the tape it will then auto run. Note that the program starts at line 50.

TILT

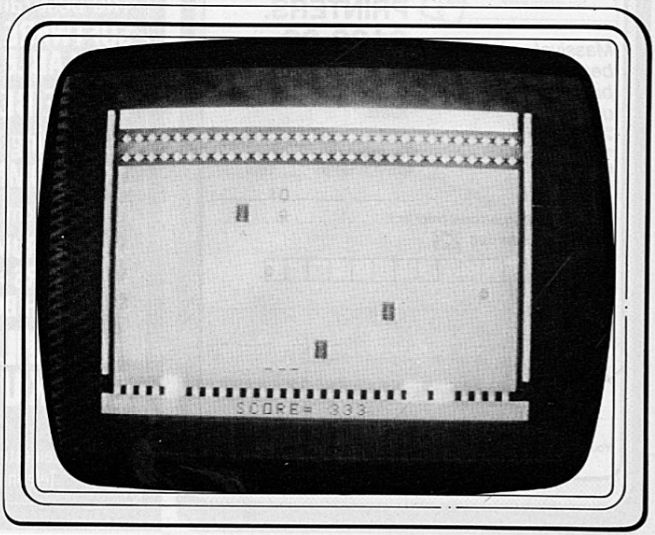
Title: *TILT*
Machine: *Dragon 32*
Application: *Game*
Language: *Basic*
Author: *Bryan Skinner*

This program, from Bryan Skinner, is that old chestnut, Breakout, but with a few modifications to pep it up a bit and the new title of Tilt. The program contains a few routines which may be of use elsewhere, more of these later.

The main rules of the game most people will already know. Basically you have to hit the ball with the bat, which you move with the cursor keys, left and right arrows. The ball then bounces across the screen and when it reaches the top it will, first of all, damage a brick, and finally knock it out of the wall, gaining you points. If you miss the ball it rebounds off the bottom of the screen but its velocity is reduced so it only gets to about halfway up the screen before it comes back to be hit again. When, sorry, if the ball is missed a blob is placed onto the screen and this, if the ball hits it, will cause it to bounce off in a random direction causing you problems. There is also a hash sign which gives you extra points when hit but it does not stay in one position.

The program also contains a couple of routines that may be of use elsewhere. The first is a method of printing in large 6 by 6 characters, as in the title TILT (lines 650-740). The routine uses a set of data statements, 6 for each character, to give instructions to the routine itself. The commands are as follows: A number specifies the vertical position of the block to be printed hence 1 will print a block in the first column at the top. 16 prints one at the top and one at the bottom as in the first column of I. The F command is interpreted as print a full column, as in the third column of I or T. * causes the block colour to be increased by 16 to allow letters to be printed in different colours. O causes a space or line of spaces, to separate the letters.

The second routine is for text formatting (lines 930-1060). The routine is entered with the string to be printed, in A$. The string is then scanned for spaces and when one is found, the routine checks the current printing position with POS. If the printing is going to go over the end of a line and split up a word a carriage return is performed. If a full stop is found the printing moves to the next line and an indent is performed. The words are output with a delay between each one, this is not necessary and can be stopped by removing line 1050.



```
10 CLEAR:DEF FNA(A)=ABS(PEEK(135)*((PEEK
(65280)OR128)<>255))
20 GOSUB 630
30 GOSUB640
40 CLS:PRINT@323,"SELECT LEVEL OF DIFFIC
ULTY";:PRINT@12*32+13,"(1-5)";
50 D=FNA(0)
60 IFD=0THEN50
70 D=D-48:IFD<1ORD>5THEN50
80 LD=-5*(D=1)-4*(D=2)-3*(D=3)-2*(D=4)-(
D=5)
100 TR=159:OF=1024:BL=79:CL=143
110 UL=-33:UR=-31:DL=31:DR=33
120 T=42:B=254:R=133:L=138:FH=175
130 HT=239:RB=1471:LB=1440:RP=191
140 PL=45:XP=99:SP=496:PP=429
150 PD=109:BB=128
170 FORI=1TOD:BT$=BT$+CHR$(PL):NEXT
180 CLS1
190 FORI=OF TO1440STEP32:POKEI,L:POKEI+3
1,R:NEXT
200 FORI=1025TO1054:POKEI,TR:POKEI+64,T:
POKEI+448,B:POKEI+32,T:NEXT
210 POKEOF+448,BB:POKE1055+448,BB
220 BP=OF+(RND(5)+4)*32+(RND(25)+3)
230 POKEBP,79
240 GOSUB630
250 PRINT@490,"SCORE= 0";
260 BT$=CHR$(CL)+CHR$(CL)+BT$+CHR$(CL)+C
HR$(CL)
270 FORT1=1TO500:NEXT
280 '*********START***********
290 BN=BN+1:IFBN>500THEN BN=0:TQ=0
300 IFTQ<LD THEN Q=RND(28)+1:RW=RND(8)+4
:RW=RW*32+OF:POKERW+Q,XP:TQ=TQ+1
310 A=FNA(0)
320 PP=PP-2*(A=9)+2*(A=8)
330 IFPP<416THENPP=416
340 IFPP+D+2>446THENPP=PP-1:GOTO340
350 PRINT@PP,BT$;
360 POKELB,L:POKERB,R
370 POKEBP,CL
380 NB=BP+X:H=PEEK(NB)
390 IF H=PD THEN580
400 IF H=XP THEN SOUND 150,1:SC=SC+INT(1
000/D):TQ=TQ-1:BP=NB:GOSUB630:GOTO370
410 IF X=0THEN GOSUB 630:GOTO 380
420 IF H=RP THEN SOUND 200,1:GOSUB630:GO
TO380
430 PRINT@SP,SC;
440 IF H<>CL THEN500
450 BP=NB
460 IFBP<BH THEN BP=BP-(X=URORX=DR)+(X=D
LORX=UL):X=-DR*(X=UR)-DL*(X=UL)
470 POKEBP,BL
480 GOTO280
490 '***END OF GAME ROUTINE****
500 IF H=HT THEN 610
510  P=RND(7)+64:FORI=1TO3:PLAY"V1003T25
0L210"+CHR$(P):NEXT
520 IF H=TR THENSC=SC+INT(1000/D):PLAY"O
1":FORO=1TO4:PLAY"O+T50L255CDEFGABCBAGFE
D":NEXT:PLAY"O1":BP=BP+96:X=-DR*(X=UR)-D
L*(X=UL):FORI=1TO5:RW=32*(RND(8)+4)+RND(
27)+1:RW=RW+OF:POKERW,RP:NEXT:GOTO380
530 IF H=FH THENSC=SC+INT(250/D):BP=BP+9
6:POKENB,143:X=-DR*(X=UR)-DL*(X=UL):GOTO
380
540 IF H=R THEN X=X-2:GOTO380
550 IF H=L THEN X=X+2:GOTO380
560 IF H=T THEN SC=SC+INT(100/D):POKENB,
FH:X=-DR*(X=UR)-DL*(X=UL):GOTO380
570 IF H=B THEN BH=1280:X=-UR*(X=DR)-UL*
(X=DL):RW=32*(RND(8)+4)+OF:Q=RND(28)+1:P
OKERW+Q,RP:POKENB,HT:GOTO380
580 BH=1024:BP=BP-64:PLAY"O1V20L255T255E
FGAB":X=-UR*(X=DR)-UL*(X=DL):GOTO380
590 IF H= BB THEN X=-UR*(X=DL)-UL*(X=DR)
:GOTO 380
600 GOSUB630:GOTO380
610 PRINT@330,"GAME OVER";:PRINT@32*12+2
,"PRESS SPACE BAR FOR ANOTHER";
620 IFINKEY$<>CHR$(32)THEN620 ELSE  10
630 X=RND(4):X=-UR*(X=1)-DR*(X=2)-UL*(X=
3)-DL*(X=4):RETURN
640 CLS
650 C1=159
660 DATA 0,1,1,F,1,1,0,0,*,16,16,F,16,16
,0,0,*,F,6,6,6,6,6,0,*,1,1,F,1,1
670 FORI=1TO30
680 READA$:IFA$="F"THENA$="123456"
690 IFA$="*"THENC1=C1+16:GOTO730
700 IFA$="0"THEN 730
710 FORL=1TOLEN(A$):V=VAL(MID$(A$,L,1))
720 POKE1024+96+32*V+I,C1
730 NEXT:NEXT
750 FORT=1TO500:NEXT
760 PRINT@417,"DO YOU REQUIRE INSTRUCTIO
NS ?";:PRINT@489,"PRESS Y OR N";
770 A=FNA(0):IFA<>89ANDA<>78THEN770
780 IFA=78THENRETURN
790 CLS
800 PRINT@13,"tilt!";
810 PRINT@66,"";
820 A$="THE BAT IS SHOWN BY ---. IT IS O
PERATED BY THE LEFT AND RIGHT ARROWS. TH
E BALL IS SHOWN BY O. IF YOU MISS THE BA
LL IT WILL NOT BOUNCE TO THE TOP AND AN
OBSTRUCTION WILL APPEAR (). IF THE BALL
HITS ONE OF THESE, ":GOSUB930
830 A$="IT WILL BOUNCE OFF AT RANDOM. ":
GOSUB930
840 GOSUB1070
850 A$="IF THE BALL HITS THE BOTTOM, A P
INK GAP IS LEFT. THE GAME ENDS IF THE BA
LL HITS ONE OF THESE. ":GOSUB930
860 GOSUB1070:A$="IF THE BALL HITS A STA
R AT THE TOP, YOU WIN POINTS AND THE STA
R WILL TURN BLUE. ":GOSUB930:A$="IF THE
BALL HITS A BLUE SQUARE, YOU WIN EXTRA P
OINTS. ":GOSUB930
870 A$="HITTING THE TOP YELLOW LINE WINS
 THE MOST POINTS. ":GOSUB930
880 A$="FROM TIME TO TIME, A £ WILL APPE
AR, HITTING THESE WILL GIVE YOU EXTRA PO
INTS AS WELL. ":GOSUB930
890 GOSUB1070
900 PRINT@480,"PRESS THE SPACE BAR TO ST
ART.";
910 A=FNA(0):IFA<>32THEN910
920 RETURN
930 REM***PRINT OUT A$
940 C$="":W$=""
950 FORI=1TOLEN(A$)
960 C$=MID$(A$,I,1)
970 IFC$=" "THEN GOSUB1020
980 IFC$=")"THENC$=CHR$(143+48)+")"
990 W$=W$+C$
1000 NEXT
1010 RETURN
1020 IFPOS(0)+LEN(W$)>31THENPRINTCHR$(13
)+W$;ELSEPRINTW$;
1030 IFRIGHT$(W$,1)="."THENPRINTCHR$(13)
+"   ";
1040 W$=""
1050 FORT=1TO100:NEXT
1060 RETURN
1070 PRINT@480,"PRESS THE SPACE BAR TO C
ONTINUE";
1080 A=FNA(0):IFA<>32THEN1080
1090 CLS:PRINT@13,"tilt!";:PRINT@66,"";:
RETURN
```

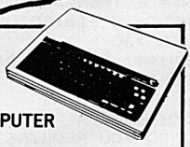
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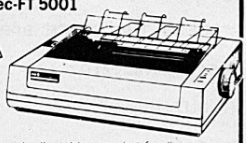
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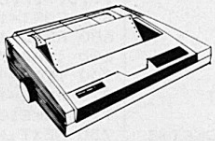
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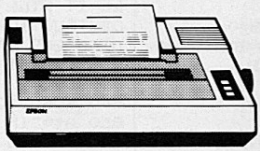
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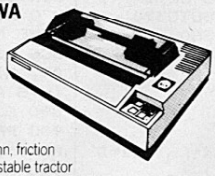
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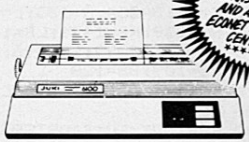
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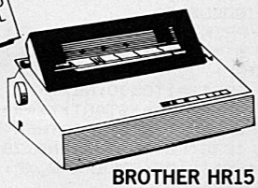
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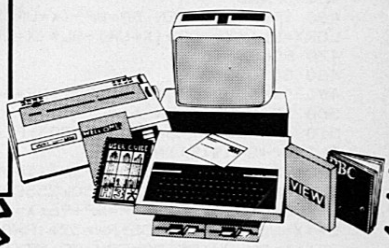
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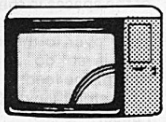
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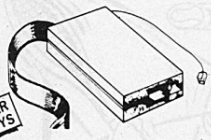
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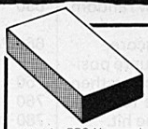
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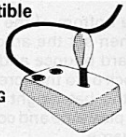
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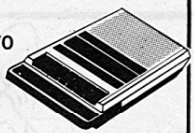
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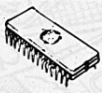
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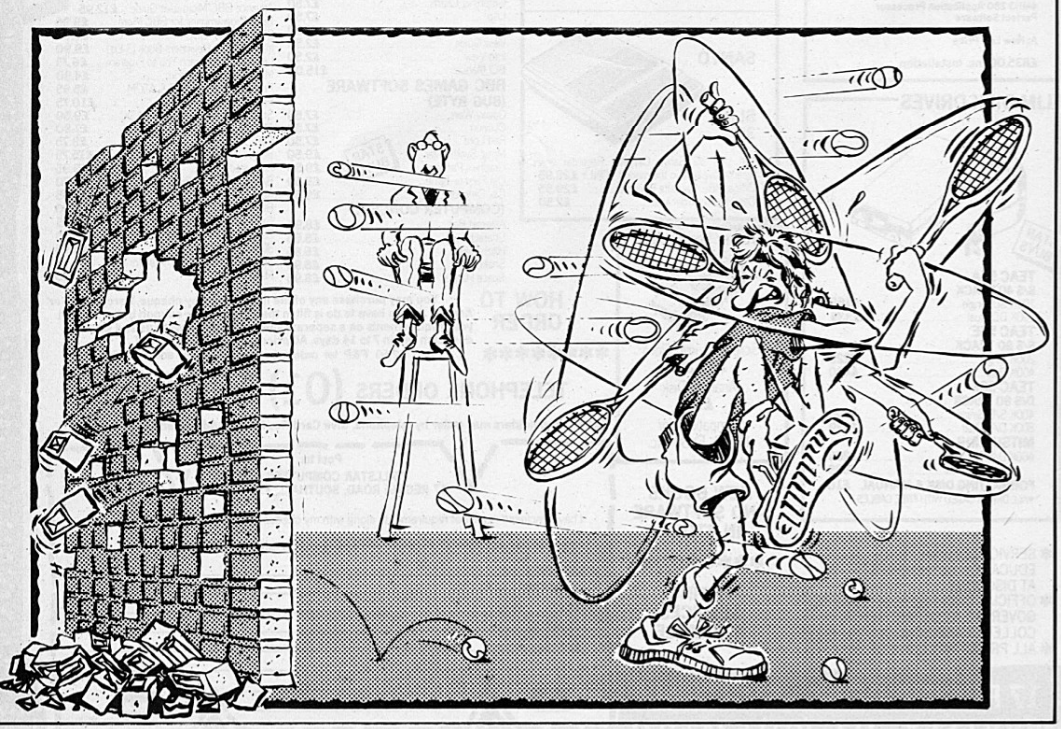
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40-70	Get the required level of difficulty from the player.
90-160	Define variables for borders, max bounce, position of the ball etc. Note that it is quicker to use variables than constants (numbers).
170	Define paddle.
180	Clear the screen.
190	Draw the left and right borders to the playing area.
200	Draw the top and bottom borders.
210	Fill in the gaps.
220	Set the starting ball position in BP.
230	Put the ball onto the screen.
240	Gosub and get the direction.
250	Print zero score.
260	Add background characters to the paddle to automatically rub them out as it moves across the screen.
300	Get the extra points for hitting the hash sign.
310-370	Move the paddle according to which of the left right arrows have been pressed.
380	Check next position of ball.
390	Check if it is the paddle.
400	Check if it is the hash sign.
410	If direction has not been det then gosub and set it.
420	If the red point has been hit then choose a new random direction.
430	Print the current score.
440	Check the next square position and if not clear then jump to a routine to check what is about to be hit.
450	New ball position.
460	New direction and check of edge position.
470	Put the ball at the new position.
480	Continue game.
520	Check for hit at the top of the screen and update the score, play tunes, bounce ball, put random blob onto the screen.
530	Check for alternative hit, in blue, at the top of the screen and update the score accordingly.
540	If right then subtract two.
550	If left then add two.
560	If top then rub out what was hit.
570	If the bottom of the screen hit then set the amount of upward bounce and dump a block onto the screen.
580	Set the bat height to normal, play tune and continue the game.
590	If black square then bounce.
600	New random bounce.
610	End of game.
620	Check for space bar.
630	Get the new bat position.
640	Clear the screen.
650	Set the colour of the first character in the title TILT.
660-740	Print the TILT logo according to the data in 660.
750	Pause
760	Prompt instruction.
780	No.
790	Clear the screen.
800	Print the title.
820-880	Instructions strings, these are printed using the format routine at 930-1060.
930	Print format routine.
940	Set the strings to be used, to zero.
950-1000	Print the string taking note of the spaces in the string.
1020	Check if the word is going to carry over to the next line and if so do a carriage return, line feed.
1030	If full stop then do CR LF.
1050	Pause.
1070-1080	Get the space bar to continue.
1090	Clear the screen, print the title and return from the subroutine.

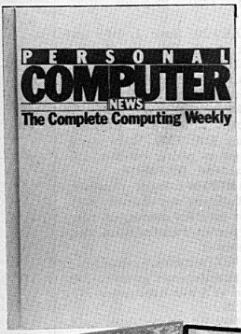
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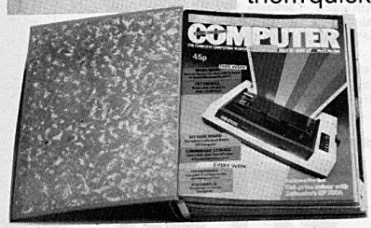


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Seikosha GP100A printer, little used, parallel cable, manual, suitable for BBC, Oric, Dragon, £150. Birchall, 33 Clarendon Road, Weston-super-Mare, Avon BS23 3EE.

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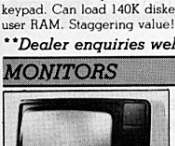
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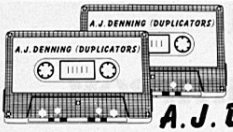
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Hark, the Oric Angels sing,
Shoot, Explode, then Zap and Ping,
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Wish we'd face up to the facts,
For Sinclair we are no match.
Others orcs and goblins slay;
But there's still no 16K!
Newbrain, Ace, the list goes on —
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This week's winner of the £20 prize is Geoff Kendell of Rugby:

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Sitting in an oval ring
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Hear Paul Kaufman set new sights
V1.1 is still not right!
Maybe one day he'll proclaim
This damned ROM is still the same,
cursed by bugs right from the start
The Oric angels must depart.
Hark the Oric angels sing
Glory to our Paul — the King.

NEXT WEEK

Software *On the cover and in the pull-out Micropaedia, a bumper bundle of games surveyed.*

Hardware *Apple goes marching on and PCN tests the old stager in its latest guise.*

Storage *PCN Pro-Tests the Byte Drive 500 disk units for the Oric.*

Psycho *Will Eliza turn your BBC into a psychoanalyst?*

Basic *We review an extended Basic for the Commodore 64.*

Games *Reviews of the latest for the Dragon, Commodore 64, and Spectrum.*

SYNTAX ERRORS

A printing gremlin bumped up the price of Transform's Spectrum keyboard by almost 50 per cent in last week's issue. The unit will not cost £99.99 but £69.95. Transform is on 01-658 6350.

When we said in a Pro-Test last week that at £600 the Tandy CGP-220 was competitively priced, we weren't doing it justice. In fact, it costs a mere £499 including VAT.

If you've read our correction to part one of the Newbrain word processing article, you'll probably still be feeling brained. The line of program under the heading Screens on page 31 of issue 38 should have read: OPEN#1, 0, 1, "L50"



PCN DATELINES

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

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

UK EVENTS

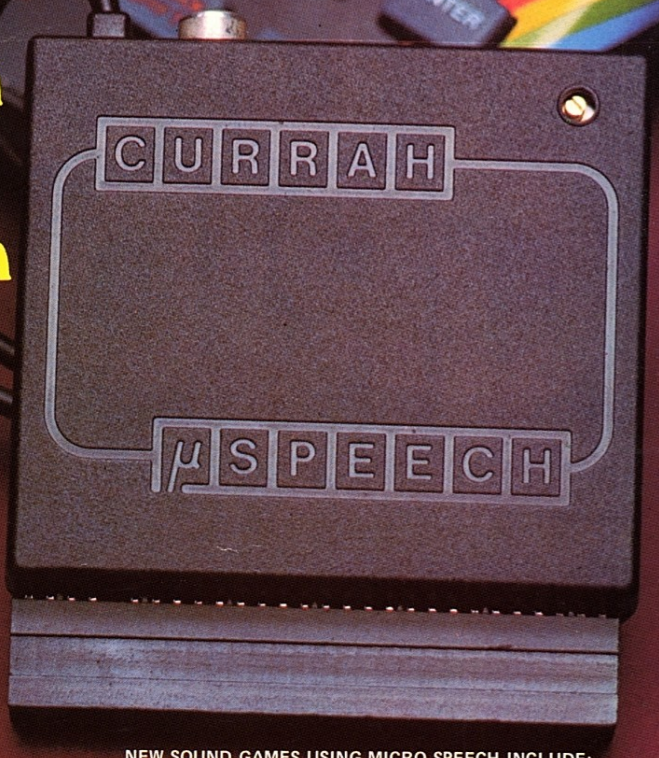
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Your Computer Christmas Fair	December 15-18	Wembley Conference Centre	Reed Exhibitions, 01-643 8040
Which Computer? Show	January 17-20	NEC, Birmingham	Clapp & Poliak Europe Ltd., 01-747 3131
Northern Home Entertainment Show	January 19-22	Excelsior Hotel, Manchester Airport	Stamley Wire Advertising Ltd., 01-253 6637
Acorn Education Exhibition	January 25-27	Central Hall, Westminster	Computer Marketplace (Exhibitions) Ltd, 01-930 1612
Peripherals Suppliers	January 31-February 2	Cunard International	Reed Exhibitions, 01-643 8040
Communications & Computer Systems Fair — CABLES	February 2-4	Pontin's, Prestatyn, Wales	Pontin's Ltd., 07456 2267
LET '84	February 13-15	Heathrow Penta Hotel	Anthony Farrar, 0923 774262
International Home Computers, Video Games & Software Exhibition	February 13-15	Heathrow Penta	Wheatland Journals Ltd., 0923 774262
Information Technology & Office Automation Exhibition and Conference	February 21-24	Barbican Centre, London EC1	B.E.D. Exhibitions Ltd., 01-647 1001
OEM Only Conference	March 7	Hilton Hotel, London W1	Tom Lewis, 01-994 6477
Computer Trade Show	March 13-15	Wembley Conference Centre, Middlesex	Reed Exhibitions, 01-643 8040
Scottish Computer Conference	March 13-15	Holiday Inn, Glasgow	Quadrilect, 01-242 8697
Essex Apple Village	March 25-28	Festival Hall, Basildon, Essex	Database Publications, 061-456 8383

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
International Winter Consumer Electronics Show	January 6-10	Las Vegas, USA	Consumer Electronics Shows, Chicago, 0101 312 861 1040
National Software Show (East)	February 3-5	Miami Beach, Florida, USA	Raging Bull, USA, 0101 415 459063
Personal Business Computer Show	February 29-March 3	Hong Kong	Overseas Exhibition Services Ltd., 01-486 1951

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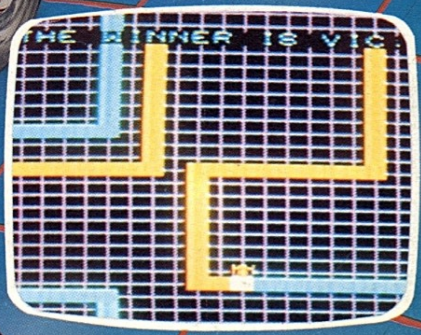
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